The Routledge Companion to Design Research

Edited by Paul A. Rodgers and Joyce Yee

THE ROUTLEDGE COMPANION TO DESIGN RESEARCH

The Routledge Companion to Design Research offers a comprehensive examination of design research, celebrating the plurality of design research and the wide range of conceptual, methodological, technological and theoretical approaches evident in contemporary design research.

This volume comprises 39 original and high-quality design research chapters from contributors around the world, with offerings from the vast array of disciplines in and around modern design praxis, including areas such as industrial and product design, visual communication, interaction design, fashion design, service design, engineering and architecture.

The Routledge Companion to Design Research is divided into five distinct parts with chapters that examine the nature and process of design research, the purpose of design research, and how one might embark on design research. They also explore how leading design researchers conduct their design research through formulating and asking questions in novel ways, and the creative methods and tools they use to collect and analyse data. *The Routledge Companion to Design Research* also includes a number of case studies that illustrate how one might best communicate and disseminate design research through contributions that offer techniques for writing and publicising research.

The Routledge Companion to Design Research will have wide appeal to researchers and educators in design and design-related disciplines such as engineering, business, marketing, computing, and will make an invaluable contribution to state-of-the-art design research at postgraduate, doctoral and post-doctoral levels and teaching across a wide range of different disciplines.

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INTRODUCTION

Paul A. Rodgers and Joyce Yee

Manifest in the process of designing and developing future products, services, systems and environments is the act of research. Typically, in design situations this research can take several forms including observing what people do in various situations, asking questions, searching for information, making and testing prototypes, provoking the status quo through disruptive interventions, challenging conventional wisdom by critical discourse, experimenting with materials and processes, and speculating on fictional future visions.

The Routledge Companion to Design Research celebrates the multitude of ways that design research is now carried out and how this research wishes to be seen and heard and enacted upon. This book is intended to foster deep inquiry into design research and open new interdisciplinary and multidisciplinary dialogues beyond single disciplinary spaces. In compiling this book we have adopted a purposely broad interpretation of design research and have endeavoured to provide a forum for many voices. *The Routledge Companion to Design Research* wishes to promote discussions amongst all that are curious about what design research might be and what it might do. Many voices mean many different ways of speaking. In this vein, Ranulph Glanville's chapter (Chapter 1) reminds us that variety is crucial and we should be careful to guard different ways of thinking, exploring and writing about design, and we should value this variety while following our own design research journeys. Consequently, *The Routledge Companion to Design Research* accommodates different kinds of conducting and writing about design that illustrates the plurality, depth and richness of design research at the moment.

At the outset of putting together this book, we were keen to cover research from a wide range of design disciplines and geographical locations. Accordingly, *The Routledge Companion to Design Research* includes contributions from design researchers working in Graphic Design, Fashion Design, Architecture, Interaction Design, Engineering Design, Service Design, Interior Design, Product Design, Industrial Design and Strategic Design. The contributors bring an amazing range of knowledge and experiences to this book including backgrounds and expertise in naval architecture, philosophy, ethics, engineering, sociology, cognitive psychology, nursing, dementia care and cybernetics. This book has strived to be inclusive in its scope and contains work that can be described as adopting a mélange of different approaches and cultures in design research including experimental, inductive, explication-based, practice-based, hybrid and 'hacked' methods. The collection of contributions in this book shows that various cultures co-exist in contemporary design research and that this pluralism should be celebrated in what is rapidly becoming a very healthy and mature field of research. Research methods need to fit their purpose and design should continue to borrow methods and approaches that fit from the physical sciences, the social sciences, and the arts and humanities if and when the situation arises.

The contributors to *The Routledge Companion to Design Research* are based in countries all over the world including Finland, the USA, the Netherlands, the UK, Belgium, Denmark, Italy, Singapore, China, Germany and Australia. The overriding aim of *The Routledge Companion to Design Research* is to create a book that includes top quality, original and innovative contributions to the area of design research. In so doing, we have adopted a selective but inclusive approach and invited a number of specific established authors in design research but also encouraged a number of developing younger design researchers as 'new critical voices'. The call for contributions to this book was also made public to a number of design research and cognate subject networks. As a result, this book comprises 39 final contributions that have been selected from well over 80 initial submissions. Each contribution has been comprehensively developed, rigorously reviewed, revised and re-worked for inclusion here. The end result is a book that includes contributions from the global design research community structured along different facets of design research in five parts.

The chapters in Part I of the book are concerned with defining what design research is in its various contexts and guises. Part I contributions also cover the nature and process of design research including the history and the purpose of design research. That is, what is design research about? Who is it for? The chapters in this part also discuss a variety of different design research approaches such as research-through-design, generative, formative, and evaluative approaches as well as ontology and epistemology. Part I presents a total of seven chapters that address the broader issue of what contemporary design research is, in terms of its origin, its nature and its approaches (Glanville, Jonas, Dong et al., Chua Soo Meng) while also offering a number of specific examples of how design research is conceived, perceived and applied within disciplinary contexts (Chon and Harland) and interdisciplinary contexts (Pullin). Writing styles differ, as we have intended in the book, illustrating the variety of approaches and aims of the different contributions. Contributors like Jonas, Dong et al., Chua Soo Meng and Chon use more philosophical and theoretical arguments to present their cases, while others such as Glanville, Harland and Pullin have preferred to use a more personal voice in their chapters.

Part II is concerned with how one might embark on a design research project including how a research question might be formulated, how a research plan is developed and how methods are chosen. Some of the chapters are focused on a specific aspect, for example, exploring how research questions might be proposed and explored (Davis) while others (Matthews and Brereton) offer guidance on the various methodological concerns faced by a novice design researcher looking to decide which methods to use. Heylighen and Nijs' chapter offers an apt starting point as it calls for design researchers to keep the arguments and evidence of 'designerly ways of knowing' open by adopting pluralistic approaches and epistemologies in their investigations. Sangiorgi and Scott's chapter offers guidance for design researchers embarking on projects aimed at enacting systemic change, which focuses on processes for social change and differences in the notion of change, intervention focus, guiding principles and methodology. The chapters in *The Routledge Companion to Design Research* illustrate the diversity (in approaches, methods and disciplines) present in design research today. This diversity in approach is evident in the final four chapters of Part II starting with Stappers and colleagues, who describe the roles played by prototypes and frameworks for structuring explorations by research through design projects. Cash and Culley's chapter highlights the role experimental studies plays in design research and presents a critical discussion on how experimental methods and methodology is applied in design. In contrast, and more closely linked to design research utilised in professional practice, Evans' chapter explores the role of design and the designer in researching the future. The final chapter by Bremner and Roxburgh presents a cautionary tale for design researchers looking to embark on a project using methods from other disciplines. They highlight the increasing use of ethnographic research methods in the area of user-based, participatory and co-design areas and urge caution since there are key differences between the purpose of observational research (which is primarily descriptive) and design (which is generally transformative).

The chapters in Part III offer a wide range of design research examples that entail various approaches, tools and methods in a range of disciplinary, academic and commercial contexts. The methods presented here are not intended as an exhaustive list; rather they are presented as offering a patina of relevant, contemporary and often very different approaches appropriate for contemporary design research. The variety of ways that research is conducted in the chapters in this part illustrates the plurality, depth and richness of design research at the moment. In this part, we also witness a blurring of practice and research as we begin to see many different ways that design practice features centrally in the production of contributions to our knowledge of design. The key role of design practice is clearly evident in the chapters in this part where the practice-based methods and approaches developed and used appear as an essential component of the contributors' modes of investigation such as visualising information (Shumack, Sadokierski and Sweetapple) and making through prototyping (Wensveen and Matthews). Likewise Bolton introduces his 'Visual Thinking Method' as a set of reflective and critical thinking tools devised specifically for designers to help reduce uncertainty in front-end design-driven innovation. Another observation in the chapters that make up Part III is the focus on enacting change, which aligns to conventional methods such as 'Action Research' (Villari) and explicitly applied in von Busch's 'hactivism' approach that calls for direct intervention into the artefacts of society. Part III opens with Koskinen's identification of four main analytic cultures in design research where he argues that several cultures co-exist in contemporary design research and that this pluralism should be present in a healthy and mature field of research. A new approach, firmly situated in Koskinen's art and design analytic culture, is 'hacktivism' (hacking + activism) introduced by von Busch. Hacktivism is an emergent research approach that is used to deal with socio-cultural issues in participatory ways, offering design researchers a way of 'cultural counterintelligence'. The remaining chapters in Part III offer examples of specific methods and approaches used in various design research contexts. Woodward illustrates the use of Christopher Alexander's pattern language as a strategy to facilitate sharing of knowledge and professional expertise between different teams. Christensen and Ball's chapter presents the 'in-vivo' method, a 'live' research technique aimed at investigating design cognition in naturalistic settings.

Part IV of *The Routledge Companion to Design Research* comprises six chapters that deal with how the outcomes of design research can be effectively communicated and disseminated for maximum impact. As such, this part includes contributions that present methods for writing up design research, communicating design research to particular audiences, and how best to communicate and publicise the findings of design research in complex and collaborative scenarios. We start this part with three personal and reflective pieces. The chapter by McMullen and colleagues presents their perspectives on and experiences of how interdisciplinary collaboration can be encouraged and how research from different disciplines can be shared and understood across different fields. They show how investigating and dissecting their conversations around the design process can expose the embedded (and often hidden) personal, social and environmental conditions of interdisciplinary critique and illustrate how collaborative interdisciplinary research unfolds over various times and places. Likewise, Roxburgh's chapter draws on his personal design practice describing techniques that he has developed to help him create a methodical approach to his writing. He recognises the frustration many creative practitioners have with bridging the gap between the 'making' and the 'writing' inherent in research projects and offers excellent examples of how the act of writing can become an embodied exercise in design research rather than perceived as a separate practice from designing. Macken continues this thread on the two modes of working – of writing and making. Her chapter similarly draws on her practice-based doctorate and she shares her approach to the relationships between the research question, the voice of the writer and the structure of the thesis, and its associated examination process. Through her doctoral work, which combines art practice with architecture theory, the form of an artist book is created as a vehicle to conceptualise the work, to realise its existence, and as a way to appraise the work rather than simply to communicate the research. The part then moves to how design research is communicated to an external audience within, between and beyond collaborative stakeholders. Fleming and Kelly's chapter describes an innovative service aimed at promoting knowledge and use of design principles for people living with dementia in care homes. They use this case study to outline certain understandings and processes necessary for successfully communicating design research to key stakeholders. Gibson and Owens' chapter is a call-to-arms for design researchers to reach across disciplinary boundaries. Their chapter elegantly describes the growing intractability and rapid expansion of the scope and interconnectedness of real world social, economic and natural systems problems, as well as their corresponding demand to link diverse perspectives with innovative action and considered behaviours. Gibson and Owens suggest this contemporary crisis makes the need to overcome equally obstinate barriers to collaboration between design researchers and others all the more pressing. The final chapter in this part deals with how meaningful play research methods might contribute to new knowledge and understanding in design. Scott's chapter examines how 'playcentric' or 'playification' research methods are being used to understand, influence and validate design decisions. His work explores how a play-based approach to design research might complement other research methods such as participatory ethnography and persona creation in order to create holistic understandings of human behaviour, as well as communicate examples and benefits of inclusion into design processes.

The contributions to Part V of *The Routledge Companion to Design Research* present eight examples of design research that illustrate how design research is embarked on, conducted and communicated. The eight chapters offer a diverse set of case studies from areas including interior and architecture design history, service design and fashion design. McKay's chapter presents case studies that explore process-related aspects of how designers generate form in order to understand how future generations of shape grammar computation systems might enhance the act of designing. Burton and Pedersen's chapter presents an unusual example of a mixed-methods approach applied to interior and architectural design history. They illustrate how design history researchers might exploit a mixed-methods approach with the potential to uncover multiple layers of data not easily uncovered through a single methodological approach. Their study of Pugin's designs and texts uses methods from the study of material culture and phenomenology and a framework rooted in the field of psychology in addition to the historic method. Similarly, Mouat's research challenges the traditional analysis of space by using an interdisciplinary approach that combines the analysis of built space with the analysis of cinematic space to understand the social and cultural constructions of space. Mouat's analysis of how spaces are depicted in film offers an external perspective on how the public perceive their spaces, cities and architecture at certain periods of time. Design research in a commercial context is illustrated in Morrow's chapter where she presents an excellent case of a project that has emerged from collaboration between a textile designer and an architect, who have developed technology that allows textiles and concrete to permanently co-form the surface of pre-cast concrete elements. The research investigation has resulted in the formation of a new commercial venture entitled 'Tactility Factory' and the development of 'skins' that can be applied in the building and interior design sectors. Likewise, both Hagen and Robertson's and van Dijk and Raijmakers' chapters present examples of design research in commercial settings and how knowledge can be attained out of the constraints and realities in professional design settings. The chapter by Rijshouwer and colleagues describes the 'Streetstarters' project in Antwerp, Belgium – a participatory, design-driven approach aimed at developing a toolkit in order to enhance social cohesion at street-level. This collaborative project enabled the project team to go beyond the usual street-related activities organised by local authorities to create a design-led project that focused on participation and on creating a space for people to engage in dialogue and social regeneration. Part V concludes with an enthralling research-through-design project by Cobb – the '100-Mile Suit'. The project is the result of a six-month design experiment that was intended to introduce a dialogue about resources and community and an attempt to unravel the detachment between consumer and product that ended up in various exhibitions throughout the USA.

We anticipate that *The Routledge Companion to Design Research* will appeal primarily to those involved in design research based in academic contexts. This book will appeal directly to postgraduate students (i.e. Masters and PhD level) who are following specific options or modules in design research but also to upper-level undergraduate students (i.e. final year and penultimate year undergraduate students) who are studying design (i.e. product, fashion, graphic, architecture, interior, textile design and so on). We see this book as having direct appeal and value to students undertaking research as part of their Masters and/or Doctoral studies in that they will acquire a range of exemplary and world-leading insights through the key contributions and case studies presented. We also see this book as having wide appeal to researchers and educators in design and design-related disciplines such as engineering, business, marketing, computing and several others. In this regard, the book will make an invaluable contribution to state-of-the-art design research and support research (at postgraduate, doctoral and post-doctoral levels) and teaching across a wide range of different disciplines.

In summary, *The Routledge Companion to Design Research* pays tribute to the plurality of design research and also to the wide range of conceptual, methodological and theoretical approaches evident in contemporary design research. As a result, this book includes contributions from the vast array of disciplines in and around emerging design research and from authors in inter-disciplinary, cross-disciplinary, multi-disciplinary and trans-disciplinary contexts. The editors are very grateful for the invitation from Routledge/Taylor & Francis who asked us to bring together a collection of design research contributions in a significant book. Importantly, we must acknowledge the fantastic efforts and dedication of all of the contributors in this book. It is to the contributors' credit that this book has come together so smoothly and made the editors' job a real joy. Over the course of compiling *The Routledge Companion to Design Research* we have been privileged to work with so many talented design researchers at various stages of their research careers. As Achille Castiglioni so beautifully put it in his contribution to the International Design Conference in Aspen, Colorado in June 1989: "I have worked with pleasure. . ." So we, too, have had enormous pleasure in compiling this book.

It is worth ending this Introduction again with Achille Castiglioni who, when he died in 2003, was declared "the president of the republic of Design" by Domus magazine. Castiglioni, who enjoyed a remarkable career in design prompts us to remember that:

> the path of design is always different, case by case; and, if possible, without pre-conceptions. No single model of design can exist . . . Design research is an effort

> undertaken with many people of different disciplines and interests which combine in the resulting design, the moment of expressive synthesis of a great collective work.

We very much hope that you enjoy the results of this collective labour.

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PART I

What is design research?

The nature and process of design research; the purpose of design research; research approaches

The chapters in Part I are concerned with defining what design research is in its various contexts and guises. It presents seven chapters that address the broader issue of what design research is in terms of its origin, nature and approaches (Glanville, Jonas, Dong et al., Chua Soo Meng); while also offering some specific examples of how design research is conceived, perceived and applied within disciplinary contexts (Chon and Harland) and interdisciplinary contexts (Pullin). Writing styles differ, again illustrating the variety of approaches and aims of the different pieces; some like Jonas, Dong et al., Chua Soo Meng and Chon adopt a more philosophical and theoretical stance to present their arguments, while others prefer to use a more personal voice, as seen in the work of Glanville, Pullin and Harland.

Glanville provides an appropriate starting point for the reader as he offers a personal viewpoint of what design research is. He has done so in the hope that it will help the reader form their own understanding of what design research is. He starts by defining what 'design' and 'research' mean before tackling the issue of what 'design research' is, charting what he terms as the sometimes 'uncomfortable marriage' between the two. He draws attention to a growing division in design research, between the more established model of design research based on a scientific paradigm in comparison to a model where a more 'designerly' way of conducting research through design is emerging. This thread is continued throughout Part I with Jonas. Jonas presents a detailed articulation of what this alternate model might be; arguing that design research is neither science nor art. He presents this alternative as a new trans-disciplinary model focusing on real-world problems. Jonas introduces the idea that 'research-through-design' is the wormhole in which we can escape the dead end of current design research. Addressing further questions of the nature of design research is the chapter by Dong and his colleagues, which helps unpick and analyse the different types of design knowledge in order to understand how design research is performed and the form that design knowledge takes.

It is important to note that while contemporary attitudes towards design are increasingly viewing design as its own disciplinary subject, Chua Soo Meng, in his chapter, warns against methodological 'exclusivism' that this approach entails. He refers to Herbert Simon's and Nigel Cross's use of a central case research approach where 'good' designs and 'good' designers should be studied. If applying this approach to the selection of what is important to study, then this makes the exclusivity stance problematic since this moral standpoint (to decide what is good or not) is not only exclusive to designers but also to other scholars in other disciplines. In support of a more inclusive approach to design research, Pullin not only offers an illustration of how design knowledge and ideas can be mapped against the different disciplinary knowledge but also presents a case study to illustrate how positioning design in the middle of other disciplines may embody a unique role for future design research.

The chapters by Pullin, Chon and Harland offer examples of how broad design research is, especially when viewed through disciplinary lenses. Both Chon's and Harland's pieces feature design research in subject areas often devoid of critical research: fashion design and graphic design respectively. As such, both are seeking to establish a foundational base for the subject. Chon presents a framework for fashion research that is sociological and humanistic in its approach and presents design knowledge in fashion as being constantly involved in a fluid meaning-making process involving designers, individuals and society. Chon's framework also offers a broader understanding of design knowledge as being socially constructed and communicated in the relationships between designers and objects, individuals and society, and designers and individuals. Part I ends with Harland's chapter, which documents his attempts to build graphic theory from graphic design research by going back to the fundamental question of what is the core of graphic design. Harland's chapter is a fitting end to a part attempting to answer 'What is design research?' in that it illustrates the importance of distinguishing theory *for* design and theory *from* design.

1
THE SOMETIMES UNCOMFORTABLE MARRIAGES OF DESIGN AND RESEARCH

Ranulph Glanville

Personal introduction

There are many possible arguments the author of a chapter on design research might make, other than the one I chose to make here. And I have no doubt that what I have written will not sit comfortably or properly, in the minds of some readers. I can imagine the instantly dismissive tone of a certain type of response, precisely the sort of response I am trying to argue against. None of this makes my account wrong: it merely makes it contentious. It may be seen as contentious in what it includes, but also, and perhaps more so, in what and who it does not mention. The difficulty in any attempt to provide a position – or a review – is to find a line and then to hang a convincing and interesting story on it. In finding that line, any author will accommodate many views, but inevitably not all, and will feature the work of some, but not most, authorities. A further difficulty is not to drown the narrative of the story in reference, while yet showing the story is justifiable. And it is also to make space to include your own view, as author, without overplaying it. The real test of a text like this is, I believe, whether the argument helps you (the reader, but the author also) better to understand, and to act better. This is a reader's judgement: like a placebo, the question is not what design research 'really' is, but how this account helps readers themselves understand and go forward.

Design

Generally, we do not learn all that much about the current use of words from their etymology, yet it is sometimes helpful and revealing to acknowledge origins.

The word design is full of ambiguity. It first came into English from the Italian (via French) around 1500, according to Côrte-Real (2010), although the etymology goes back to Latin. Côrte-Real gives two sources:

- disignare, meaning to draw (hence the identification of designing with drawing)
- designare, meaning to designate

We should notice that both sources are verbs: that is, they are concerned with acting rather than the outcome of acting. As we will discover later, the slippage of the word design to be treated as a noun as well as, and often in preference to, a verb has a considerable influence on the shape of design research.

It is not as though the English speaking world did not have design and designers before these modified Latin words were imported and compounded. Nor are words used in other Germanic European languages for a cognate activity consistent with English: the Dutch 'vormgeving' is literally 'form giving' while the German 'Gestaltung' also refers to 'forming', the making of a pattern or a whole. But it seems we did not use a special term to distinguish the activity we now call designing before 1500, except for musical designing (composing – which, to my mind, suggests the use of pre-defined units) and words relating to architecture. As for the word architect, its Ancient Greek origin is made up of two parts:

- arkhi-, meaning chief
- tektōn, meaning builder

Although architect refers to building (i.e. constructing), it does not necessarily refer to what we now call buildings. What is considered the first (western) book on design is by Marcus Vitruvius Pollio (born *c.* 80–70 BCE, died after *c.* 15 BCE, generally referred to as Vitruvius). He was the creator of the idealised Vitruvian man, famously drawn by Leonardo, and the author of what is still the best definition of architecture – as constituted of three equal parts: well-made, functional and delightful. His book was published around 15 BCE as "De Architectura libri decem" (Ten Books on Architecture), containing instructions on making Water Mills, Clocks, Town Planning, Temples, Civic Buildings and Aquaducts (amongst others). It was not limited to what we would nowadays think of as architecture or even building(s): and tektōn itself comes from the Greek word techné, meaning doing/making – from which we get our word and concept technology. Vitruvius's book was, in effect, what we might think of as a design manual. I use the verb, design, to indicate what I hold is the activity central to all designers, including architects.

Design, as a subject in its own right, appears during the Industrial Revolution, usually dated in the UK (where it originated) between roughly 1760 and 1840. (Pye (1999) gives a good account, and the British Broadcasting Corporation's 2009 TV series "The Genius of Design" is convincing.) The ability to produce, by machine, multiples of large and expensive objects greatly outside human skill and scale meant there was a need to be able to construct these objects in the mind, before committing machines (and their operators) to production. Early machines were already programmable: the Jacquard loom was programmed by punch cards later used in the early days of computer programming (when they were called Hollerith cards) and still used to control silk spinning and weaving machines in China. From this moment, we can distinguish industrial design from architecture – yet the centre of each discipline is, I would argue (in the absence of the verb to architect), the same; and the verb to design, describing this shared central act, is relevant to both fields and, I believe, to all designing.

Machines are tended by mechanics and engineers. Indeed, much of what Vitruvius described as architecture would now be thought of as (civil) engineering. In some schools, architects are trained as civil engineers, later adding design as a sort of top-up. This engineering approach is rather different to the approach of those who come from what in the UK we traditionally think of as a design education (see Archer, 2005) as I sketch in the next paragraph; an important difference when it comes to research that reflects back to early days of formal design education.

In the UK, until recently, art and design[1] education – as opposed to apprenticeship – was taught in vocational colleges such as those set up by William Morris and others. These colleges, often called Working Men's Institutes, eventually became technical and art colleges and polytechnics which, in the UK version, were to be colleges of further education based in the local community and concerned with vocational training. In contrast, universities were based in academic research. Engineers were generally taught at universities (though mechanics were taught at vocational schools). Architects were taught at either: though the University of Oxford still rejects architecture as a vocational, non-academic subject. Design was taught at vocational colleges and is still only slowly making inroads in many older universities. Thus, while design (except where married to engineering) and architecture are rejected as academic studies by the University of Oxford, Oxford Brookes University (with its origins in the Oxford School of Art) welcomes both. At Cambridge University, architecture is part of a Department of Art History and had no official taught studio component until about 1970. There is no design department, although the word design has crept into engineering as it has, for instance, at London's Imperial College.

This difference between universities and polytechnics was maintained in much of the British influenced world. In terms of research it has made an enormous difference. Until the recent change in which almost all colleges and polytechnics became universities, staff members at these institutes were solely teachers: research was not part of their job. All this has changed, but, as we shall see, the difference in origin is highlighted in approaches to design research.

Design was taught as a practice in colleges with no tradition in research. Engineering has been taught in an academic research culture at universities, with little interest in practice. This difference is crucial in design research.

Research

Many think the word research connotes searching and searching again (re-); and, indeed, research does generally involve this iterative and testing approach. But the origins of the word are different. Research comes, in the sixteenth century, from the French re-chercher (re-cherchier in the Old French form):

- re-, expressing intense force
- chercher, meaning to seek

So research normally means to seek, deeply, with intensity. What is sought is reliable, new knowledge.

Nowadays, research in general is often confused with the particular type of research we call scientific research. But research does not have to be, let alone be identified with, science (Archer, 1995). To start with, the current understanding of knowledge in the English speaking world does not accord either with local uses in other languages (a German speaker can happily ask a painter about his/her scientific research – they use two verbs for our one, to know – kennen and wissen) or with the usage at the time when what we now call University was born (starting with the University of Bologna in 1088), when the Latin word scientia (science) simply meant knowledge. The Greek word philosophy, meaning love of knowledge, was used for the divisions of knowledge mediaeval universities promoted. The precursor of what we nowadays call science was known as Natural Philosophy. The word scientist was not invented until the early mid-1800s, so Isaac Newton was not a scientist.

There is, thus, confusion: while practitioners of research are certainly interested in producing what we call knowledge through their practice, this knowledge does not have to be scientific in the Anglo-Saxon sense, developed through what we now call the scientific revolution. In English usage, the phrase 'scientific knowledge' is either an oxymoron, or a serious constraint!

What will help us is to remember that science, as knowledge, is far wider and older than knowledge gained through the pursuit of the activity we now call science.

We have long understood that there are different types of knowledge. Aristotle (384–322 BCE), in his Nicomachean Ethics, distinguishes several ways of knowing. Of particular concern here are 'sophia' and 'phronesis'. I inevitably oversimplify, but, put roughly, sophia is theoretical knowledge, while phronesis, practical knowledge, is what sophia is based on and must refer back to. There is a type of phronetic knowledge that exists in, for instance, the hands in use – as with a highly skilled potter or physiotherapist. This knowledge cannot be explained or expounded but can be shown and learnt – an example of what design theorist Polanyi (1966, 1974) calls 'The Tacit Dimension'. Compare the similarity in the theory/practice division between university and vocational college!

Modern science is generally dated to around the time of Isaac Newton (1642–1727), using Newton's Mechanics as its ideal. In an exquisite account "The Simplification of Science and the Science of Simplification",[2] Weinberg (2001) tells how Newton simplified the cosmological universe to develop his mechanical model, which included, amongst other things, gravity and the inverse square law. This sort of simplification to create the universal ideal is one of the great strengths of scientific theorising.

The success of science is due to many things, including its method. Scientific method is intended to provide knowledge that is and remains testable. In principle, this knowledge remains reliable for as long as it is not disproved, ideally being subject to continuous testing and retesting. Karl Popper's description of this scientific ideal suggests the purpose of science is to disprove currently held knowledge, a process he names 'Conjectures and Refutations' (Popper, 1963). Scientific knowledge should be repeatable (similar experiments will produce similar results), consistent (it will not contain contradictions) and it will be complete (nothing that should be covered is left uncovered). As it happens, these are also the criteria at the heart of the unsuccessful quest of (meta-) mathematics to show that all knowledge is founded on mathematics. I have suggested that science, in general, may place more emphasis on repeatability than the other two criteria. I see repeatability as the criterion behind the exclusion of the observer, because observers will be different, thus providing different observations.

So important has method become that the scientific method is applied to groups of methods to check they are methodical, giving rise to the subject 'Methodology'.

Science attempts to give us reliable (long-lived, but never absolute) descriptions and explanations of the world as we find it, and is remarkably successful and often very beautiful. Science is not what is, but a description of what is – as we observe it. It gives us no truths, but it gives us viable knowledge and, with that, ways of acting and predictions that are almost always right. However, it is not the only approach (consider history, for instance), nor is it (as Paul Feyerabend (1975) showed in *Against Method*) inherently better than other approaches, although, collectively, we forget all this, giving a spurious authority to science and scientists. This authority damages and belittles other ways of gaining knowledge, as well as, eventually, belittling science and scientists. Research is not a set of procedures and rules, but a way of acting. There are other ways of knowing, and there were ways of knowing before we had modern science. Not much is sillier than a scientist operating out of his/her area of competence, demanding that everything be treated through the scientific approach.

Design research

Background

In a sense, design cannot be separated from research. For many years I have argued that research is a particular, restricted form of design, in terms of both experiments carried out and the creation, assembly and integration of new knowledge within the range of the existing (Glanville, 1981, 1999, 2006). I do not believe it is either reasonable or practicable to try to trace a full history of design and design research which might go back to before the Ancient Greeks. Ignoring architecture, in modern times since the moment of recognition that there is a subject (what has become industrial design) as well as an activity, we might start from Taylor's (1919) work applying science to management, and Elton Mayo's (1975) examination of the relationship between productivity, the observer and environment at the Hawthorne Works (1924–32), in particular what is often referred to as the Hawthorne Effect (Landsberger, 1958). These examples show other fields being introduced as means by which to study and propose improvements to the subject, treating designing as material to be subjected to evaluation using the approaches of (alien) subjects, in these cases management and (environmental) psychology. In fact, design has been subject to historical treatment for a far longer time, and every designer has to carry out some sort of (often low level) exploration (research) for every project they undertake.

It is clear, however, that in the scientific and technological optimism (one might say arrogance) of the post World War II years, science was seen as the universal provider of answers to almost any question, and the authority of science and scientists was virtually unquestioned in the popular mind. This was explored by Jacob Bronowski (1956), and forms the rich backdrop to his 1973 TV epic, "The Ascent of Man". In this social environment, it was quickly noted that design was not scientific and did not have any proper (that is, scientific) theoretical base. Several attempts were made to correct what was seen as a flaw. One came out of the 1958 Oxford conference on Architectural Education which generated an agenda for architectural education still widely used to this day, splitting it into (design) science, on the one hand, and in the other context (studied through theory, laboratory and essay) brought together in the design studio, in which everything is shaken up to produce a synthesis-as-outcome through the act of designing.

Another was the rise of design methods, an attempt to reduce the arbitrary in designing, rationalising the activity so outcomes would be less wilful and more scientific (by what Tomas Maldonado called operational science, a systems-thinking approach which embodied both art and science). This movement, inspired by memories of the Bauhaus, was lead through the Ulm School of Design in Germany (Ulm HfG, opened 1953 with Max Bill as rector, closed 1968), where many of the most distinguished designer thinkers of their generation worked, including Maldonado, Horst Rittel and L. Bruce Archer. Their influence was enormous, and persists. The Ulm approach continued, for example, through Archer's position at the Royal College of Art (RCA), London (and elsewhere) until Archer's Design Research Department was closed by the RCA's rector Jocelyn Stevens in 1984.[3] The key notion was that design is an academic topic in its own right, and should be recognised as such; and that design research should satisfy scholarly, academic criteria using well-founded evidence applied through systematic analysis (Rinker, et al., 2011). However, some of the early enthusiasts, including Rittel (with his over-complex "Wicked Problem" – Rittel and Webber, 1973) and John Chris Jones (1992) who turned to chance processes and the random, are among the distinguished early leaders who came to reject the dominance of method, rationalisation and linear causality so present in early design research.

The recent world-wide movement to promote research in universities and to assess and evaluate it in a competitive funding environment means that the ideas and understandings developed at and from Ulm are often considered increasingly crucial to design, design research and design education, today – at least by some.

Two approaches

Above, I have suggested a division in how we understand design, which I have linked to the kinds of educational establishments in which we study. I pointed out that although this view is simplistic, engineers study to apply theory in (research-based) universities, while designers study in vocational schools which are more practice based and hands on.

While much of the research in design follows the scientific paradigm used in engineering, not all does.[4] Recently, work originating in the practice of designing has begun to be recognised, often as a different type of research. This research does not lack key components of other research – such as rigour and publication, and their sub-activities, including testing, contextualising, use of method – but these components do not necessarily take the form we are used to from the scientific model (e.g. Glanville and van Schaik (2003), Koskinen, et al. (2011), van Schaik and Johnson (2012)), and are thus sometimes difficult for even the most learned and well-informed to spot, let alone appreciate. It may even be that learnedness and well-informedness, within one tradition, create this difficulty in another.

In this reading, research based in practice is more concerned with Aristotle's phronesis than sophia, and connects to the vocational rather than the academic mode of learning and of making and transmitting knowledge. It is necessary and important, because it is based in and responds to what designers do, that is, the act of designing. I shall refer to this variety of design research as (designing) design research (in contrast to (engineering) design research). Surprisingly little research has been done into how designers design, and what their experience of designing is, in part because it is terribly hard to do within a scientific framework for a number of reasons, including the need to interfere with the designer's behaviour as (s)he designs, in order to obtain their explanatory commentary (this sort of problem is familiar also in action research, amongst other approaches). Also significant are the vast time spans, complexity of relationships involved and variety of work locations and types that may change throughout the process of designing. However, some important work has been carried out, particularly that by Henrik Gedenryd (1998), who died shortly after presenting his research as a PhD, sadly losing the chance to publish it more widely and accessibly. I surmise a further difficulty: that many scientists have trouble conceiving the possibility of and need for this sort of research. Cross (2006, 2011) throws valuable light on this.

Much of the research done within the (engineering) design research framework explores explanatory theories and theorisation, or the assessment of the performance of designed objects (i.e. the artefacts that are outcomes of design actions). The focus is almost entirely on the artefact (whether the artefact is a physical item or, for instance, a process). Observed behaviours are considered properties of such artefacts. Unfortunately, this sort of result is rarely helpful to the designer, since:

a) it tends to tell him/her that (s)he is wrong, without revealing how, effectively, to correct the error, and
b) it considers the world as objective rather than constructive, whereas the designer is essentially changing the world, a necessarily constructive act.

One is left questioning the value of research which has no interest in helping practitioners in the field being researched in their practice, scarcely recognising the sort of world they occupy!

(Designing) and (engineering) design research are not the only approaches to research into design. Amongst others are those used in the humanities (using the term in the widest sense). As already noted, history has been used for centuries to critique design, supposedly making it easier for designers (and others) to understand. Other approaches, some new (e.g. cultural theory) and some old (e.g. philosophy) are also popular. In general, we may note that these theories tend to have been applied to design, without much concern for the nature of the subject of design itself, and with little interest in learning from the subject they are imposed on: a sort of academic colonialism. Often, the 'research question' in this sort of work is not at all clear. In some cases, it is difficult to see what is held in common between a chosen subject's approach (or theory) and that to which it is applied, in which case the approach or theory cannot be an approach or theory of that area of application (Glanville (2005)) – though on occasion a mismatch can open up new and valuable possibilities, such as occurred with the application of deconstruction to architecture. So while (designing) and (engineering) design research are not the only approaches, they are the ones we will further explore here.

In its modern incarnation, the appreciation that practitioners have their own ways of learning and a particular species of knowledge is usually credited to Donald Schön, a professor of education and of planning at Massachusetts Institute of Technology (MIT), although, as Schön admitted, there is a long tradition that includes the work of the pragmatist philosopher John Dewey. Schön (1983) interviewed a handful of professionals from different fields and came to the conclusion that they learnt continuously to improve their performance by reflecting on what they did, modifying their actions as a consequence of their reflection. In Schön's sense, reflection means deep thinking, with a meditative edge. Schön argued that the type of knowledge professionals have, and their ways of creating new knowledge (by reflecting in action) was epistemologically valid, and that university based academic knowledge was not the only or, more importantly, the true way. In a certain respect, Schön's approach provides real-world support for Feyerabend's (1975) argument (q.v.) that there is no inherent superiority in the scientific account of the world, or the knowledge it generates. Schön (1985) also examined how architects work in the design studio, successfully arguing that their practice was in many ways superior to that used in a traditional university education, a finding reproduced on a larger scale by Geoffrey Broadbent and colleagues in South America (1997).

As I have already hinted, for a long time many have held (and indeed still hold) that there is only one way of doing research – the scientific way. I do not accept this, and trust I have established that there are also other ways (e.g. Glanville (1999), Jonas (2012), Koskinen et al. (2011)). In particular, there are two approaches that may be used in design research, reflecting two quite different approaches to knowing (sophia and phronesis), the ways we study design (in universities and in vocational colleges), and the position we take over the relation of theory and practice (understanding and acting). Let me add that I have come to the conclusion that to divide the world into, for instance, theory or practice, is a mistake. We should join the two together again as theory-and-practice – returning to Aristotle's interdependence. But if I have to vote for one, then I will vote with the minority – for the vocational, for practice and acting, and for phronesis – because I believe greater value in our research will come from helping designers designing: treating design as a verb rather than a noun. And because I value design as an alternative way of thinking to the scientific approach of problematisation, the (engineering) design research approach to research is of secondary interest. In this opinion I share a position with the growing number of 'through practice' PhD programmes that have been developed especially in Australia (van Schaik and Johnson (2012)), and more recently in the Nordic countries, and at St Lucas (now the LUCA faculty of the Catholic University of Leuven) in Belgium. This is not surprising: I played a significant part in the development of the pioneering programme at RMIT University, and brought RMIT and St Lucas together to help develop this approach in Europe.

Characterising (designing) and (engineering) design research in design

In this section I shall consider some contrasting concepts that can help us distinguish these two approaches to design research.

Vocational (non-academic) and academic (scientific)

We live in experience, not in explanations of experience, even though such explanations are both powerful and useful. That is why phronesis takes precedence, in Aristotle's world, over sophia. This is not to deny sophia its proper place, but rather to demand a proper place for phronesis. Designers do not describe the world as it is, but rather they change the world (no matter how tiny the change) by making new objects, services, processes, etc. It is important to keep in mind the different approaches: research in engineering based in description and explanation and research in design based in/through doing.

Some identify research with the academic. By definition, historically this has naturally excluded research in doing. But academic (and particularly scientific) research is not the only sort of research: to identify research with the academic/scientific is to put the cart before the horse, and to insist that the general is defined by the specific, which runs counter to the rules of logic.

The challenge is not to dismiss, but to construct another type of research as powerful as scientific research. This is, in itself, a problem of design. As mentioned, I have argued that all research is, first and foremost, a problem of design, and so should be thought of first as (designing) design research (Glanville (1999)). To have more than one way of researching – more than one way of thinking and of knowing – enriches human life. And if criteria are different, or differently met, then, given the legitimacy in hoping to have both, the art is to learn to recognise and bring the best from each to the other rather than excluding and rejecting one.

Practice and theory

One difference between practice and theory is that, in general, theory is created by an observer standing outside the system to describe it, while practice, being something done, necessarily involves the observer acting within (as part of) the system.

This connects to understandings such as Michael Polanyi's (1966) 'tacit'. Recall that Polanyi insisted there is a type of knowledge which cannot be put into words: it will slip through the (metaphorical) fingers of any attempt to do so! However, he did not believe this knowledge was uncommunicable: the potter teaches his/her student through their hands, beyond and outside the world of verbal language and formal logics. This type of knowledge, often knowledge associated with practice, is real and important (and communicable) but, not being representable in language, it joins Schön's reflective practice, lying outside the academic conventional.

I noted above that Aristotle, while suggesting that the knowledge belonging to sophia is superior to that belonging to phronesis, also insisted that sophia comes from phronesis, and returns to (inform) it: the relationship is circular. In our culture we tend to think of theory as somehow superior, applied to practice in a (linear) power relation: theory instructs practice what to do. This is in contradiction to the way Aristotle understood the connection.

The research we carry out should, I maintain, be sensitive to which category, understanding (describing) or acting, it is intended to inform.[5] The first originates in the desire to describe the world as is, the second in changing the world. This indicates different types of research, reflected in the difference between (engineering) and (designing) design research. There is a relation between the two. However, this should not be the power relation it so often is but a circular interrelationship of equality.

It has been claimed that research originating in, and concerned with, practice is not rigorous (as discussed in Archer (1995)). I reject this view, which I believe comes about from confusing rigour with the particular form in which rigour is cast. Probably the most thorough and demanding test of any research is to act on it and examine the consequences of that action. This is testing. My understanding of rigour lies in continuing to pursue the matter at hand (to continue questioning) until the questions run out: that is, not to stop when the going gets hard, but to persist and hence break through. Behind this understanding stands honesty, the fundamental quality that must be the base from and within which all research is carried out. There is no inherent reason practice is less rigorous than theory. It may be that some practitioners are lax. But lazy and deceitful scientists are also familiar, as are those who act simply as unquestioning technicians. The failing of individuals is not the failure of a field.

Knowledge for (assisting) and knowledge of (assessing)

In 1993, Christopher Frayling published *Research in Art and Design* (Frayling (1993)). The key move in his argument was to change prepositions. He referred to research for design, into design and through design. In so doing he helped us contextualise the word design as noun and verb, but also as something to be studied (subject), and a way of studying relevant to the something to be studied (approach).

Acting in the spirit of preposition switchers Herbert Read and Martin Ryle, Frayling showed us two things. First, that there are differences in what people think design research is, or could be. Second, that the small change of swapping a preposition can effect an enormous change in meaning. The device behind the second difference (change in preposition) was also used by my former colleague, Dutch social theorist Gerard de Zeeuw, discussing the difference between a model of what something is and a model for exploring – which designers have traditionally called a sketch model.[6]

I extended Zeeuw's model pair into knowledge giving knowledge of and knowledge for. The former approaches Aristotle's sophia, describing the world as we believe it is, the familiar knowledge of facts; the latter the knowledge of acting (including experimenting), of changing the world – Aristotle's phronesis. It may thus be characterised as knowledge helping us act. I have observed (both from personal experience and from the response of many professionals and students) that research which generates knowledge often constrains designers because, in essence, it tells us that we're wrong (in the sense that our decisions lead to something that does not work properly), without offering much guidance about what we should do to improve matters: it assesses, but it does not guide. Knowledge for enables us to act, and can never be the same as, or, perhaps, as exact as knowledge of. But it does help us improve and change: it supports designers. The criterion is not 'right', 'true' or 'best', but 'good enough'.

An example may help. Thirty-five years ago, when desktop computers were not yet even a novelty, calculations for the loss of heat were done by hand. To carry out the full calculations for a modest house took about half a day, almost invariably producing a result that was unacceptable. The result told you little about what to do to get a good enough result. So the calculation was repeated, and repeated and repeated; or, all too often, just abandoned. I remember this from painful personal experience! The use, nowadays, of spreadsheet software with optimisation algorithms has turned this around and the knowledge is now usable by designers. We have knowledge for, shaped for designers to act with, rather than knowledge of what the situation would be.

Technology is often seen as a link between these two types of knowledge. Technology can be interpreted as, amongst other things, a way of turning knowledge of into knowledge for. But even at its best, this is indirect, requiring the help of others, lacking the directness that designers like.

The terms knowledge of and knowledge for are not the only possible terms. It has been argued, for instance, that there is a strong connection with Gibbons et al.'s (1994) notion of mode 1 and mode 2 investigation which leads to different types of knowledge (Verbeke and Glanville (2005)), and, according to more recent developments, what is called science 1 and 2 (Mueller (2009)). Of course, we should not forget the terms Aristotle gave us, sophia and phronesis. Yet I continue to like my terms because of their immediacy and simple directness.

Verb and noun

The last contrast we consider is the part of speech the word design is taken to be: i.e. verb or noun. Much of what is collected under this heading has already been at least partially covered, but co-ordinated assembly under this heading seems helpful.

In English, both verb and noun are possible. But they indicate very different concerns. To research design-as-noun is to be concerned with the outcome of a design process, and to somehow evaluate it. In other words, it is a matter of assessment: the aim is to examine the performance of some designed object (or process) against a set of chosen criteria.

In contrast, to research design-as-activity (designing) is much more ephemeral. Most designing happens over a long period, often in the back of the head and inconveniently away from the work site (drawing board/computer). To determine the steps made by observing a designer's behaviour all too often gives little, if any, understanding of the internal processes the designer goes through, especially those of which (s)he is less aware, and gives none of that which is not directly expressed as discrete, observable behaviour. On occasion, researchers try to overcome the difficulty by asking designers to work in a temporarily constrained situation and to describe what they do as they do it, but neither the time frame, nor the describing are normal parts of the act of designing, and so distortion is introduced by the experiment itself, meaning we are no longer examining what we meant to. The best way I know through which to understand what is involved in designing is to invite the designers themselves to reflect on their own designing after the event (on various and variable timetables, in Schön's manner).

And we should remember why we want to understand: in order to improve. This is research intended to give assistance.

It may seem to the reader that the former approach is simpler than the latter: that to examine design-as-noun is more straightforward than to examine design-as-verb, and the result is less subjective. However, (designing) design is an activity (a way of thinking and of being in the world) which is subjective, personal and experiential. It needs an agent to do it! I am reminded of the way that life has been examined in biology, where, bizarrely, living entities are killed in order to examine life. In contrast, how refreshingly powerful Varela, Maturana and Uribe's (1972) Autopoiesis is, which considers life as the process of continuing to live!

The sort of difference here, between artefact and action, is familiar in other fields, and has lead to the development of powerful methods such as action research and grounded theory that may help such research. In making my arguments, I am certainly not dismissing ready-made methods out of hand. But I do insist we should be wary, checking any chosen method for appropriateness.

The purpose of assessment is, ultimately, improvement: that is, we assess a designed artefact (e.g. object or process) in order to confirm it is of adequate standard and if not, to raise it to that standard. But having knowledge of the artefact does not tell us how to improve it; and knowledge we cannot act with is useless in a world of actions. Too often, we lack a knowledge of how, rather than what, to do; yet this is the heart of designing. For this reason, if no other, research into design-as-verb must be fundamental in design research.

I repeat, Aristotle may have considered sophia as superior knowledge to phronesis. But he also reminded us that sophia is based on and comes from phronesis, and it returns there for its own validation: a theory that doesn't work in the universe of discourse to which it is applied is not a theory of that universe of discourse – which is only to restate the argument made above about the appropriateness of theory to practice.

Conclusion

I have argued that when we talk of design research we often talk of two different views of both design and research. One of these views has, Terry Love tells us, far greater academic presence (which does not grant it superiority): in fact, I have argued, it is more restricted than the other. Yet, each may have its place, and which one we choose to pursue should be determined by the nature of our interest and enquiry. Much of the positioning in design research has been a jousting for superiority, often even an attempt to exclude the view a particular author does not favour. I have come to the conclusion that this approach, while sometimes necessary in order to focus a particular piece of research, is generally silly. However, in taking my position, I can also be accused of being partisan.

We have learnt, in the sciences of ecology, that variety is crucial: we should not artificially reduce nature's variety. Thus, we are careful to guard and protect all the bugs, known and as yet unknown to man, in the Amazonian rain forest. Yet, when it comes to ways of thinking, we are less accommodating, more willing to argue that there is only one proper way of thinking, and therefore of doing research. If this chapter has one overriding point it is that this is not so: we should guard different ways of thinking, of conceiving, interacting with and examining (coming to know) the world, and we should value this variety while following our own paths. The composer Arnold Schönberg, who invented atonal and then serial (twelve tone) music, is reported to have stated something very similar about music: "There is much good music to be written in C Major. But not by me" (Newlin 1974).

Nevertheless, there are what Nigel Cross (2011) has called "designerly ways of thinking",[7] and it is, I believe, these that we should look to enhance as the main aim of design research. One element in the designerly is delight. So perhaps we should return to our earliest (western) text on design, Vitruvius's "De Architectura libri decem". Vitruvius claimed architecture (remember, architecture was used in a more general sense than referring just to buildings, a manner more akin to how we use design nowadays) was constituted, he wrote, of three equal parts, "firmitas, utilitas, vensutas", which translate as well-constructed, functional, bringing delight. Of these, firmitas and utilitas are relatively straightforward, and are handled by both varieties of design research. But delight is not really considered in (engineering) design research – in my opinion a serious, even near fatal, omission. The modernist slogan attributed to Louis

Sullivan, that "form follows function", can be seen as an optimistic and somewhat self-serving plea, that delight will arise automatically if only the functional aspects are properly handled. Sometimes it does, but sometimes it does not. And what does this slogan mean when we invent a new use for some artefact, when function follows form in the manner of Gibson's (1986) concept of 'affordance'?

Again, to whom should we aim to bring delight? To the world at large, to the immediate users and also to those who make it, the designers.

There is a trade-off here. We have enormous, I would hope persistently insurmountable, difficulty in defining delight so that it becomes a metric. When all is definable, to achieve the best may be a viable aspiration. When it is not, what we mean by the best is no longer so clear, and we have to aim, rather, for what is good enough. But there are hidden advantages in pursuing what is good enough: room for alternative suggestions, the possibility of continuous improvement, the idea that it is always possible to try again (in Samuel Beckett's (1984) phrase "Try again. Fail again. Fail better" which, though never intended for design, provides me with my favourite definition). Gerard de Zeeuw (of models of and for), in discussing the solving of problems in society, talks of the need to replace the problem being solved with another to be solved because humans like to solve problems, so removing problems leaves a serious hole in our existence. This leaves design as a way of acting that invites continuing involvement, a sort of perpetual job creation programme. If we want to promote delight in design, we should perhaps choose a model for research that might lead to improvement in delight, carefully.

At the start of this chapter, I remarked that its purpose was not to be right, but to help the designer understand and improve. In this I reflect a central message I have been arguing. How might the chapter help? I hope it casts light on a major division in design research, in a manner that encourages a coming together rather than a continuing battle, and that it shows the value of practice and of rigorous research into, in and through practice. But I also hope it may provide the reader with some confidence where, after World War II, designers had little: design is an important way of thinking and acting, and we should have faith in its value, and in the value of our acting with it. If I have convinced you, the reader, of my views, or if you have found any clarity, or an excuse to think further, I take that, too, as a success.

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Notes

1 Other words closely associated with design are art and craft. I mention these because design has a secondary meaning that suggests something underhand. A crafty person may be very artful, with designs on something (or someone), as in Dickens' "The Artful Dodger". The words imply at least as much of the loveable rogue, as of the impeccably cool perfection of Jonny Ive!

2 Weinberg's account was extracted from pp. 12–15 of the book *An Introduction to General Systems Thinking*, and presented as a freestanding article by George Klir in 1991.

3 RCA mythology gives several very different explanations for Stevens' action.

4 Terry Love told me he carried out an informal survey of research outputs and found 80 per cent or more were (engineering) design research. He also asked others who had carried out similar surveys and found them in general agreement. Interestingly, these were not scientific surveys! However, they are strongly indicative.

5 This distinction was introduced, implicitly, in the early days of design research by Broadbent in his insistence on his maker categories. See Broadbent (1973).
6 Zeeuw introduced this distinction in seminars he held in the mid-1980s. In spite of repeated requests, I do not believe he has written or published this very powerful distinction. I have no idea why not.
7 See also Bryan Lawson's extensive work, for instance, Lawson (2006) *How Designers Think*.

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2

A CYBERNETIC MODEL OF DESIGN RESEARCH

Towards a trans-domain[1] of knowing

Wolfgang Jonas

The situation

The cultures of the Sciences and the Arts were still largely integrated during the Renaissance. Their separation since the seventeenth century finally led to what we know as 'nineteenth century science' and 'art school design' today. Supposedly, science produces theoretical knowledge, which design, at best, applies in practice. In order to overcome the deficits and make design an academically respected discipline, it is often argued that designerly knowledge production has to adopt scientific standards.

Friedman (2003: 510) resorts to the established distinction of "clinical", "applied" and "basic" research in medicine. Basic research "involves a search for general principles", applied research "adapts the findings of basic research to classes of problems" and clinical research "applies the findings of basic research and applied research to specific situations". Medicine can refer to a stable reference system for assessing success or failure, whereas the usefulness in design remains unclear. The distinction of clinical/applied/basic corresponds to the degree of de-contextualisation of the subject matter. Yet, design deals with the fit of systemic wholes in life-world environments. These fits immediately lose their significance in de-contextualised situations. Therefore one might argue that 'basic' research is meaningless in design and that 'clinical' research is the most 'basic' and – at the same time – the most challenging form of Design Research. Glanville (1980) and Archer (1995) support this view. Friedman constructs a further antagonistic and, again, overly schematic distinction of reflection and research:

> Reflection [. . .] develops engaged knowledge from individual and group experience. It is a personal act or a community act, and it is an existential act. Reflection engages the felt, personal world of the individual. It is intimately linked to the process of personal learning [. . .] Research, in contrast, addresses the question itself, as distinct from the personal or communal [. . .] In short, research is the 'methodical search for knowledge. Original research tackles new problems or checks previous findings. Rigorous research is the mark of science, technology, and the "living" branches of the humanities' (Bunge 1999: 251). Exploration, investigation, and inquiry are synonyms for research.
>
> *Friedman 2002: 19*

This persistent attempt at eliminating the observing system and at keeping up the barrier and epistemological hierarchy between the 'swampy lowlands' of reflective practice and the 'high ground' of rigorous research (Schön 1983) is definitely a step back compared with the emerging conceptual models of Practice-based Design Research. It also ignores recent developments in Science Studies, as will be shown in the following section (The perspective: design and science converging) and the penultimate section (Mode-2 Science, Transdisciplinarity and RTD). Friedman's own words demonstrate the weakness of this position. In saying that "reflective practice is one of an array of conceptual tools used in understanding any practice – including the practice of research" (Friedman 2002), he implicitly states that reflective practice is an essential research medium, probably the most important one in the *Sciences of the Artificial*. A circular one, admittedly.

Norman (2010) supports Friedman's view and laments the lack of scientific rigour and content in design education: "There is little or no training in science, the scientific method, and experimental design". His vision seems to be the designer as 'applied behavioral scientist'. Reverently insisting on distinguishing 'mere' design from 'proper' research by ignoring the epistemological characteristics of design and science contributes to solidifying the supposed hierarchy between the two and promotes the 'colonisation of design' (Krippendorff 1995).

Changing economic, social, cultural and technological conditions present serious challenges for university education. The types and forms of knowledge currently imparted by universities are predominantly descriptive rather than projective, and generated for academic peers rather than the public good. Most socially and economically relevant knowledge is conveyed outside the university (Scharmer and Käufer 2000). University education can no longer be concerned primarily with the socialisation into established institutional and societal norms. It must rather provide spaces and opportunities for experimental actions, examine possible, desirable and promising futures and transcend the present world. Scharmer and Käufer's perspective offers opportunities for re-inventing the university as a utopian space of exploration, improvisation and controversial sense-making. It helps re-articulate the relationship between science and the public, between knowledge and research, and between academic and non-academic practices. Design can contribute significantly.

The 'Scholastic University' was focused on teaching a canonical set of disciplines. The 'Modern University' builds on Humboldt's classical ideal of the unity of teaching and research, in a growing number of disciplines. Its focus was knowledge generation in the 'ivory tower', separated from the rest of the society. The limits of this model are obvious today. In response to increased societal complexity, the university is now renewing its conceptual core. Humboldt's model is being expanded and re-founded on a new basis.

In the emerging 'Next University' (Baecker 2007) the strict separation from society is eroded and the focus shifts towards the *unity of practice, research and teaching*. Researchers and teachers abandon their positions as external observers to become active, committed co-designers of social, cultural and economic realities. The age of *Anthropocene* requires the reflection of values. 'Weltanschauung'[2] is an essential issue in socially relevant inquiry (Churchman 1971). Research (producing knowledge), teaching (disseminating knowledge) and practice (using knowledge to guide action) can no longer exist separately, nor can technology, design and art. The dynamics of these developments and the assumptions on which scientific knowledge production is based must be reconsidered.

We can build on important previous contributions from design, which has long been familiar with the basic epistemological 'problems of prediction and control' (Jonas 2003) and the situation of dealing with 'not-knowing' (Jonas and Meyer-Veden 2004). The early designerly concepts should be taken seriously and developed further. Current positions in Science Studies, which can be interpreted as the convergence of design and science, frame this ambitious endeavour.

The perspective: design and science converging

The dualism of the Sciences and the Arts still underpins today's prejudices against designerly modes of inquiry. One of the first strands of argument, which suggests the idea of re-integration, emphasises the importance of practice in knowledge generation. Pragmatism (Dewey 1986) argues that the separation of thinking, as pure contemplation, and acting, as bodily intervention into the world, is obsolete: thinking depends on life-world situations that have to be met. The active, intentional improvement of an unsatisfactory, problematic situation is the primary motivation for thinking, designing and, finally – in a refined and purified manner – for scientific inquiry. The achievement of projected consequences is the measurement of success. Knowing is a manner of acting and 'truth' is better called 'warranted assertibility' (Dewey 1941). This

Table 2.1 Convergences of science and design

Science → *Indications of the shift of science towards socially relevant innovation*	*← Design* *Indications of the shift of design towards socially robust knowledge creation*
The forgotten controversy at the beginning: Cartesian rationalism *vs.* Montaigne's scepticism (Toulmin 1992)	The concept of the *Sciences of the Artificial* (Simon 1969)
Pragmatist philosophy (Dewey 1986)	The definition of *scientific research as design activity* (Glanville 1980)
The concept of *problems of organised complexity* (Weaver 1948)	The de-mystification of the creative process as *evolutionary* (Michl 2002)
The increasing importance of generative and synthetic forms of research, e.g. in engineering, nano- and genetic design (e.g. Pfeifer and Bongard 2007)	The importance of design *beyond the product*: services, systems, organisations, scenarios, social design (e.g. Vezzoli and Manzini 2008)
Grounded theory building as creative action in the social sciences (Glaser and Strauss 1967)	The concept of the *trajectories of artificiality* (Krippendorff 2006)
The evidence generated by empirical *laboratory studies* (e.g. Knorr-Cetina 1999, Rheinberger 2006)	The concepts of *Practice-led Research, Project-grounded Research,* and *Research Through Design* (e.g. Jonas 2007, Findeli 2008a)
The considerations of *Science and Technology Studies* and *Actor-Network Theory* (Latour 1993, 2004)	The concept of *Design Thinking* (Brown 2009)
The emerging concept of *Mode 2 Science* and *Transdisciplinarity Studies* (Nowotny, Scott and Gibbons 2001, Nowotny 2006)	The approaches of *Design Fiction* (Bleecker 2010, Lukic and Katz 2010) and *Critical Design* (Dunne and Raby 2001)
Design-based research in *management, pedagogy, nursing*, etc. (e.g. Boland and Collopy 2004)	The exploration of the concept of *abduction* in design (Chow and Jonas 2010b)

comes close to what we argue to be emerging forms of Design Research and a convergence of design and science. Recent intellectual movements in both science and design support this hypothesis.

On the one hand, the social embeddedness and context-dependency of scientific inquiry have been widely acknowledged, and there are indications of science gearing towards a designerly process of innovation and change. Projects in bio-, nano- and genetic sciences are synthetic rather than merely explorative endeavours. Activities in informatics such as social networks and 'big data' research turn into global real-time design experiments. Not to speak of climate research and geo-engineering. The *Anthropocene* might become the age of joint endeavour of design and science, reconciling analysis, creative action and ethics. On the other hand, the intensity of knowledge production in design has been recognised; it is moving towards deliberately producing socially robust knowledge. These developments indicate a convergence of design and science towards a *trans-domain*, a tentative term for a social and intellectual space and mindset, which accommodates transdisciplinary projects and develops corresponding facilities and networks. An outline of the theories and concepts is sketched in Table 2.1. Some salient aspects will be discussed in the following sections: 'Research through design' and 'Mode-2 Science, Transdisciplinarity and RTD'.

The hypothesis of convergence arises from the observation that both traditions share the same underlying *cybernetic* process pattern of *experiential evolutionary learning*. This model assumes far-reaching structural identity from the biological to the cognitive and cultural level (Riedl 2000, Vollmer 1998). The basic structure reveals a circular process of trial (based upon expectation) and experience (success or failure, confirmation or refutation), or of action and reflection. The aim is not a true representation of some external reality, but rather a process of (re-) construction, for the purpose of appropriate (re-) action. An inductive/heuristic semi-circle leads from purposeful experiential learning to hypotheses, theories and prognoses about how the world works. It is followed by a deductive/logical semi-circle that leads to actions and interventions, which result in new experiences that confirm or refute existing theories.

One of the most prominent patterns of this type is Kolb's (1984) experiential learning process. The pattern finds application in various fields, especially in design methods (e.g. Owen 1998). Yet, many of these models have a deficit, which obscures their potential: they do not account for the essential step of creating the new. They neglect *abduction*, which is the central mechanism of knowledge generation in everyday life, design and science. There is, therefore, a need for models that explicitly acknowledge the creative phase and thus provide a theoretical framework for *Research Through Design* (*RTD*). Internal or external perturbations (called ideas, creativity, intuition, accidents, environmental changes, etc.) create variations in the circle, leading to stabilisations (negative feedback) or amplifications and evolutionary developments (positive feedback). Dewey's five-step cycle in Figure 2.1 includes the abductive step 'create'. Table 2.3 elaborates on this issue.

A solid base: evolving models of design

Beside the ongoing scientification of Design Research (Bayazit 2004), there are growing endeavours to take up and develop the original approaches. The evolution of schemes accounts for design-specific ways of knowing. Synthesising these may give rise to a new understanding.

Weaver (1948) supported the conceptualisation of Design Research by introducing 'problems of organised complexity' as the central challenge of the second half of the twentieth century. He anticipates *Mode-2 Science* (Nowotny, Scott and Gibbons 2001), which describes modern

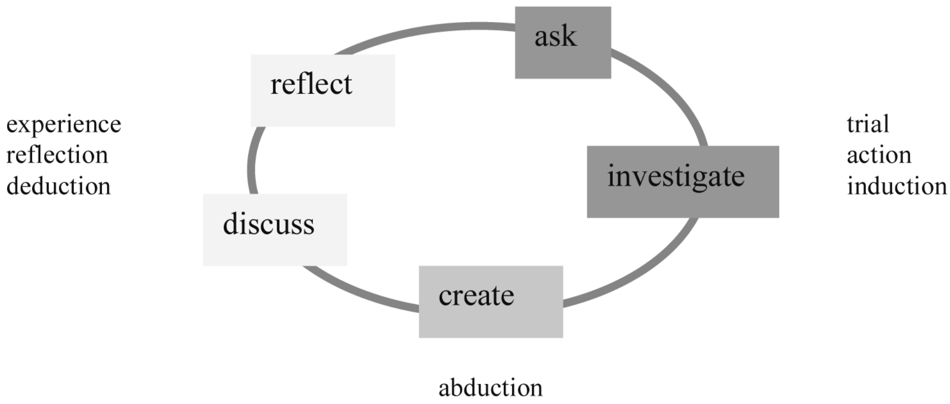


Figure 2.1 Learning cycle with inductive, abductive and deductive phases

Source: Dewey 1910

knowledge production as increasingly problem-oriented, normative, socially accountable and transdisciplinary. Simon (1969) was one of the first to conceive design as a distinct subject and form of research, different from the Sciences and the Humanities. Design Research is not conducted for its own sake, but to improve real-world situations, to 'transfer existing situations into preferred ones'. The concept of relevance shows up here, which seems to be in permanent conflict with scientific rigour; a polarity which may finally dissolve in a pragmatist view. In locating design at the interface between the artefact and its contexts, Simon introduced the idea of situatedness and context-dependency of Design Research. The parallels with *Mode-2 Science* 20 years later are obvious, but the exchange between Design Research and Science Studies is hardly developed. Grand and Jonas (2012) suggest a closer relationship.

Archer (1979) introduces 'Design as a discipline', which has to cover a huge diversity of heterogeneous subjects. The prolific paradox of the 'undisciplined' discipline (DRS 2008) has been present from the very beginning. Archer (1981: 30) took a Wittgensteinian stance[3] and argued "that my own approach to finding an answer to the question What is Design Research? is to try to discover what design researchers actually do." His definition: "Design Research [. . .] is systematic enquiry whose goal is knowledge of, or in, the embodiment of configuration, composition, structure, purpose, value and meaning in man-made things and systems" is similar to Findeli's (2008b): "Design research is a systematic search for and acquisition of knowledge related to general human ecology considered from a 'designerly way of thinking' (i.e. project-oriented) perspective."

Archer (1981: 31, 35) lists ten areas of Design Research, from which "constituent sub-disciplines" emerge, namely "Design Phenomenology", "Design Praxiology" and "Design Philosophy". Cross suggests that (1999: 6) "design research would therefore fall into three main categories, based on products, process and people" and even relates them to historical epochs: the 1920s, the 1960s and the 2000s. Referring to Simon (1969) he introduces the "designerly ways of knowing" and warns:

> that we do not have to turn design into an imitation of science, nor do we have to treat design as a mysterious, ineffable art. [. . .] we must avoid totally swamping our research with different cultures imported either from science or art.
>
> *Cross 2001: 50*

In the 1920s, design was occupied with products. In the 1960s, the "design science decade" (Fuller 1999), there is the search for rationality. The *Conference on Design Methods* in 1962 marked the beginning of the *Design Methods Movement* with its desire to base the process on objectivity and rationality. The *Sciences of the Artificial* (Simon 1969) highlighted the culmination and the watershed of this development. Simon himself, in chapter 6 on 'Social Planning: Designing the Evolving Artefact' (1996: 163) made a considerable shift in acknowledging complexity, uncertainty and the evolutionary character of social design processes.

In pointedly illustrating the fundamental paradoxes that occur when design (as an activity projecting what should be) is misconceived as a scientific endeavour (analysing what is), Rittel (1972) made contributions to this debate that cannot be overestimated. The theory backlash of the 1970s obstructed the growth of these still vague ideas and it took a decade to recover. Cross summarises the Design Research Society's 1980 conference on *Design. Science: Method* (2001: 51):

> The general feeling from that conference was, perhaps, that it was time to move on from making simplistic comparisons and distinctions between science and design; that perhaps there was not so much to learn from science after all, and that perhaps science rather had something to learn from design.

In the 2000s, Cross detects the focus on people in Design Research**.** His phase model of products – process – people shows a stunning parallel to what Findeli later presents as the 'Bremen model' (Findeli and Bousbaki 2005), where he describes a shift of concern from aesthetics (products) to logic (process) and finally towards ethics (people) in Design Research. Cross (2001) tries to clarify the confusion about design and science. Reflecting on 'Scientific Design' (design with scientific and other foundations), 'Design Science' (design as science) and 'Science of Design' (design as subject matter of science) he finally argues for 'design as a discipline':

> Design as a discipline, therefore, can mean design studied on its own terms, and within its own rigorous culture. It can mean a science of design based on the reflective practice of design: design as a discipline, but not design as a science. [. . .] The underlying axiom of this discipline is that there are forms of knowledge special to the awareness and ability of a designer, independent of the different professional domains of design practice.
>
> *Cross 2001: 54*

He worries about the 'swamping' of Design Research, yet we cannot avoid it. The design community owes the metaphor of the 'swampy lowlands' and the 'high ground' to Schön (1983), who challenges the *Design Science Movement* and argues for an epistemology of practice, instead. His *Reflective Practitioner* explicitly raises the issue of rigour vs. relevance:

> There are those who choose the swampy lowlands. They deliberately involve themselves in messy but crucially important problems and, when asked to describe their methods of inquiry, they speak of experience, trial and error, intuition, and muddling through. Other professionals opt for the high ground. Hungry for technical rigour, devoted to an image of solid professional competence, or fearful of entering a world in which they feel they do not know what they are doing, they choose to confine themselves to narrowly technical practice.
>
> *Schön 1983: 42, 43*

Owen (1998), also in the pragmatist tradition, believes that, although design's own research culture is still young and weak, the import of seemingly approved paradigms and methods may be counter-productive (1998: 10):

> Yet, it is reasonable to think that there are areas of knowledge and ways of proceeding that are very special to design, and it seems sensible that there should be ways of building knowledge that are especially suited to the way design is studied and practiced.

In slight contrast to this assertion – and in line with our further argument – Owen analyses the circular process of knowledge building (inquiry) and knowledge using (application) in various scientific and non-scientific disciplines and argues that they are fundamentally the same. The differences lie in the purpose of the activity and in the codes and value bases used.

Research through design as cybernetic mode of inquiry

Frayling (1993) made the distinction of research 'INTO' (ABOUT), 'THROUGH' and 'FOR art and design' popular. Owen concentrates on building knowledge FOR the improvement of the design process and on applying this knowledge in design. The pragmatist focus, which integrates inquiry and application through feedback loops, indicates that the knowledge base is fed THROUGH the design processes. Design is object and instrument in Owen's model. He gives a number of recommendations, including an urge to do research ABOUT design:

> Initiate studies of the philosophy of design. Just as studies of the philosophy of science, history, religion, etc. seek to understand the underpinning values, structures and

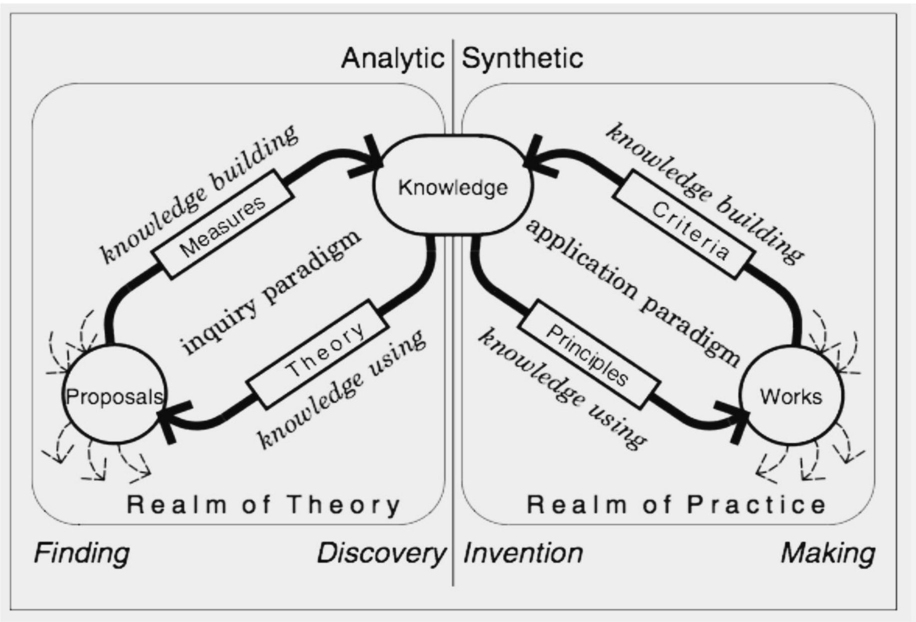


Figure 2.2 Circular processes of knowledge building in theory and practice

Source: Owen 1998

> processes within these systems of knowledge building and using, there need to be studies of the nature of design.
>
> *Owen 1998: 19*

The categorisation FOR/ABOUT/THROUGH, which – for the first time – does not distinguish as to subject matter or an assumed categorisation of the 'real world' as in other disciplines, but according to purpose, intentionality and attitude towards subject matters, is essential for a genuine designerly research paradigm.

Research ABOUT and FOR design is unambiguous. The epistemological status of *RTD*, however, is still fragile. Grounded Theory as well as Action Research will probably contribute. Both admit the involvement of the researcher as well as the abductive emergence of theories from empirical data, in contrast to the established concept of theory building as the verification of previously formulated hypotheses. Archer (1995) adheres to the distinction and puts *RTD* in the level with Action Research (1995: 11): "It is when research activity is carried out through the medium of practitioner activity that the case becomes interesting". Findeli (1998) explains:

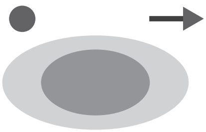
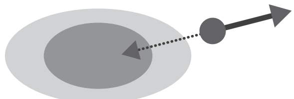
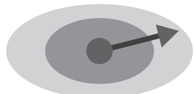
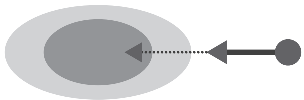
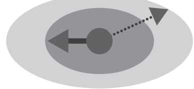
> 'project-grounded research' [. . .] is a kind of hybrid between action research and grounded theory research, but at the same time it reaches beyond these methods, in the sense that our researchers in design are valued both for their academic and professional expertise, which is not the case even in the most engaged action research situations.
>
> [. . .] although the importance of the design project needs to be recognized in project-grounded research [. . .] practice is only a support for research (a means, not an end), the main product of which should remain design knowledge.

In *cybernetic* terms, this means a shift from 1st to 2nd order observation. We include our own observing and acting, not as deplorable limitation but as a constitutive and essential part of the inquiry. This resolves Friedman's alleged antagonism of reflection and research. Design Research is conceived as a process of 1st order cybernetics regarding scientific inputs of any kind and of 2nd order cybernetics regarding the ways of using and integrating this knowledge by means of reflecting purposes and observer involvement. Table 2.2 illustrates four generic situations of inquiry: There is the wider context/life-world and the design/inquiring system. Researchers can be situated outside these systems as disembodied Cartesian observers or inside the inquiring system as embodied/situated/intentional observers. And we have the observer perspective, which can focus either on the inquiring system or on some goal outside (such as material or market research, etc.). The scheme provides a fourth mode, which will be tentatively called 'research AS design'.

Research FOR design: An idealised/disembodied/objective observer of some isolated external phenomenon, generating knowledge FOR a design/inquiring system. Research is defined/determined by underlying basic theoretical assumptions regarding the structure/nature of the design process (What is design? How does it work?). → Design as: cognitive/semiotic/communicative/learning process, etc. Research by means of disciplinary scientific methods, aiming at the improvement of the design/inquiring system regarding various externally determined criteria (so-called 'applied science').

Research ABOUT design: An idealised/disembodied/objective observer of a design/inquiring system, generating knowledge ABOUT this system. Research is defined/determined by motivations aiming at inquiring and understanding the nature of diverse aspects of design. →

Table 2.2 The concepts of research FOR, ABOUT, THROUGH design, related to observer positions and perspectives. A fourth category is emerging: Research AS design

Observer position and perspective relative to the design/inquring system and the life-world 	**1st order cybernetics** Observer is situated outside the design/inquiring system producing facts	**2nd order cybernetics** Observer is situated inside the design/inquiring system producing (arte)facts based on values
Observer looking outwards	**Research FOR design** 	**Research THROUGH design** 
Observer looking inwards	**Research ABOUT design** 	**Research AS design (?)** 

Source: Glanville 1997

Design as subject of disciplinary scientific research: philosophical, anthropological, historical, psychological, etc.

Research THROUGH design: An embodied/situated/intentional observer inside a design/inquiring system, generating knowledge and change THROUGH active participation in the design/inquiring process. Research is defined/determined by ethical assumptions regarding the purpose of designing (What is design good for? How do we want to live?). → Design as: projective/human-centred/innovation/emancipatory/political/social process, etc. Research in the medium of design, guided by the design process, aiming at transferable knowledge and innovation according to various internally determined criteria. For a comparison of the different versions of *RTD* see Chow (2010).

Research AS design: An embodied/situated/intentional observer inside a design/inquiring system, concentrating on the production of 'variations' AS raw material for the design/inquiring process. Research in action, performed in the medium of design. → Design as the inaccessible medium of knowledge production: a learning process. Probably the essential mental and social 'mechanism' of generating new ideas, the location of abductive reasoning. Research AS design may denote 'Design Thinking' as a cognitive and social process, which, in turn, can be the subject of inquiry ABOUT or THROUGH design.

The issue of rigour vs. relevance occurs again. Findeli (2008a, b) introduces a new perspective in arguing that 'project-grounded research' (his term for *RTD*) has to combine research FOR and ABOUT design in order to become both relevant and rigorous. Thus, one may conclude that research in design only makes sense if all observation modes are taken into consideration. *RTD* requires 'objective' scientific input generated by research FOR or ABOUT design. But the process remains locked in sterile assumptions, if research THROUGH the medium of design is neglected. It is the abductive step, research AS design, which is able to combine the logical syllogisms of induction and deduction into a productive cycle. This playful dance of perspectives seems to be the most important conversational medium for the generation of new design knowledge.

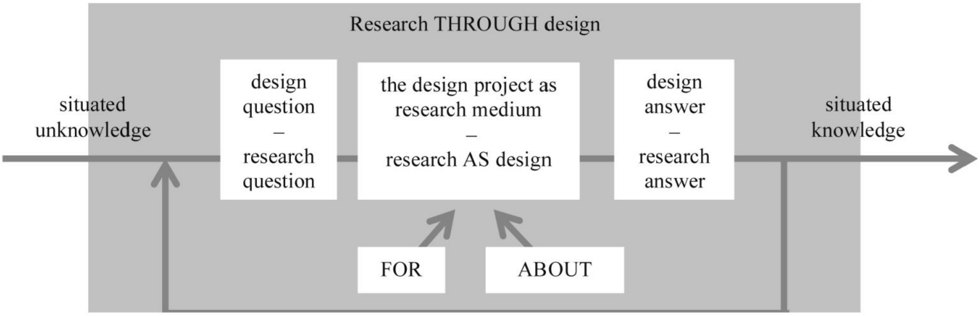


Figure 2.3 Research THROUGH design means the reflected, purposive and playful use of observer modes during the design research process

The nature of design prohibits the reduction of Design Research to scientific research. On the contrary: scientific research has to be embedded in designerly models of inquiry. There are the all-embracing *subject matters* of aesthetics/products – logic/process – ethics/people, and the essential distinguishing *purposes* of understanding design-relevant phenomena, of improving the design process and of improving the human condition. Theses purposes can be related to the *epistemological attitudes* or modes of research ABOUT design, FOR design and THROUGH design.

Mode-2 Science, Transdisciplinarity and *RTD*

Integrative approaches are needed to bridge the gaps between incompatible knowledge cultures and types of knowing. Design has always had this 'problem', whereas science has faced it only recently. This is where science can learn from design.

Baecker (2000) extends Luhmann's (1996) social systems theory, in which humans are conceived as combinations of two closed autopoietic[4] systems, namely bodies and consciousnesses (Maturana and Varela 1987). The social is created by a third autopoietic system, which is communication. The closure of these three system types means that they cannot control but only irritate each other. They are causally de-coupled; each of them operates according to its own internal structure and organisation. Design is used to deal with knowledge gaps between these causally de-coupled systems (Baecker, 2000: 163; own translation):

> Design as a practice of not-knowing may be read in reference to diverse interfaces, but the interfaces between technology, body, psyche and communication are probably dominant. If these 'worlds', each described by a more or less elaborate knowledge, are brought into a relationship of difference, this knowledge disappears and makes room for experiments, which are the experiments of design. [. . .] Not to take anything for granted here anymore, but to see potential of dissolution and recombination everywhere, becomes the playground of a design that eventually reaches into pedagogy, therapy, and medicine.

Further knowledge gaps originate from the causally de-coupled evolutionary phases of variation/selection/re-stabilisation in every real-world design process (Jonas 2003).

The argument for convergence, as put forward in the second section of this chapter (The perspective: design and science converging), is implicit in Table 2.3: various *Sciences of the*

Table 2.3 Triadic concepts of experiential learning processes in Design Research, emphasising the frameworks for *Research Through Design* and *Transdisciplinarity Studies*

Authors	*phases/components/domains of knowing in Design Research*		
Jones (1970)	divergence	transformation	convergence
Archer (1981)	science	design	arts
Simon (1969), Weick (1969)	intelligence	design	choice
Nelson and Stolterman (2003)	the true	the ideal	the real
Jonas (2007) *RTD*	Analysis	Projection	Synthesis
Fallman (2008)	Design Studies	Design Exploration	Design Practice
Brown (2009)	Inspiration	Ideation	Implementation
Nicolescu (2002) *Transdisciplinarity Studies*	System knowledge	Target knowledge	Transformation knowledge

Artificial, such as Design (Archer 1981, Jonas 2007, Jones 1970 and Nelson and Stolterman 2003), Management Studies (Simon 1969, Weick 1969) and Human-Computer Interaction (Fallman 2008) reveal the generic three-stage pattern of inductive, abductive and deductive reasoning. The essential 'designerly' competences are located in the middle column. The process of *RTD* integrates Analysis (science) and Synthesis ('normal design') by means of abductive Projection (Chow and Jonas 2010a, b). See also Table 2.5.

There is a striking structural resemblance of *RTD* and *Transdisciplinarity Studies* (Nicolescu 2002, 2008), which claims to integrate system knowledge, target knowledge and transformation knowledge. In the *RTD* scheme, the first type of knowledge addresses the causes of present problems and their future development (system knowledge/Analysis). The second type concerns the values and norms that define the goals of problem-solving processes (target knowledge/Projection). The third type relates to the potential transformations and improvements of a problematic situation (transformation knowledge/Synthesis). Nowotny (2006) calls *Transdisciplinarity* a central feature of *Mode-2 Science*, which denotes a new form of knowledge production since the mid-twentieth century (Scott et al. 1994). While *Mode-1* knowledge production is academic, investigator-initiated and disciplinary-based, *Mode-2* is problem-focused, context-driven and interdisciplinary. According to Häberli et al. (2001: 4) 'The core idea of transdisciplinarity is different academic disciplines working jointly with practitioners to solve a real-world problem.' Like in *Mode-2 Science*, the goal is to understand and change the world. When the very nature of a problem is under dispute, *Transdisciplinarity* can help generate or design relevant problems and research questions.

The distinction between *Mode-2* and *Transdisciplinarity* remains fuzzy, which reflects a typical German use of the latter (Nowotny 2006). Yet, there are more radical conceptions. Nicolescu (2002, 2008), for example, strives to deal adequately with the problem of complexity by integrating diverse and often contradictory perceptions without destroying them. He suggests three *Axioms of Transdisciplinarity*, which explicitly address the knowledge gaps between the different levels of reality and the perceiving subject: (1) the 'ontological axiom' – in nature and society, as well as in our perception of and knowledge about them, there are *different levels of reality* for the subject, which correspond to different levels of the object; (2) the 'logical axiom'

Table 2.4 *Transdisciplinarity* integrates different 'worlds' (Brown et al. 2010: 46); the relation to Luhmann (1996)

Segment of reality	*Human interest*	*Domain of science*
The external physical world (bodies)	Technical (instrumental)	Empirical-analytic/physical sciences
The inner subjective world (consciousnesses)	Practical (values/practical rationality)	Hermeneutics; social and historical sciences
The normative social world (communications)	Emancipatory (critical or self-reflection)	Critical social sciences; critical systems thinking

– the transition from one level of reality to another is vouchsafed by the *logic of the included third*; and (3) the 'epistemological axiom' – the structure of the totality of all levels of reality is *complex*; each level is determined by the simultaneous existence of all other levels.

Open Transdisciplinarity (Brown et al. 2010) goes further and implies the equal practice of various heterogeneous knowledge cultures in a collective learning/designing process. Here, 'specialised' (scientific) knowledge is but one of five relevant types comprising 'individual knowledge', 'local community knowledge', 'specialised knowledge', 'organisational knowledge' and 'holistic knowledge'. The concept thus contributes to the interface-building between epistemologically different 'worlds', or to the bridging of 'knowledge gaps'. Table 2.4 reveals the relation to Luhmann's systems of body, consciousness and communication.

So what: towards a *trans-domain*

Scientific and designerly research may converge towards a new *trans-domain*. This does not mean that two original components merge into one and then disappear. Rather, a new intellectual mind-set and communicative space emerges, which allows a multitude of approaches in the 'beauty of grey' between the fundamentalist poles of pure black and white. Advanced systems thinking and cybernetics are the integrative core of the new space, which creates an experimental platform for negotiations of *Transdisciplinarity*, *Mode-2*, *Not-Knowing* and other not yet solidified or substantiated aspects of a new intellectual tendency. The provisional character of the *trans-domain* allows for a multitude of alternative approaches providing life-world perspectives, including the preservation of traditional disciplines and their interactions. In line with this, Glanville (1980: 93), in his classical paper 'Why Design Research?', conceives of 'research as a design activity' and regards scientific research as a sub-discipline of Design Research:

> Under these circumstances, the beautiful activity that is science will no longer be seen as mechanistic, except in retrospect. It will truly be understood honestly, as a great creative and social design activity, one of the true social arts. And its paradigm will be recognised as being design.

So what? In the *trans-domain*, it is imperative for Design Researchers to develop and reflect on their own specific knowledge production processes, rather than fetishizing science. *Projective abduction* integrates science and design and is thus instrumental to establishing the new model. The above mentioned 'problems of prediction and control' are addressed adequately. Research on complex problems is presented as a reflexive play with observer positions, guided by the logic

Table 2.5 The topology of the *trans-domain*. *Mode-2 Science*, *Transdisciplinarity* and *RTD* link design and science by means of projective abduction

	Analysis/Induction	*Projection/Abduction*	*Synthesis/Deduction*
design practice, *normal design*			. . . just addresses a given brief
scientific research, *Mode-1 Science*	. . . does not aim at change		
Mode-2 Science, *Transdisciplinarity*, *RTD*	system knowledge	target knowledge	transformation knowledge

of the design process. This playful dance of perspectives is – in our view – the most important conversational medium for the generation of new knowledge. Incoherent knowledge types and domains of knowing are integrated by accepting irreducible complexity (Mikulecky no year):

> Complexity is the property of a real world system that is manifest in the inability of any one formalism being adequate to capture all its properties. It requires that we find distinctly different ways of interacting with systems. Distinctly different in the sense that when we make successful models, the formal systems needed to describe each distinct aspect are NOT derivable from each other.

Research THROUGH design turns out to be the 'wormhole', through which we can escape the dead end of current Design Research. We can finally stop to desperately seek the recognition of science and instead present design as a role model for a new form of science.

Notes

1 The European Commission is using the term in its COST programme, see www.cost.eu/domains_actions/TDP, accessed 27 December 2012: 'Trans-Domain (TD) COST Actions offer researchers fertile ground for future networks across many science and technology disciplines, by allowing unusually broad, interdisciplinary proposals to cover several scientific Domains.'
2 Churchman uses the German word for the framework of ideas and beliefs through which an individual, group or culture interprets the world and interacts with it.
3 Ludwig Wittgenstein's turn from formal logic to ordinary language is often characterised by the notion that 'the meaning of a word is its use in the language'.
4 The term autopoiesis was introduced in 1972 by Chilean biologists Humberto Maturana and Francisco Varela to define the self-maintaining chemistry of living cells. Since then the concept has also been applied to the fields of systems theory and sociology.

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3

THE STRUCTURING OF DESIGN KNOWLEDGE

Andy Dong, Karl Maton and Lucila Carvalho

In this chapter, we draw on a cutting-edge sociological approach to describe the structuring of design knowledge. Two concepts from Legitimation Code Theory, *specialisation codes* and *semantic gravity*, are used to explore the nature of competing claims to legitimacy and context-dependency of meanings in design knowledge. We argue that a focus on the structuring of design knowledge that explicitly articulates its organising principles helps clarify the acquisition and enactment of design practices and processes of cumulative knowledge-building in design.

Introduction

Design knowledge – comprising theories, practices, principles, cases, guidelines, patterns and cognitive strategies – influences more than design praxis. Design knowledge has been applied to business strategy (Brown, 2008, Verganti, 2009, Martin, 2009), technological innovation (Hobday et al., 2011, Hobday et al., 2012), management theory (Boland and Collopy, 2004), educational curriculum (Kolodner et al., 2003) and human development policy (Oosterlaken, 2009), to name but a few. Indeed, many management scholars could explain the concept of 'design thinking' without needing to appreciate its origins in architectural design (Rowe, 1987). A plurality of descriptions of and claims to design knowledge underlies this reach into new fields as "design and design thinking continue to expand their meanings" (Buchanan, 1992, p. 8). Design has thus successfully expanded into a host of domains. However, this expansionist plurality comes at a cost. Often understandings of design knowledge remain locked within the specificities of the practices under consideration – they reflect whatever is being looked at. The result is a segmented understanding of what constitutes 'design knowledge'. This segmentation is reinforced by a tendency to focus on empirical descriptions of the *content* of design knowledge rather than the organising principles underlying design knowledge regardless of the substantive content. Moreover, this focus on its surface features is also found in attempts to integrate understandings of design knowledge into a coherent theory (Love, 2002, Manzini, 2009, Franz, 1994). The combined result of expansion, plurality and a focus on content is that the field of design risks fragmentation of its knowledge (Galle, 2008) and a lack of agreement on even the most basic of its terms (Poggenpohl et al., 2004).

The perspective we illustrate here suggests that exploring the structuring of design knowledge aids understanding its diverse forms and that these forms shape design knowledge in all manner of ways, including its social accessibility, empirical adequacy, potential for cumulative development and explanatory power. Rather than developing a general, unified canon of design knowledge or criteria for this canon, we aim to help explore competing claims to design knowledge in terms of their organising principles. To bring these principles into view we shall introduce concepts from a framework for the analysis of knowledge practices and their effects: Legitimation Code Theory (LCT). Specifically, we shall explore two organising principles underlying the ways scholars have presented criteria for design knowledge. First, we focus on *specialisation codes* or the ways the legitimacy of knowledge and knowers in design – its methods and techniques and those said to possess them – are articulated in debates over design knowledge. Second, we explore differences in *semantic gravity* or the context-dependence of legitimate design knowledge, focusing on two dominant and contrastive research approaches. Different settings of these organising principles, or *legitimation codes*, represent different understandings of design knowledge. We discuss problems raised by competing claims to legitimacy, or *code clashes*, and the importance of avoiding the field's fragmentation by making transparent what code is emphasised by which actors, when and for what practices. To conclude, we highlight the significance of understanding the structuring of design knowledge and discuss the effects of these organising principles on knowledge practices associated with design.

Towards principles of design knowledge

The promise of design as a core competency beyond task-level technical proficiency makes design studies an exciting field of research. Within this field, design knowledge tends to be viewed diversely, as comprising: a set of practical skills, such as sketching and modelling; cognitive strategies, such as framing (Dorst, 2011) and analogical reasoning (Visser, 1996); and individual or group dispositions, such as curiosity (Beverland and Farrelly, 2007), deep cultural interests (Strickfaden et al., 2006) and cross-disciplinarity (Adams et al., 2011).

While diversity can be a strength, the plurality of claims to create design knowledge from various disciplines can also introduce segmentation among knowledges that are context-dependent. Design scholars have recurrently attempted to bring coherence to these positions through theories of design (e.g. Hatchuel and Weil, 2009), unifications of paradigms of design (Dorst, 2008, Dorst and Dijkhuis, 1995), and specifications of criteria for unifying theories (Friedman, 2003, Love, 2002). Owen's 'map of disciplines' (Owen, 1998) re-frames the question from 'what is design research?' to 'how is knowledge built?' and distinguished disciplines in terms of two dichotomies: 'analytic' or 'synthetic'; and 'symbolic' or 'real'. 'Analytic' disciplines focus on discovery, whereas 'synthetic' disciplines emphasise making; 'symbolic' disciplines interact with abstract phenomenon, whereas 'real' disciplines engage with physical artefacts. Owen then described alternative modes of knowledge production associated with these four types. Against a single design research method, he argued that modes of design research should be based upon the extent to which the inquiry is targeted towards establishing new or mastering existing theory and methods.

Models such as Owen's offer a valuable first step: they bring the nature of design knowledge into view. However, they also need theoretical development. As researchers attempting to enact such models experience, they struggle to capture empirical practices, which rarely fit within their lists of types, or processes of change within and between types. This invariably leads to the creation of further typologies with more or different types and sub-types of knowledge or to new demarcation criteria. However, the problem is not the comprehensiveness of categories but the form of the models themselves: their typological form limits their practical usefulness. To explore the nature of design knowledge we thus need to conceptualise the organising principles that generate diverse types of knowledge practices in design.

Legitimation code theory

Legitimation Code Theory (LCT) offers a multi-dimensional conceptual framework for analysing the organising principles of knowledge practices (Maton, 2014). LCT is a central framework within the 'school of thought' of social realism, which shows knowledge to be not only socially constructed but also real in the sense of possessing properties and powers that have effects. Accordingly, social realist research explores the organising principles of different forms of knowledge, their modes of change and their implications for such issues as social inclusion, student achievement and knowledge-building (e.g. Maton and Moore, 2010). LCT extends and integrates ideas from a range of theories, most centrally the sociological frameworks of Pierre Bourdieu and Basil Bernstein (Maton, 2014). Over the past decade the framework has grown rapidly as a basis for empirical research into education at all institutional levels and across the disciplinary map – from universities to primary schools, from jazz to physics – in a widening range of national contexts, as well as beyond education, including museums, armed forces and parliaments (e.g. Maton et al., 2014).[1] This includes a small but growing body of work exploring design (Carvalho et al., 2009, Shay and Steyn, 2014). LCT is being enacted at various levels of analysis, from single passages of text to national education systems, and using both qualitative and quantitative research methods (Maton et al., 2014). It thus allows studies of diverse practices and contexts, using diverse methods, to build on one another.

LCT comprises a multi-dimensional conceptual toolkit, where each dimension offers concepts for analysing a set of organising principles underlying practices as *legitimation codes* that propose differing ways of viewing legitimacy within the field. There are currently five dimensions to LCT, each centred on conceptualising a different form of legitimation code (Maton, 2014). In this chapter we shall draw on concepts from two dimensions: from Specialisation we shall employ *specialisation codes*; and from Semantics we adopt *semantic gravity*.

Specialisation of design knowledge

To introduce the notion of *specialisation codes*, consider Edmund Happold's argument about what the professions of engineering and architecture bring to design:

> An engineer's training is classical; it is a training in control. An architect's training is primarily romantic, a training in aesthetic conscience. This is not to say that no architect can reason or that all engineers are unromantic. Yet people certainly tend to think in one mode or the other, and to misunderstand what the other mode is about. They see conflict between the two modes and control by their own mode as essential.
>
> *Happold, 1986, p. 136*

Here Happold is describing very different bases of achievement: one where legitimacy is based on a shaping of the knower's gaze (architect); the other where legitimacy follows the acquisition of specialist knowledge (engineering). The organising principles underlying these competing ideas of what it means to be good at design can be understood in terms of *specialisation codes* (Maton, 2014). These concepts begin from the simple premise that every practice, belief or knowledge claim is about or oriented towards something and is made by someone. They thus involve relations to objects and to subjects. One can thus analytically distinguish: *epistemic relations* (ER) between knowledge and its proclaimed objects of study (that part of the world towards which they are oriented); and *social relations* (SR) between knowledge and its authors or subjects (who is enacting the practices). Each relation may be more strongly (+) or weakly (–) emphasised in practices and beliefs. These two relative strengths of emphasis together give the 'specialisation code'. Thus, a claim to knowledge may be viewed as legitimised by its epistemic relations, by its social relations, by both, or by neither. Figure 3.1 outlines four principal codes:

- *knowledge codes* (ER+, SR–), where possession of specialised knowledge, skills or procedures are emphasised as the basis of achievement, and the dispositions of actors are downplayed;
- *knower codes* (ER–, SR+), where specialist knowledge or skills is less significant and instead the dispositions of actors are emphasised as measures of achievement, whether viewed as natural (e.g. 'genius'), cultivated (e.g. artistic gaze) or socially based (e.g. feminist architecture);
- *elite codes* (ER+, SR+), where legitimacy is based on both possessing specialist knowledge and being the right kind of knower ('elite' does not necessarily mean 'socially exclusive' but rather the necessity of possessing *both* legitimate knowledge *and* legitimate dispositions); and
- *relativist codes* (ER–, SR–), where legitimate insight is neither determined by specialist knowledge nor knower attributes.

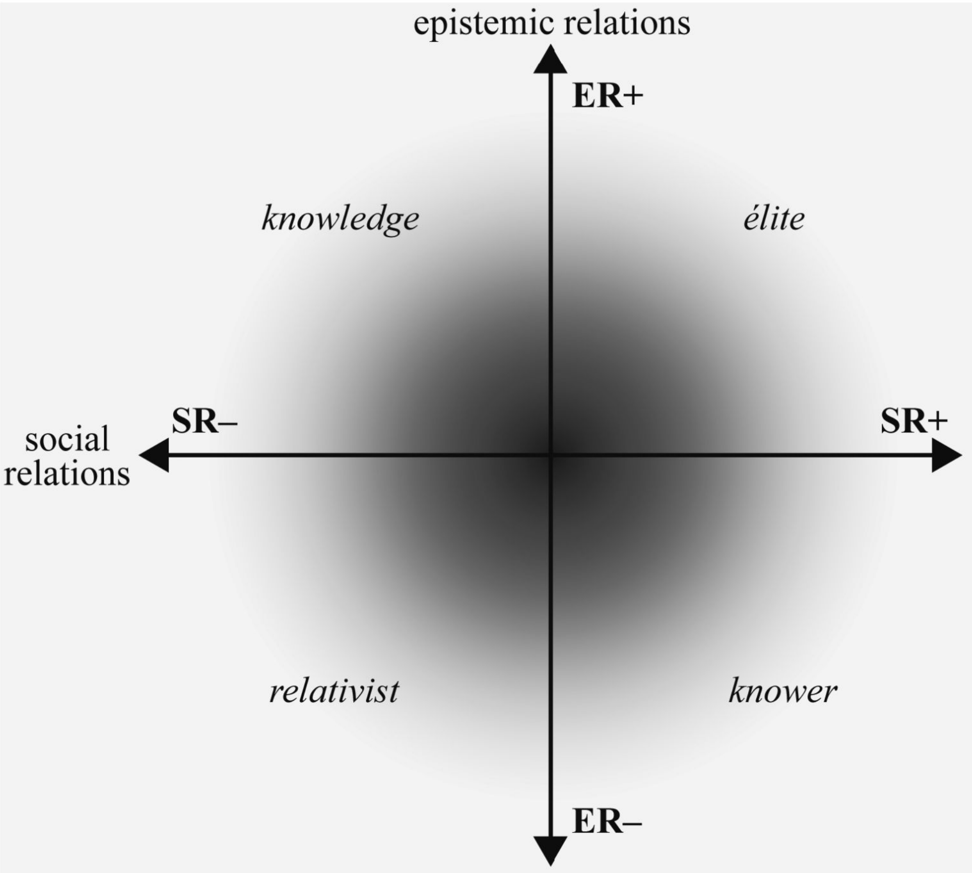

Figure 3.1 Specialisation codes

Source: Maton, 2014, p. 29

Returning to our example, for Happold engineers embody a knowledge code, architects embody a knower code, and they therefore experience what LCT terms a 'code clash' (Maton, 2014) between competing principles of legitimacy.

The notion of specialisation codes thereby provides a way to understand competing constructions of legitimate knowledge and knowers within the field of design. For example, a major study explored how designers perceive legitimacy within their field (Carvalho et al., 2009). Interviews (N=10) and an online survey (N=139) were conducted in four design-related disciplines: architecture, engineering, digital media and fashion. Results revealed the bases of achievement: in engineering emphasised specialist knowledge, procedures and methods (knowledge code); in fashion emphasised designers' dispositions (knower code); and in architecture emphasised both specialist knowledge and specialised attributes of knowers (elite code). Digital media combined knowledge codes and knower codes, depending on the respondent. We should emphasise that strengths of epistemic relations and social relations (and thus specialisation codes) are relative; put another way, there are always knowledges and always knowers. The difference is emphasis in legitimacy (Maton, 2014). Thus, this is not to suggest that engineers have no engineering 'gaze' or fashion designers lack technical skills. Moreover, "dominant codes may not be transparent, universal or uncontested: not everyone may recognise and/or be able to realise what is required and there may be more than one code present, with struggles over which is 'dominant'" (Maton, 2014, p. 77). In short, specialisation codes offer insight into the forms taken by knowledge practices without suggesting they are immutable or essential, and highlight the ways in which these become subject to 'code clashes' between fundamentally contrasting views of legitimacy.

Crucially, the forms taken by knowledge practices have effects. For example, when knower codes dominate a context, individuals may face challenges in becoming the 'right' kind of knower (Maton, 2004, Maton, 2006). Design education often acculturates students in institutionally based cultures into a specific kind of knower with a particular set of tastes. Wilson (1996) studied the socialisation of cultural awareness in relation to the evaluation of architecture in 150 British students selected across all years of education from two schools of architecture. Socialisation within a school oriented the students towards particular styles of architecture, depending upon the school in which they were enrolled. In other words, architectural education was producing a certain type of knower with a set of sensibilities specific to a school of architecture. As studies using LCT demonstrate (e.g. Chen et al., 2011), this can be problematic for those whose pre-existing sensibilities do not match the required dispositions, especially if what is required is not made explicit. Moreover, where different codes come into contact, such as in multidisciplinary research teams or faculties, there is the possibility for 'code clashes' among actors whose bases for achievement are fundamentally different (Carvalho et al., 2009).

Semantic gravity: context-dependency and design knowledge

To introduce the second concept we wish to highlight, *semantic gravity*, consider two positions on design knowledge. Boling and Smith, scholars of visual design and interior design, respectively, argue that design knowledge should be communicated as "transparently as possible from the perspective in place at the time" rather than "as abstractions, such as principles or models" (Boling and Smith, 2012, p. 52). In contrast, Höök and Löwgren, human-computer interaction designers, propose design knowledge as "strong concepts" that are "cutting across particular use situations" and "resides on an abstraction level above particular instances" (Höök and Löwgren, 2012, p. 1). While both highlight context-dependence as significant, the former view legitimacy as flowing from the concrete, context-specific nature of design knowledge, and the latter view legitimacy as based on its freely floating and abstracted nature. Both, however, share a sense that the issue is a choice between concrete and abstract forms of knowledge. The concept of *semantic gravity* offers a means of analysing these contrasting positions and overcoming this false dichotomy:

> *Semantic gravity* (SG) refers to the degree to which meaning relates to its context. Semantic gravity may be relatively stronger (+) or weaker (–) along a continuum of strengths. The stronger the semantic gravity (SG+), the more meaning is dependent on its context; the weaker the semantic gravity (SG–), the less dependent meaning is on its context. . . . Semantic gravity thus traces a continuum of strengths with infinite capacity for gradation. Moreover, by dynamizing this continuum to analyze change over time, one can also describe processes of: weakening semantic gravity (SG↓), such as moving from the concrete particulars of a specific case towards generalizations and abstractions whose meanings are less dependent on that context; and strengthening semantic gravity (SG↑), such as moving from abstract or generalized ideas towards concrete and delimited cases.
>
> *Maton, 2013, p. 11*

The forms taken by strengths of semantic gravity depend on the specificities of the object of study. Table 3.1 adapts Maton (2009) to illustrate strengths of semantic gravity with forms of design knowledge.

Using this concept, the arguments of Boling and Smith (2012) and Höök and Löwgren (2012) can be re-described as advocating knowledge with stronger and weaker semantic gravity, respectively. LCT also highlights that these strengths may be appropriate for different purposes, disciplines, social groups, etc. – i.e. no single strength is the key to legitimacy. They thus represent endpoints on a far greater range of possible practices rather than a forced choice between two positions.

Matches and clashes between such contrasting strengths of semantic gravity help explain how knowledge claims are viewed by actors within a discipline. For example, Christopher

Table 3.1 Examples of strengths of semantic gravity of design knowledge

Semantic gravity	*Form*	*Description*	*Example*
weaker ↑	Abstraction	Presents a general principle applicable to wider or future design practice	Design principles (e.g. the ten Principles of Good Design by Dieter Rams)
	Generalisation	Presents a general observation or draws a generalising conclusion about issues and events *in the case*	Design pattern
	Review	Goes beyond the context and offers a value judgement or claim based on new information or personal experience	Design review (e.g. architectural criticism)
↓ **stronger**	Summarising description	Summarises information directly from the context	Design case

Alexander's pattern language for architecture (Alexander et al., 1977) is notable for its welcome application by other disciplines, such as computer science (Manolescu et al., 2006) and education (Goodyear, 2005), but opposition within architecture itself (Dovey, 1990). As Dovey relates, the 'enemies' of Alexander's pattern language offer diverse criticisms but share an opposition to its "dependence on the 'one right way' of designing" (Dovey, 1990, p. 7). In other words, the strength of semantic gravity characterising Alexander's design pattern language is deemed too weak; postmodern architecture theory, for example, eschewed universalism with a commitment to the development of knowledge about architecture by reading meaning from specific cases – buildings.

As well as conceptualising the basis of such clashes, 'semantic gravity' also enables the analysis of change over time. For example, organisers of the Design Thinking Research Symposium 7 (The Design Meetings Protocols) stated:

> For the seventh workshop we wanted to concentrate on *naturally occurring design activity in the authentic setting of design practice*, allowing a more complicated and contextual view of the design process to emerge, a trend in design research that has gathered pace in recent years.
>
> *Lloyd and McDonnell, 2009, p. 115*

They advocate and describe a shift within the design studies research community towards preferring design knowledge acquired closer to the context of practice. This represents an explicit shift towards strengthening semantic gravity, one also evident in a Special Issue of *Design Studies* about the study of design as it is practised using ethnomethodology and conversation analysis. The Guest Editor Rachael Luck wrote that the papers (emphasis added) "explore the *distinctiveness of design situations* and as such are *not directed towards generalisation*, although, as we shall see, they can be considered generative in nature' (Luck, 2012, p. 521).

This move towards acquiring design knowledge closer to its context of acquisition (in practice) rather than laboratory settings of brief, fixed duration, and away from the generalisation of design cases towards "rigorous praxeological accounts of (design) practice" (Luck, 2012, p. 523) contrasts with the weaker semantic gravity exhibited by the cognitive design research paradigm (Visser, 2006, Visser, 2009). Proponents view design as "fundamentally mental, representational, and a signature of human intelligence: Features that surely make it an important subject of study in cognitive science" (Goel and Pirolli, 1992, pp. 395–396). Cognitive design research, and its related research methods, produces generic schemas (Gero, 1990) and descriptions of thinking processes associated with design. Criticisms of this cognitive view of design activity are long-standing and have varied in their focus and theoretical origins (Lloyd, 2003). Nonetheless, in addition to any specific substantive differences of which theory is advocated, what methods chosen and so on, these approaches fundamentally differ at the deeper level of their organising principles, specifically their relative strengths of semantic gravity.

LCT and implications for design research

Having introduced two concepts from LCT to explore the organising principles of design knowledge, we turn to the question of the effects of the forms of knowledge on practices and cumulative knowledge-building in design. Design scholars have addressed and re-addressed the question of whether design research has any value, and, if so, what methods of research should be adopted in establishing the design canon (Cross, 1999, Friedman, 2003, Love, 2002). We believe it is more productive to start from the basis that different forms of design knowledge have different affordances (Maton, 2009). In other words, knowledge has perceptible qualities upon which users base their actions (Gibson, 1979). From hereon in, when we mean design knowledge, we refer to the content and form of knowledge, i.e. tools and methods (ER+), schools of design (SR+), design cases (stronger semantic gravity), design principles (weaker semantic gravity) and so on. When one applies design knowledge in a specific context, the form of the knowledge matters.

The acquisition of knowledges tracing a range from stronger to weaker semantic gravity is necessary for design practice and for practitioners to build upon prior knowledge for future design practices (cf. Dym et al., 2005). Cumulative learning (building domain expertise) involves the simultaneous acquisition of both abstract design principles and their use in a specific context. This is the type of transition designers undertake in the progression from novice to master (Lawson and Dorst, 2009). To do so requires forms of knowledge that support progressing from specific design cases to abstract design principles and vice versa. In other words, this progression requires 'gravity waves' – recurrent weakening and strengthening semantic gravity – that grow bigger over time as they reach upwards from concrete instances to greater levels of generalisation and abstraction (Maton, 2013, Maton, 2014).

Research by Ball et al. (2004) compared the analogical reasoning capabilities of novice masters-level engineering students and professional practicing engineers. Their task entailed the design of an automated car rental facility. The researchers coded the concurrent verbalisations of the designers in relation to spontaneous analogical reasoning, that is, the manner by which the participants referred without prompting to prior design cases and applied knowledge from those cases to the design task. They found that whereas the novice designers referred to specific characteristics of prior design cases (stronger semantic gravity) that could be applied immediately to experimental design task, the expert engineers applied abstract, experiential knowledge (weaker semantic gravity) obtained from prior design cases. Examples of design principles relevant to the experimental task included principles associated with the design of outdoor terminal displays; in contrast, examples of concrete cases associated with the design task included specific screen designs at other venues that could be applied at the car rental facility. Ball et al. (2004) conclude that progressing from novice to expert requires design students to acquire skills to rely less on concrete episodes and more on design principles. This is not exclusive to design. Studies using LCT to explore not only design (Shay and Steyn, 2014) but fields as diverse as biology, history (Maton, 2014), English (Maton, 2009) and physics (Georgiou, 2014) are highlighting the significance of differences in such organising principles of knowledge practices as *semantic gravity* to changing notions of achievement through apprenticeship.

Weakening the semantic gravity of previously acquired knowledge to move beyond the specificities of a case is a key strategy for then strengthening semantic gravity by applying that knowledge. Research in design fixation confirm that it is essential to abstract relations among source cases before applying them to the current design context (Goldschmidt, 2011). Research by Zahner et al. (2010) demonstrates a positive effect of abstract design knowledge (weaker semantic gravity) on de-fixation under two situations: by providing abstract formulations of design problems as case stimuli and by asking designers to produce generalisations of specific design cases presented as stimuli before applying them to the design task. Design tools assisting in the process of abstracting case data to higher levels of generalisation similarly reduce fixation effects (Linsey et al., 2012). This evidence suggests that design knowledge with weaker and stronger semantic gravity can mutually reinforce and support each other. The surface features of design cases prime the recognition and retrieval of schematic knowledge (Klein, 1993). Knowledge embracing a range of strengths of semantic gravity is thus necessary for design practice and for the field to build upon knowledge for future design practices (cf. Dym et al., 2005).

The point of these examples is to demonstrate that it is not simply the content of knowledge but also its underlying structure or organising principles that affect knowledge practices in design. Having access only to knowledge characterised by overly strong semantic gravity may be too specific to apply to other cases, producing design fixation. Likewise, having access to knowledge characterised by overly weak semantic gravity may not have sufficient detail to realise solutions for the current design context. Using this concept, our response to the debate between design cases (Boling and Smith, 2012) and 'strong concepts' (Höök and Löwgren, 2012) is that this offers a false dichotomy: both forms of knowledge are required to enable the selection and recontextualisation of research – or practice-based design knowledge. In summary, the recontextualisation of knowledge, an essential attribute of knowledge-building over time (Maton, 2013), requires the weakening of semantic gravity from specific cases and meanings to general principles. Moreover, changes in semantic gravity of knowledge are also evident in the processes of recontextualisation whereby 'design thinking' has come to be applied within disciplines outside design. This recontextualisation depends upon, inter alia, the encapsulation of core concepts (weaker semantic gravity) about reasoning in design (Beckman and Barry, 2007).

The false dichotomy between design cases and 'strong concepts' is also shown by the ways design researchers and practitioners exploit a range of strengths of semantic gravity in design knowledge, from abstract, generalised principles and complex meanings to concrete and specific practical applications. In routine design tasks, with well-defined and specific problems, it may be more efficient to apply context-dependent meanings from prior problems: design knowledge would here exhibit relatively strong semantic gravity, such as a specific rule or code-driven design method for steel structures. In contrast, for design-driven innovation, designing from first principles (Cross and Cross, 1996) may be more likely to lead to breakthroughs, foregrounding the value of design knowledge having relatively weak semantic gravity. In further contrast to these states, other practices require strengthening and weakening semantic gravity. For example, when designers search for and develop new, creative solutions to known, stable problems, they need to overcome design fixation and may engage in design by analogy. Analogical stimuli of problems 'far' from the domain of the design situation (the problem and analogical problem share few features) can lead to more creative solutions (Fu et al., 2013) and avoid design fixation (Tseng et al., 2008). The ability for designers to weaken semantic gravity to search for creative ideas far from the problem situation and then strengthen semantic gravity by bringing those ideas to bear upon the specific problem in collaborative design situations is also linked to more creative outcomes (Dong, 2006). In short, as these illustrative examples highlight, no single state or form of knowledge is the key to successful design practice, and analysing the diverse forms taken by design knowledge requires conceptualising its organising principles.

Conclusion

In this chapter, we have briefly explored how the organising principles underlying design knowledge have real effects on the manner by which design research is performed, the form that design knowledge takes and knowledge practices. We highlight how debates within the field about legitimate design knowledge, produced through various research methods and research contexts, could be explored using the concepts of specialisation codes and semantic gravity from LCT. Using these concepts, we describe the specialisation codes dominating certain disciplines of design and the debates within the design research community over the form that design knowledge should take. We analysed the way in which design knowledge that embraces a wide range from stronger to weaker semantic gravity is crucial to design practice. In short, we have pointed to real effects of the forms of design knowledge in the way individuals in the field perform research, legitimate knowledge and practice design.

Organising principles underlying knowledge practices do not remain static; rather, the ‘settings’ of principles such as semantic gravity reflect ongoing debates within fields regarding the bases of achievement within them. As these settings change, so too may educational curriculum, as evidenced by changes to architectural education curriculum as the field moved away from the design methods movement and modernism (away from ER+) (Robbins, 1984, Ward, 1989). Thus the issues reach from design practice to design education.

No doubt, debates over the ‘right’ form of design knowledge will continue. As we discussed, the organising principles underlying design knowledge have implications beyond design practice. While this chapter focused on intellectual implications, anxiety over the viability of design as a legitimate research discipline in universities worthy of doctoral level training (Pedgley and Wormald, 2007, Margolin, 2010) is a pressing and practical concern. Defining the distinctive strengths and contributions of the various forms of design knowledge and defending the settings of organising principles underlying them will be essential for design research to compete among other fields for a place in approaches to knowledge production.

Note

1 For examples of this rapidly growing body of work, see the LCT website: www.legitimationcode theory.com

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4

INCLUSIVE DESIGN RESEARCH AND DESIGN'S MORAL FOUNDATION

Jude Chua Soo Meng

Introduction

For Herbert Simon and Nigel Cross, the science of design represents that general account of design that captures the "common creative activity that [different professionals in different design disciplines] are engaged [in], and [about which they] can begin to share their experiences of the creative, professional design process." (Simon 1996: 137; Cross 2007: 123–124; also see Friedman 2002). Design research can detail what such a science of design entails. In this chapter, I hope to make a case for an inclusive design research agenda. Such an inclusive research agenda is open to insights from other non-design disciplines, such as moral philosophy. As I will argue below (see section headed 'Designerly ways of knowing'), it may be tempting to interpret Nigel Cross's recent remarks on 'designerly ways of knowing' as endorsing a kind of methodological exclusivism, which is wary of and steers clear of what non-design disciplines have to offer when researching and studying design. This, I argue below, would be a mistake (see section headed 'Nigel Cross: the quest for the central case'). Instead, Cross's own research strategy, like Simon's, is inclusivist, and for good reasons (see section headed 'Warrants for the central case approach'). I then explore what this implies for a theory of design, which is that 'design' is not merely a form of instrumental thinking but is instead an ethically robust manner of critical thinking attentive to choice-worthy ends.

Nigel Cross on design research

We can begin with a methodological question, which has attracted some attention recently. When developing a general theory of design, how should design researchers stand in relation to research in other supposedly centrally non-design disciplines on design-relevant processes, say in the humanities, the social sciences or the hard sciences? How should design researchers relate to design-related research work by those say in philosophy, education, economics or physics? Design, which is the making of artifacts or the modification of reality towards a preferred state of affairs, is the subject of investigation of a variety of disciplines. Many fields involve design and study the design process. Philosophers think up plans for creating the best society and offer meta-analyses of that thinking, teachers design lesson plans and curriculums and reflect on these planning processes, and scientists design and debate about the reliability of experimental methods. So asking this question seems to invite a very banal response. Design researchers should, rather obviously, take seriously the research arising from non-design disciplines on design-related processes.

Designerly ways of knowing

However, suppose non-designer researchers, because they are laden with paradigmatic beliefs from their own non-design disciplines, offer a corrupted picture of design's true nature? Nigel Cross (2007: 127) alerts us:

> One of the dangers in this new field of design research is that researchers from other, non-design, disciplines will import methods and approaches that are inappropriate to developing the understanding of design. Researchers from psychology or computer science, for example, have tended to assume that there is 'nothing special' about design as an activity for investigation, that it is just another form of 'problem solving' or 'information processing' . . . Better progress seems to be made by designer-researchers . . . As design grows as a discipline with its own research base, so we can hope that there will be a growth in the number of emerging designer-researchers.

In several pieces, Cross suggests that design has its own inner, coherent logic and that this designerly epistemology is *unique to design and known to designers*; Cross's fear is that non-design disciplines misrepresent design by imposing their own reductive or biased interpretations of what design is by failing to be open to its unique qualities which saturate the paradigmatic frames of these non-design disciplines. His encounter with Herbert Simon's 1969 edition of *The Sciences of the Artificial* and its technical, rationalist and problem-solving interpretation of design corroborates this fear. So there is some basis for this stance, which recommends being conscious and wary of possible misguided attempts by non-designers to interpret design reductively, thus hindering our own learning of what design thinking really is. What design thinking in itself really is when uncorrupted by these distortions, Cross labels 'designerly ways of knowing'. He says:

> The claim from the Royal College of Art study of 'Design in General Education' was that 'there are things to know, ways of knowing them, and ways of finding out about them' that are specific to the design area. The authors imply that there are designerly ways of knowing, distinct from more usually-recognized scientific and scholarly ways of knowing . . . Design must have its own inner coherence, in the ways that science and the humanities do, if it is to be established in comparable intellectual and educational terms. But the world of design has been badly served by its intellectual leaders, who have failed to develop their subject *in its own terms.*
>
> *Cross 2007: 22*

To be clear, therefore, my interpretation is that Cross's thesis of there being 'designerly ways of knowing' implies two propositions, one following the other. These are, as implied from the quotations above, first, that such designerly ways of knowing are known to designers. Second, since such designerly knowings are known to designers, then we should expect designer-researchers to produce reliable research work on design. For Cross, this second thesis in turn presents two possible implications: that one should especially welcome results of designer-researchers' research, or that non-designer researchers who adopt other paradigmatic orientations to research design should be scrutinised critically by the design research community. This collection of ideas constitutes the implicit premises of his research paradigm. No doubt, Nigel Cross does compliment research by Dorst, which explores the various different paradigmatic biases in Herbert Simon and Donald Schön – the one with a 'rationalist' paradigm and the other with a conception of design as 'reflective practice'. Dorst defends a thesis about their mutual complementariness, implying that both paradigms for design are welcome. Still, Cross's own take is to adopt the hypothesis that there is a unique designerly way of knowing, and that this is grasped by designers. Cross seems especially keen to welcome research by designers which will flash out this unique designerly knowing. It is in this more complete sense that we should understand the assertion that "there are designerly ways of knowing": i.e. that this is a shorthand for the more complete composite belief that besides the fact that there are designerly knowings there is also the notion that such designerly knowings are grasped by designers, whose research on design we should encourage. Such a desire to welcome 'designer-researchers' is the sub-text when Cross (2007: 127) says the following:

> We are still building the appropriate paradigm for design research. I have made it clear that my personal 'touch-stone' theory for this paradigm is that there are 'designerly ways of knowing'. I believe that building such a paradigm will be helpful, in the long run, to design practice and design education, and to the broader development of the intellectual culture of our world of design.

Of course, this does not, strictly speaking, mean that no non-designer researcher can detail reliable design theory. However, given Cross's compelling warning that the importing of non-design disciplinary beliefs threatens the quality of design research, the *reception* of any such a warning is at risk of initiating a bifurcation first between (a) designer-researchers and (b) general-researchers; and second between (c) a mode or methodology proper to researching design in which paradigmatic beliefs or knowledge from other disciplines are kept at a distance and (d) the research mode which willingly imports insights from other disciplines, but which nevertheless might now be construed as a methodological orientation ill-fitted for design research. At risk, too, along with these bifurcations, is the displacement both of general, non-designer researchers of design and design research modes which are open to other disciplines and their beliefs and insights. Because of these reasons, Cross's warning needs to be articulated with reflective precision so that its reception is critical and balanced.

Indeed, one way to interpret Cross's warning is for researchers precisely to view design by *bracketing* their non-design disciplinary beliefs lest these may taint one's research – the corollary of this is that, from the point of view of *method* in design research, one should proceed *as if* there should be nothing that one's non-design discipline can offer. In other words, here one is extremely cautious about one's non-design disciplinary background, and too keen to keep that, whatever it is, at bay. If taken this way, it is hard to see how other disciplines and disciplinarians could contribute significantly to design research. One might say, with Cross, that "it does not mean that we completely ignore these other cultures [i.e., the sciences and the arts] . . . [and that] we need to draw upon those histories and traditions [of the sciences and the arts] where appropriate" (Cross 2007: 124). Still, practically speaking, in what sense could a scientist, or a philosopher, or a linguist, or an ethicist, or an educationist, etc. be relevant to design research that could surface a theory of design? Their contribution would not be through drawing on their unique disciplinary expertise; meaning, their contribution to design research is precisely to *not* contribute *qua* a person in that non-design discipline, but merely as a *general researcher without disciplinary specialisation*. This is because even if we admit that in principle non-designer researchers could, by importing their disciplinary cultures, produce reliable design research, such a reception of Cross's warning is to translate that warning into methodological advice precisely to *not* proceed like that, but rather to *prune* one's research paradigm of these cultures.

In sum, one possible interpretation and application of Cross's thesis concerning the existence of 'designerly ways of knowing' and related claims is to suggest that design researchers should avoid drawing on insights from non-design disciplines: "we must avoid swamping our design research with different cultures imported either from the sciences or the arts" (Cross 2007: 124). To put it bluntly, in relation to design research, the disciplinary insights of other disciplinarians should be viewed *as if* methodologically redundant, or worse, suspect, even if in principle they may not be. For this reason, I call this manner of interpreting Cross's thesis about designerly ways of knowing 'the exclusivist position'. But the exclusivist position does not, I think, cohere with Cross's research paradigm (which I will introduce in the next section), and therefore is not an accurate way to interpret Cross's thesis about designerly ways of knowing.

In the next section I try to surface an aspect of his research strategy which sits in tension with exclusivist research strategies. I argue that Cross's research strategy to develop the central case of designerly ways of knowing implicitly acknowledges a need to access work done outside of design circles by non-designers, precisely by drawing on the specialisations of their non-design disciplines, implying, therefore, a kind of inclusivism. In fact, the exclusivist position if held dogmatically undermines the attempt at a general theory of design or of designerly ways of knowing in the long run.

Nigel Cross: the quest for the central case

Quite self-consciously, when studying what design is, Cross does not consider as subject matter worthy of investigation any and everything that could relevantly be called 'design'. Cross's preference is to zoom in on what design is according to the mind of good designers. He says:

> Personally I am particularly interested in what the best, expert designers have to say about design, because they may help us to develop insights into what it means to think, not just like any of us, but like a *good* designer.
>
> *Cross 2007: 51*

Here one selects for oneself only that which is *worth* studying, from amongst the things one *can* study. For there are many designers, and many ways of designing, and whilst all could be studied if we are to study what design is, it would be more fruitful to narrow our focus down to only those designers that for some reason or other it would be more *illuminating* to analyse. If we had to give a technical name to this approach to the analysis of concepts, it is the development of the 'central case' (c.f. Finnis 1980: 3–18; Chua 2013). For there are many forms of 'designing', but only some are central, and others are peripheral. So the task before us is not to study all of these indiscriminately, but to adopt a normative criterion for discerning the peripheral and central instances of design, and to focus only on the latter. In Cross's case, such a criteria is signaled by the word 'good'. Good designers are central, and not-good designers are peripheral. Cross's strategy is shared by Herbert Simon, who develops a science of design by studying not any designer's epistemology, but only those who reason carefully – i.e. those who according to Simon are good designers.

Warrants for the central case approach

This focus on the central case appears to me correct, and compares strongly with the warrants, all transferable, of recent similar approaches to theorising in other professional, and hence, design-related fields. For instance, in education, philosophers had for a time been interested in detailing the essence of 'teaching' or other terms in education, and their colleagues in history and sociology, such as Gary McCulloch, Gill Helsby and Peter Knight (2000: 5–6) and Geoff

Whitty (2000: 281–295), respectively, thought this was totally wrong headed. David Halpin, likewise thinking along with the Romantic William Hazlitt, writes:

> It is fair to say also that Hazlitt would have hated the abstractionism, or 'second-orderliness', of those philosophers of education who have sought in times past to define teaching analytically. I suspect he would have shuddered, as I do now, at reading for example: 'Teaching is the label for those activities of a person A, the intention of which is to bring about in another person, B, the intentional learning of X.' These are the words of the eminent educational philosopher, Paul Hirst, published at the peak of the influence of London's so-called 'Bedford Way School of Philosophy of Education', of which he was a prominent exponent. While these words offer a logically coherent definition of teaching, what they say about its actual nature is unrecognizable to this former classroom teacher. Hazlitt, I guess, would prefer, and *find more illuminating*, sociological, ethnographic descriptions of what one does in school classrooms.
>
> *Halpin 2007: 123 (italics mine)*

Therefore, Halpin lists a few other accounts of teaching from a variety of sources which describe teaching to be 'an art' and 'an opportunistic process', and suggests that teachers often "function intuitively, using in the process skills of imaginative foresight and improvisation, which makes the identification of their intentions unclear", and when comparing them with Hirst's definition, suggests they "get to the heart of what teaching as a form of life is actually like" (Halpin 2007: 123–124). While it is true that Halpin is offering a different and, as he says, sociological-ethnographic description of teaching, clearly one can question if these accounts are representative of all teaching, or one could wonder why, even if ethnographically accurate, Halpin is choosing *those* accounts and not others. For surely there must be some teachers who do not grasp teaching in this light, and for whom teaching is *not*, contrary to Halpin's selected descriptions, "influenced by qualities and contingencies that are unpredicted" but rather is precisely "dominated by prescriptions or routines" (Halpin 2007: 124). My questions are not an attempt to challenge the quality of Halpin's educational research, rather they are aimed at surfacing what I notice to be a measure of self-consciously un-objective, biased selectivity in this ethnographic study – a selectivity that is to my mind welcome and strategic; and the criteria for selection is what, for him, constitutes "good teaching", which sometimes "follows no method except that of the personality of the teacher himself . . . [but which] does not render such activity as non-teaching, [as] Hirst seems to be suggesting" (Halpin 2007: 124). And for Halpin, most importantly, 'teaching' that is worth elaborating – thus *good* teaching – is the kind in which (utopian) imagination has a role to play, as he goes on to detail in his book. So the task for Halpin is not the philosophical definition of the essence of teaching through the elaboration of the conceptual common denominator of most of what is teaching, but neither is it merely a study of a particular form of teaching by a particular person in a particular place; rather it is the elaboration of a *choice* form of teaching – and whether it is sociologically rare or common is quite irrelevant – which, from *his* (Halpin's) point of view, he believes illuminating, and worth considering.

The central case and the moral viewpoint

Halpin's implicit recommendation is for theorists developing a general theory or central case of something to *focus* their study on what *is worth examining, and what is illuminating* lest one ends up with the banal and irrelevant, even if all true. And this is achieved through adopting the viewpoint of the person who has a sound judgement of what is significant in the field.

But not only that! John Finnis (1980), who also explicitly employs and elaborates on the central case approach, further argues that such a person would necessarily have to know, in relation to that, *what is significant in itself*, since this should in turn steer and inform one's judgements about what is significant in any theoretical field (Finnis 1980: 16). Meaning: if, therefore, like Simon and Cross we wish to develop the theory of design or the description of design thinking in its central case, then we will have to do so by taking on such a morally sound person's viewpoint, because only such a viewpoint can identify those intrinsically significant things that would inform our appreciation of the significant things in the design field. Nonetheless, such a viewpoint is in turn available to the theorist *himself* as he works out carefully the very practical reasons identifying these intrinsically important things and their implications. These important things, which a general theory of design must engage and relate to, are to include what are of themselves important to seek and do, and the prescriptive rules to guide our seekings and doings, viz., what Finnis called the 'basic goods' or 'basic values' and the principles of practical reasonableness. So, if we are to develop a theory of 'design' or 'design epistemology' in its central case, then we could fittingly approach such a notion or epistemology from the viewpoint of the designer whose practical reasoning is sound. Such a viewpoint would throw light on professional and design thinking, the latter's relation to the basic goods and the principles of practical reasonableness. Such a viewpoint is not the viewpoint exclusively of designers, nor is it necessarily typically the viewpoint of a designer. Instead it is the viewpoint of the ethicist.

In other words, the work here that design theorising presupposes is in fact the work which moral philosophers do: the detailing of what is worth seeking and doing, and what should not be sought and done, i.e. an ethics. Thus the question about 'what design is' turns out, in our analysis, to be a question about what matters, and this question is not always competently answered by designer-researchers, but is instead the specialised domain of moral philosophers. Since the development of design thinking in its central case presupposes a perspectival access to the moral viewpoint, which is in turn discerned by a studied grasp of what is truly valuable, then this means that if the aspiration for such a general design theory is to be fulfilled, design research needs to be pursued inter-disciplinarily with or by scholars in other disciplines, and to access insights available from work by moral philosophers in the first instance, who may not at all be designers, and through whom some of the descriptions to such a viewpoint have been developed.

The inclusivist promise: saving Simon's design theory

Let us take stock. I have been arguing that any methodological exclusivism sits uneasily with the prospect of an illuminating general theory of design, aimed at an account of design in its central case. If so, then design research and design theory is better served by Cross's inclusivist design research programme, where various disciplinarians are welcomed into the research of design and its epistemology.

But what of the worries that Cross has raised: worries about the dangers of other disciplinarians distorting the representation of what design is – worries that methodological exclusivism could have addressed? Well, an inclusive stance at design research addresses by engagement these dangers as well as an exclusivist design research programme, which addresses these by avoidance. This means that the exclusivist research paradigm is neither sufficient nor necessary for the development of a general design theory; Cross's inclusivism, however, is. In the next sections we can see how this might be true in the case of Simon's design theory.

Design and scientism in Simon

Cross's concern was with the 'scientising' of design. This involves interpreting and examining design through the possibly narrow epistemic lenses of the scientific paradigm, importing thus the values of the scientific paradigm (Cross 2007: 119–127). This is a danger he reads in Simon's work and is particularly true of Simon's earlier work, which betrayed a strong commitment to a "positivist, technical-rationality" (Cross 2007: 123). The slavishly instrumentalist account of design thinking that positivist, technical-rationality inspires does appear to paint a kind of peripheral, corrupt picture of design. So, indeed, there has been some attempt to distance Simon himself from such-like accounts of 'design'. For example, Clive Dilnot (2008) recently offered a more nuanced interpretation of Herbert Simon's design theory that sees in Simon a desirably *critical* epistemology in contrast to an unreflectively instrumentalist epistemology:

> Herbert Simon's famous definition of design [which is o]ften evoked as a justification for instrumental action, the 'devising of courses of action aimed at changing existing situations into preferred ones' is in fact *secondary* not primary. The process ends with the realisation of previously unforeseen possibilities cast into a new configuration, but *begins* from an understanding that it is possible to critically discern amongst the potentialities existing within a situation those that can form the basis of a new (preferred) entity. No motivation for setting in train the 'devising of courses of action aimed at changing existing situations into preferred ones' happens without an initial apperception that what-is is in some manner deficient vis-a-vis what could be.
>
> *Dilnot 2008: 178–179*

Dilnot is much more sensitive to the theoretical potential in Simon's design theory than Cross is. Dilnot's reading is also more complete, interpreting Simon's science of design through taking into account the whole spectrum of his works, such as the later third edition of his *The Sciences of the Artificial*, which captures these fluid, constructive trajectories in ways the earlier editions did not (Chua 2009).

However, Cross might object that Dilnot has overstated the potential of Simon's design theory, and Cross would be right – at least as the theory stands. Notice that for there to be a critical judgement which calls a reality 'deficient', it is not enough that a counter-factual *possibility* be posited; rather, the counter-factual possibility must also be judged as better or good, and so the *normative-laden-ness* of such judgements cannot be denied. Therefore, what Dilnot means by 'what could be' is really 'what *should* be'. This is where Simon gets in trouble. Although Dilnot reads in (and, possibly, *into*) Simon these critical trajectories, they do not seem in principle to be adequately supported by Simon's own theoretical biases. Simon's positivism acknowledges the fact of preferences but denies the reality of norms besides the merely instrumental. However, any critical trajectory which grasps a fact to be '*deficient*', i.e. *normatively* undesirable, and which implicitly posits, 'what could be' – or more precisely, 'what *should be*' – cannot exist without presupposing an axiology which recognises that substantively normative concepts like the good ('the *ought to be*') and the bad ('the *ought not to be*') are intelligible and true. These notions of good and bad must be over and above the merely preferred or repulsive, the latter belonging to the genus of the factual and hence not at all normative. They must also be notions of 'good' and 'bad' that are different from the instrumental 'good for' or 'bad for'. In contrasting criticality with mere instrumental thinking, Dilnot clearly excludes judgements of the 'instrumental good' and the 'instrumental bad' as sufficiently constitutive of critical judgements and, I would say, correctly. If something is merely judged to be a deficient means for what one wants, then unless and until we can say what one wants is good in itself, it would be question-beggingly presumptuous to call that an unambiguously critical judgement: 'what if the desired end was also bad, and in this case was prevented from being realised?'. More crucially, a good means for a bad end may not be deficient with respect the end, yet most deserves critical condemnation and design intervention! Yet without the ability to judge these final ends normatively, the possibility of criticality in design is diminished precisely where it matters the most. In the end, then, for there to be what Dilnot means by a critical epistemology we need to have an axiology that gives us the capacity to speak of things or states of affairs as good in themselves or bad in themselves. Yet such an axiology is precisely what Simon will 'rubbish'. This is true even if we take into account the fact that, since the latest edition of Simon's *Administrative Behavior*, Simon had himself disavowed logical positivism in a commentary on the original (Simon 1997: 68–69). Nevertheless, Simon continued to maintain that there is no rational basis for normative claims of the intrinsic 'good' and 'bad' on account of the naturalistic fallacy, i.e. no 'ought's' from 'is's' (Simon 1997: 69). If so, then for Simon these proposals for intrinsic goods or bads are not *normative* prescriptions capable of criticality, but merely *factual* reports of preferences. Put another way, you cannot simply say you don't like something or say that you're not getting what you want and call that a critical judgement; you have at least to say it is inherently wrong – and Simon cannot say that.

Simon, Dilnot and design criticality

All is not lost. If we welcome work in moral philosophy then many of Simon's earlier theoretical commitments can be contested, and a design theory that corrects these positivist corruptions can arrive at the critical in ways that Dilnot commends as important and in the direction he pressed his interpretation of Simon's design theory towards. In other words, the 'criticality' in Simon, so pregnant with promise for design in its central case, need not be still-born, so long as we draw inclusively from other disciplines – specifically, moral philosophy.

Working from a retrieval of the thought of Aristotle and the medieval Aristotelian commentator Thomas Aquinas, moral philosophers like John Finnis (1980) and Germain Grisez (1991 [1967]) argue that human intelligence can grasp basic values or goods worth seeking, and rules to guide our quest for these goods. Such goods or values are not merely feelings or preferences. Such a moral theory was first defended in Germain Grisez's 1967 piece in the then *The Natural Law Forum* in which he offered an interpretive commentary of Aquinas' *Summa Theologica* I–II, q. 94, art 2. Finnis has argued over the years that human intelligence had a number of foundational first principles that identify for us the things worth seeking for human flourishing, and these principles are not inferred, but rather are insights grasped abductively by persons of experience (Finnis 2011: 45). When thinking about what we ought to do, compared with thinking about what is the case, Finnis explains that human intelligence works to grasp that certain goods or states of affairs are intelligibly good, choice-worthy and something we ought to pursue or do (Finnis 1983).

This was a departure from neo-scholastic interpretations of Aquinas' ethics which held that ethical precepts were deduced from a prior account of human nature, or a metaphysics of final ends tending towards the love of God (see Finnis 1980: 33–49). In any case, if the knowledge of basic goods or values was not had through inferring these on the basis of prior premises, whether these make up a metaphysics or an account of human nature, then this is particularly pertinent and useful when engaging Simon's axiology. Previously, Simon appeared to be on very stable ground for rejecting any pretension to derive an account of normative final ends ('ought') from purely descriptive ('is') claims, appealing to what is called the 'naturalistic-fallacy'.

Finnis would agree that it would be fallacious to derive the 'ought' from the 'is'. However, unlike Simon, he would nevertheless still maintain that there are reasonable claims of intrinsic goods besides instrumental ones that can be known. Indeed, Finnis has maintained that reason grasps a plurality of such underived and, hence, self-evident basic goods, which are aspects of human flourishing. By persistently pressing for the ultimate reasons of one's actions, one arrives at a set of goods which can be and are often pursued for their own sakes and for no other further reasons. Such goods include: life, truthful knowledge, friendship, aesthetic experience, skillful play, practical reasonableness and religion, which mature persons understand to be intelligibly choice-worthy goals that need no further justification, even if one has no particular taste for any of these (Finnis 1980). If such a moral philosophy is employed as a corrective foundational warrant for the reality of normative precepts, the criticality that Dilnot sees in Simon's design theory could now take flight.

Concluding thoughts

In this chapter I have tried to make the case for an inclusive design research agenda that draws on recent moral philosophy in a manner that is consistent, I think, with the research strategies in both Simon and Cross. As shown, drawing on insights in other fields or disciplines, such as moral philosophy, enables theorists to overcome intellectual roadblocks in Simon's practical epistemology and supports the emergence of a notion of design that is a criticality in the sense that Dilnot means it: to be able to critically identify and address the deficient. In this way, 'design' becomes synonymous with an *ethically robust* manner of thinking attentive to choice-worthy goals, contrasted with a mere instrumentalist concern for arriving at means (even if they are clever means) in the slavish service of what is *liked* or *preferred* (by consumers). If Dilnot (2008) is right that many professional designers eschew criticality given the marketisation of the profession, then this notion of 'design' – when taught in educational curriculums – will help our students interrogate and reshape – i.e. re-'design' – whatever these professional designers should have but have nonetheless failed to 'design'.

Acknowledgements

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5

MAPPING INTERDISCIPLINARY DESIGN RESEARCH AS FLOW AROUND A MEDIDISCIPLINARY SEA

Graham Pullin

Mapping research as exploration

Any research, including design research, might be thought of in terms of exploration – a journey into the unknown, or not-yet-known. Making maps that represent processes is always an interesting exercise in visualisation. There are many precedents, including Charles Eames's iconic diagram of the design process (Neuhart, Neuhart and Eames 1989: 13). In *Table-Top Geography* (see Figure 5.1), illustrator Helen Murgatroyd plots out the preparation of food dishes, making intriguing maps of everyday activities. Murgatroyd was herself inspired by the work of Alfred Wainwright and Mark Lombardi, mapping landscapes and networks respectively.

This chapter arose out of an attempt to draw a map of a design research project. This endeavour has led to a new perspective on the nature and role of design research in an interdisciplinary context. The initial model was that of an expedition, since the research included two PhDs which, although initially together, separated half way through, each to pursue its own agendas. In the way that Antarctic expeditionary maps often show different parties – perhaps one party returning to base whilst a smaller group strikes out for the Pole – it was hoped that this relationship between the projects might be shown on a map.

The first question though was onto what landscape, which framework, to map the journeys.

(Re)introducing the interaction design research triangle

Frayling and Fallman

Christopher Frayling's categories of 'research into design', 'research for design' and 'research through design' (Frayling 1993) are still valuable in identifying different roles for design research and different modes of enquiry. To a design researcher joining academia following a career at the consultancy IDEO, however, this distinction sometimes seems to divide aspects of practice-led research practice that feel inseparable.

Fifteen years later, Daniel Fallman introduced *The Interaction Design Triangle of Design Practice, Design Studies, and Design Exploration* (Figure 5.2, left) in a paper of the same name (Fallman 2008). It was Fallman's contention that interaction design research in particular is characterised

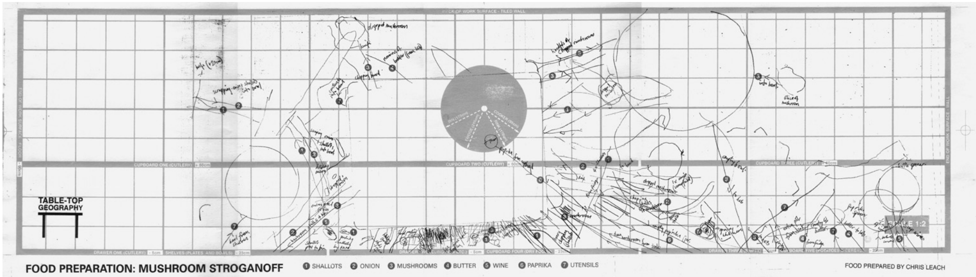

Figure 5.1 Table-Top Geography by Helen Murgatroyd

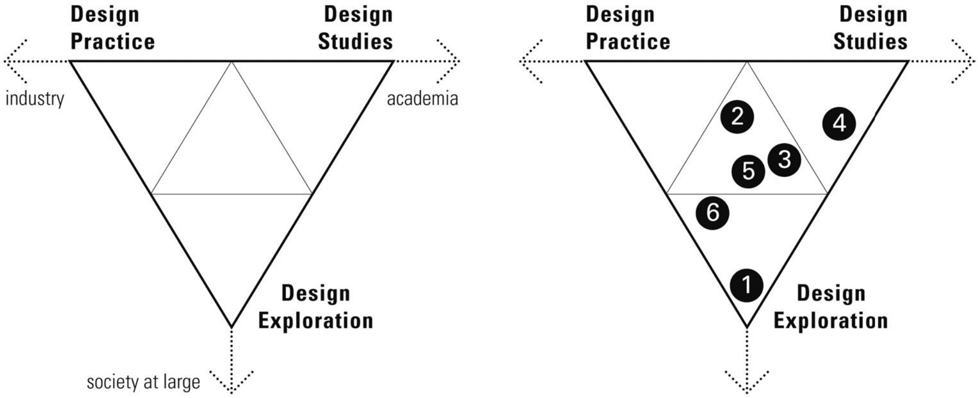

Figure 5.2 The Interaction Design Triangle as introduced by Daniel Fallman (Fallman 2008, redrawn by the author) (left); *The Interaction Design Triangle* as used by Joyce Yee to map six practice-based design PhDs (Yee 2010, redrawn by the author) (right)

by a flow between three modes of enquiry – in combination. By Fallman's definitions, 'design practice' denotes activities that are very close, and sometimes identical, to those undertaken when practising interaction design outside of academia (Fallman 2008: 6). 'Design exploration' is different from design practice:

> primarily due to the perspective from which the artifact is being constructed. In design exploration, the most important question is: 'What if?' As a sign of recognition, design exploration research almost always excels in what Schön calls 'problem-setting', and Ehn refers to as 'transcendence' (i.e. exploring possibilities outside of current paradigms – whether these are paradigms of style, use, technology or economical boundaries).
>
> *Fallman 2008: 7, referencing Schön 1992: 3–14, and Ehn 1988*

'Design studies' most closely resembles traditional academic disciplines and is also where influences from other disciplines are most visible (Fallman 2008: 9).

Fallman reports that the model has proved useful over a number of years at Umeå Institute of Design (Fallman 2008: 15), where he is a Professor of Informatics.

Appropriating the Triangle

The paper has ranked fifth most downloaded article from *Design Issues*, in a list including papers from 2001 to 2014 (MIT Press Journals 2014). Another sign of its influence is that researchers elsewhere have appropriated the Triangle. Joyce Yee mapped six practice-based design PhDs, each influential in their methodological innovation (Yee 2010). To serve this purpose, Yee plots each PhD on the Triangle (Figure 5.2, right): Ramia Mazé's (Mazé 2007) "inquiry into issues of time in interaction design" (Yee 2010: 11) appears at the very centre of the Triangle (labelled No. 5 in Figure 5.2, right), whereas Anthony Dunne's pioneering of a critical design methodology (Dunne 1997) is positioned towards the extreme of design exploration (and labelled No. 1 in Figure 5.2, right). Plotting each as a point on the Triangle is not strictly in line with Fallman's notion of loops, which we will come to, but Yee's purposes are different: by mapping the centres of gravity of six PhDs, something is revealed of their spread.

Using the Triangle

Six Speaking Chairs and *Speech Hedge*

The case study involves two connected and complementary projects. Their common goal is to provoke discussion about the importance of the tone of voice of synthetic speech in what are known as voice output communication aids, of which Stephen Hawking is the most famous user. Tone of voice – here used to mean the ability to say the same words in subtly different ways and with different conversational outcomes – is all but missing from most communication devices. These are typically based on Text-To-Speech (TTS) technology in which any word can be spoken, but the only control over *how* a word or sentence is spoken is basic punctuation: a full stop for a supposedly neutral intonation, a question mark for a rising intonation or an exclamation mark for a louder or otherwise more emphatic delivery. This does not even scratch the surface of how most of us employ our tone of voice in everyday conversation to convey meaning, exert influence and deepen relationships. But while we might all recognise tone of voice when we hear it, it is an elusive quality that even phoneticians struggle to define (Fox 2000). This is challenging territory. Design research can contribute to many areas by visualising intangible issues. In this case, designers can help to seed debate about the importance of tone of voice as well as by proposing interfaces by which we might actually control it.

Six Speaking Chairs, a collaboration with Andrew Cook (Pullin and Cook 2010a), is a collection of interactive exhibits that make different ways of thinking about tone of voice accessible to laypeople, in order to provoke new conversations (Figure 5.3). Each of the chairs represents a different mental model, visualised in an archetypical user interface. So, phoneticians' intonation diagrams are represented by a touchscreen, drawing on which will control the timing and pitch contour of a spoken word, in real time; whereas the heterogeneous stage directions of a playwright (Shaw 1916) are represented by numerous doorbells with descriptions scribbled under each: coyly, coaxing, whimpering, whispering and so on (Figure 5.4, left). Note that these descriptions include conversational intent, not just emotional state – which tone of voice is too often more narrowly defined as (Campbell 2005).

Figure 5.3 *Six Speaking Chairs* by Pullin and Cook, in which found chairs and interactions are employed to embody different ways of thinking about tone of voice, found in diverse disciplines

Source: Authors' photograph

Figure 5.4 *Six Speaking Chairs* showing Chair No. 6 with its 17 doorbells, each labelled with a stage direction from *Pygmalion* (Shaw 1916). The invitation to 'please customise' formed the basis of a participatory exercise, '17 ways to say yes' (left); *Speech Hedge* showing a Toby Churchill *Lightwriter* alongside the Apple *iPhone* interface. The tone 'Apologetically' represented by a plant made up of six elemental leaves formed the basis for a further participatory exercise (right)

Speech Hedge, a collaboration with Ryan McLeod, is a more conventional, but still imaginative, concept that explores how subtly nuanced tone of voice might even be introduced into communication devices in the near future. It proposes an app running on an Apple *iPhone* as an accessory to a more conventional communication device (Figure 5.4, right). The phone displays a choice of 16 tones of voice which can be chosen as a modifier of the speech coming out of the TTS device. Each of these tones is represented as a seedling, a diagram of a plant with a few different coloured leaves. Each has been assembled by the user themselves, or another layperson, by combining leaves in different combinations (with 16 colours and up to eight leaves there are over a million combinations – colour mixing on a computer monitor is not a bad analogy – although with no guarantee that all will be useful or even sound human). Tones that sound useful are then subjectively labelled by their creator and collected or shared.

Mapping the projects

Fallman reports that at Umeå most PhD projects take "the form of loops in between at least two of the activity areas" (Figure 5.5, left):

> Loops, as the name suggests, are trajectories without either starting or end points that move in between different activity areas. . . . loops are crucial in that they represent what sets interaction design research apart from other research: the ability to move freely between design practice, design exploration, and design studies.
>
> *Fallman 2008: 11*

Within the Triangle, mapped according to Fallman's original guidance, *Six Speaking Chairs* involves a loop between the activity areas of design exploration and design studies (Figure 5.5, right). That is it is fundamentally a design exploration, drawing inspiration from Dunne and Raby's *Placebo* (Dunne and Raby 2001) and Goldsmiths Interaction Research Studio's *Curious Home* (Gaver et al. 2007) projects, received through their publications – therefore through design studies. Within the Triangle, again mapped according to my interpretation of Fallman's guidelines, *Speech Hedge* also involves a loop, but this time between design exploration (the project definitely asks: "What if?") and design practice, because its reference points are interaction design as practised in industry (Figure 5.5, right).

Fallman has reviewed this use of his diagram and declared it to be "more or less *exactly* as I had hoped people would use it . . . The illustrations . . . are spot on what I had hoped for!" (Fallman 2012).

Inverting the Triangle

So far, so good. These mappings visualise the activities internal to design research. But the most interesting aspects of these projects involved their interactions with individuals and disciplines beyond design research.

Presentation of *Six Speaking Chairs* was followed by an exercise based on Chair No. 6, the one with 17 doorbells. Participants – including speech and language therapists, people without

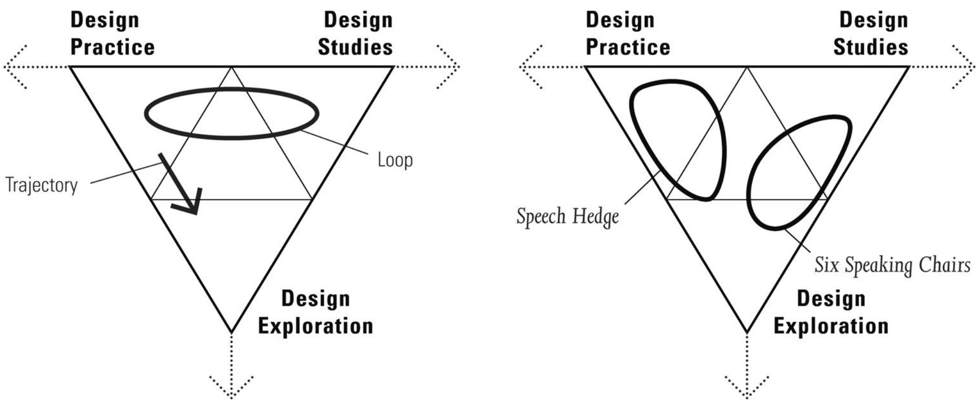

Figure 5.5 Loops on the Interaction Design Triangle as shown by Fallman (Fallman 2008: 11) (left); Loops on the Interaction Design Triangle as *Six Speaking Chairs* and *Speech Hedge* mapped as loops (right)

speech and speech technology researchers – were asked to list the tones of voice that they would choose, were they to be restricted to just 17 for the rest of their lives (restricted or, in the case of people using communication aids, significantly expanded!) The responses were illuminating: between just 40 respondents there were some 250 unique descriptions of tone of voice. More important still, less that 40 per cent of these were 'emotional' descriptions such as 'happily', 'sadly', 'angry' or 'afraid', which are so often assumed to encompass expressive speech.

Presentation of *Speech Hedge* was followed by an exercise in which diverse participants were asked to compose complex or subtle tones of voice – such as 'coaxing' – by combining elemental tones. The responses demonstrated a remarkable shared understanding, suggesting that a user interface based on similar principles might be intuitive to laypeople, rather than only speech technologists.

How might this interdisciplinary interaction be mapped? Exploring its evolution is in no way a criticism of the Triangle – the original purpose of which was to differentiate qualities of interaction design research from Human-Computer Interaction (HCI) and other related disciplines. The purposes of this chapter are different: to contextualise interaction design within less related, more diverse disciplines, within interdisciplinary research. So this is a complementary tool – a different way to use the Triangle in order to illuminate different things.

Landscapes and seascapes

In his dissemination of the *Designing for the 21st Century Research Initiative*, Tom Inns includes a map that combines a timeline of design history with a more interdisciplinary view through the metaphor of a river estuary.

> Finding relationships between the 41 research projects supported by the *Designing for the 21st Century Initiative* is complex. To make sense of this broad portfolio I often think of each project as being a research ship within *The Interdisciplinary Design Delta* shown above.
>
> *Inns 2010: 10*

Workshops are integral to Inns' own research process, and these often involve mapping exercises. In one workshop, focused on design management, participants were asked to annotate a pre-printed fictitious map showing the islands of design management education, practice and research (Figure 5.6, left). Each group was asked to mark up:

> Who lives on each island? How do the islands trade with each other? What do they import and export? What are the trade routes? What are the currencies? What bridges need to be built? How do they cope with changing tides?
>
> *Inns 2009: 20*

One participant inverted Inns' map: the word 'ocean' is crossed out and has been renamed 'The Continent of Design'. Correspondingly, the three islands become two lakes and a pond, and smaller islets become swimming pools (Figure 5.6, right).

This seeded the idea of a similar inversion of the *Interaction Design Research Triangle*, one in which more attention is paid to mapping journeys across and beyond the bounds of the Triangle (Figure 5.7, right) than within it (Figure 5.7, left). So if it ever represented a landscape (Fallman does not use this metaphor, just talks of 'areas') it is now an inland sea. All of a sudden, it is less a map *of* design research than a map of everything surrounding design research, everything acted upon *by* design research.

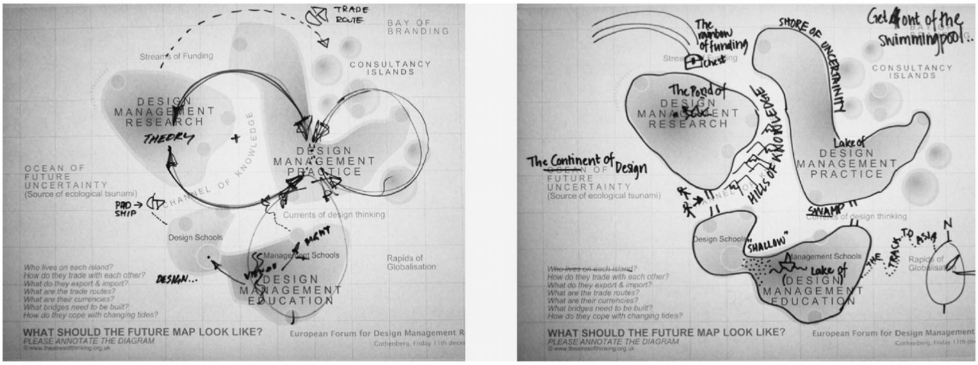

Figure 5.6 Tom Inns' exercise in mapping design management research with design management as islands (Inns 2009: 20) (left); Tom Inns' exercise in mapping design management research with the map inverted, the islands turned into lakes in 'The Continent of Design' (Inns 2009: 18) (right)

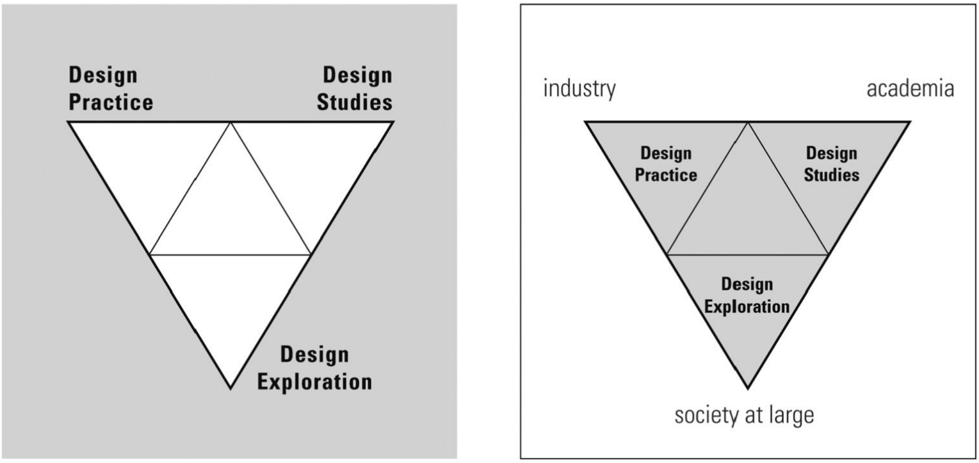

Figure 5.7 Inverting the Interaction Design Triangle to reflect the current emphasis on the area inside the Triangle, the area outside is shaded (left); The Interaction Design Triangle shaded inside, with the area outside the Triangle left open for mapping (right)

Redrafting the Triangle

A number of minor changes have been made to Fallman's Triangle – at a level of draftsmanship, rather than reinvention: I have interpreted Fallman's writing that "[his] triangle presents a two-dimensional space for plotting the position of a design research activity drawn up in between three extremes" as meaning that design research activity takes place *within* the bounds of the Triangle. Inside and outside will become significant later, so the three extremes, 'design practice', 'design studies' and 'design exploration', are therefore rewritten just inside the Triangle, referring to the points of the Triangle. On the other hand, Fallman talks of "three vital, external interfaces" with "industry", "academia" and "society at large" (Fallman 2008: 5). Therefore, these three terms are written outside the Triangle (Figure 5.8). Since there is no written reference to any asymmetry of the Triangle, or of any hierarchy between its three points, it will be redrawn as an equilateral triangle.

Remapping the projects

In attempting to remap the projects as much outside as inside the Triangle, the first challenge is to identify the disciplines, fields and communities, beyond design research, that they involved. The area of assisted communication for people with 'complex communication needs' is itself complex. It involves speech, disability and technology (Higginbotham 2010) and the overlaps between them: speech and disability overlap in the field of augmentative and alternative communication (AAC), which also includes sign language and communication boards, so is not always based on 'technology' in the digital sense; disability and technology overlap in the area of assistive technology, which also includes wheelchairs and hearing aids; technology and speech overlap in the area of speech technology, including speech recognition and speech synthesis.

The next step is to orientate these disciplines to the axes of the Triangle, looking at the primary areas of speech, disability and technology. *Six Speaking Chairs* involved the study of speech outside of disability or technology, including the academic disciplines of phonetics and linguistics, so 'speech' can be aligned with 'other disciplines', adjacent to design studies; although 'disability studies' is also an academic field, the mantra 'nothing about us without us' (Charlton 1998) makes it appropriate to align 'disability' with Fallman's 'society at large', adjacent to design exploration; technology, in this case digital technology, is closely associated with 'industry' and adjacent to design practice (Figure 5.8).

This means that the overlaps between these fundamental fields have fallen as follows:

- AAC is positioned between academia and society at large – which feels appropriate for a field rooted in clinical practice and with a strong participation of disabled people;
- assistive technology is positioned somewhere between industry and society at large – which might mean between mainstream markets and the particular needs of disabled people;
- speech technology is positioned between academia and industry – which feels appropriate for an area in which development and commercialisation are important activities.

Not that alternative orientations are not possible. In discussion, Fallman thought that in theory at least you could swap some of them and the model would still make sense: "So if you for instance swap disability and speech you get a very different perspective. But on the other hand, maybe that's not really a problem" (Fallman 2012). Agreed, because the goal is not to establish a definitive perspective, rather to illuminate from new perspectives.

Beyond the Triangle

The differing nature, role and audiences for the two projects, *Six Speaking Chairs* and *Speech Hedge*, lend them quite different traces on the map (Figure 5.8). The first incarnations of this were reminiscent of Murgatroyd's plotting, with events marked individually. The version presented here is simplified and more reminiscent of Eames's diagram – although the act of mapping itself may well be where the main value lies to the researcher.

Beyond the Triangle, *Six Speaking Chairs* involved deep excursions into unfamiliar territory, so the mental models represented by each chair are not invented so much as uncovered. They are found objects from foreign fields. As such, the creation of the chairs was as much an act of curation as of design – which is one reason why it employs found chairs, rather than new or

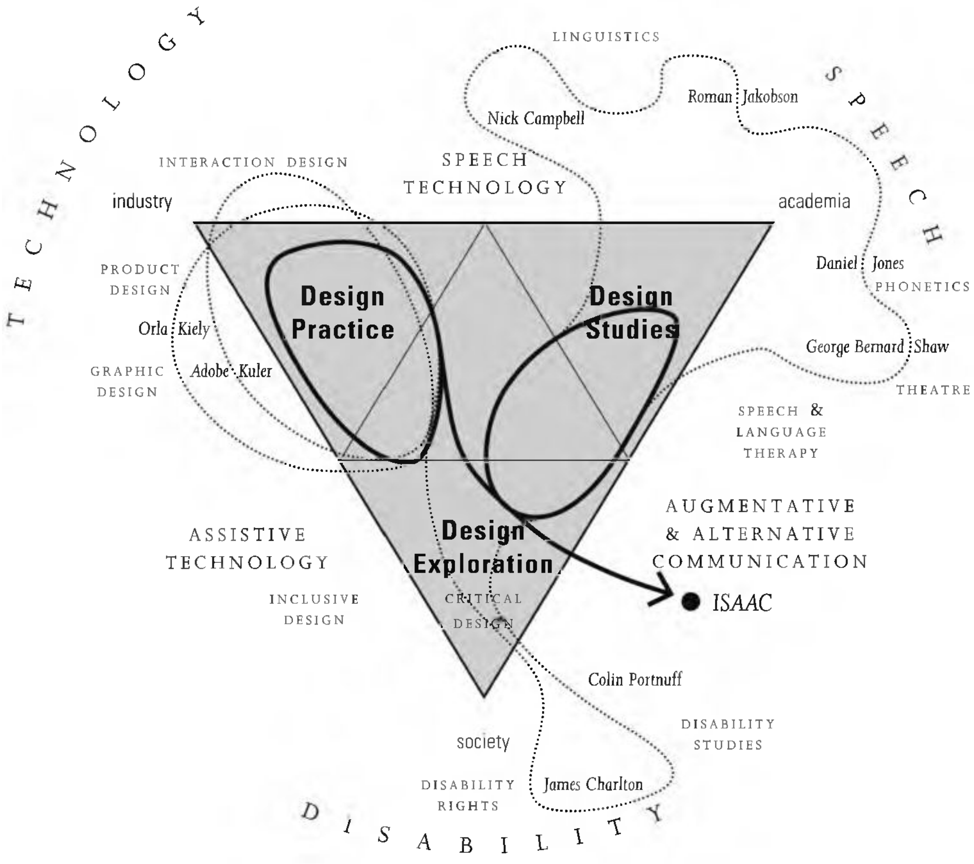

Figure 5.8 Mapping the circulation of knowledge and ideas on *Six Speaking Chairs* and *Speech Hedge* using the Triangle. Dotted lines show excursions 'inland', particularly incursions into linguistics, phonetics and the theatre to gather models of tone of voice. The arrow shows the flow of ideas to the primary audience: augmentative and alternative communication

specially designed ones (Pullin 2010). The expeditionary nature of the study is discernable in the mapping. The incursions inland provided raw materials for the design exploration, but are not integrated into the activity of design.

Outside the Triangle, *Speech Hedge* was much more informed by the state of the art in speech technology and in particular the Centre for Speech Technology Research at the University of Edinburgh (Clark et al. 2007) – but there was also more spontaneous inspiration from contemporary interaction design and graphic design, in particular the work of Orla Kiely (2010), which seems more part of design practice. These sources are more evident from the perspective of design (they are closer to the coast of our inland sea). The role of *Speech Hedge*, in contrast to that of the chairs, is to integrate these elements into a coherent whole. One that still invites critical reflection, as much about whether this is a desirable goal as whether or not it is feasible.

Whilst both projects lend themselves to several diverse audiences, their roles are quite different. The role of *Six Speaking Chairs* is to encourage divergent thinking, and their ambiguity as objects, as well as their multitude, is an important mechanism. *Speech Hedge* presents a much clearer "What if?", more focused and I hope still thought-provoking. The ambition for *Speech*

Hedge is to influence the assistive technology industry. Whereas the aspiration for *Six Speaking Chairs* would first be to influence future research into augmentative and alternative communication – its role is more indirect, catalytic, provocative.

Transcending exploration

Influence and impact

For this research, the primary audience is the field of augmentative and alternative communication (Pullin and Cook 2010b), rather than a design research audience (this chapter being a by-product rather than the original goal). An important hub for both projects – a place returned to again and again – is the biennual conference of the International Society of AAC (ISAAC). ISAAC is attended by a healthy mix of clinicians, researchers, people with complex communication needs as well as manufacturers, so for this reason it is placed mid-way between disability and speech, society and academia. It is here that the research is intended to have the most influence. So the interactions with this community should be prominent.

In 2006 (Pullin and Alm 2006), ISAAC was used to sound out the idea of applying critical design to this area; in 2008 (Pullin and Cook 2008), the *Six Speaking Chairs* were introduced and the audience responded with their 17 ways to say yes; in 2010, the first insights from the *Six Speaking Chairs* were shared (Pullin and Cook 2010b); in 2012, this research formed the basis of the keynote lecture for the state of the science conference for the Rehabilitation Engineering Research Center on Communication Enhancement in Baltimore (Pullin 2012); and in 2014, a paper including design principles distilled from this research will be submitted to the academic journal AAC as a Forum Note – an influential format of academic paper, to which responses are encouraged and published.

Returning to Fallman and Frayling

Beyond the specifics of these two projects, in their landscape of speech, disability and technology, does this mapping illuminate anything more generic about interdisciplinary design research? One observation is that whilst the areas inside the Triangle are generic – the whole point being that they are common to any (interaction) design research – the areas outside the Triangle are project-specific. Speech, disability and technology refer to *Six Speaking Chairs*, but not to Dunne's, Mazé's or Fallman's own PhD students' projects. Being more specific about these illuminates the relationship between academia, society at large and industry; it acknowledges that these already have relationships with each other and that these existing relationships are part of the context in which design research takes place; it may facilitate new connections, but it is rarely the sole bridge between them.

Daniel Fallman is supportive of this exploratory evolution of the Triangle in order to illuminate different aspects of design research. "Your idea of 'looping' outside of the model is a valid contribution and one which happens a lot in all kinds of design research" (Fallman 2012). Fallman has himself employed the Triangle as a starting point to illuminate further issues, in particular those of rigour and relevance in design research – criteria that he and Erik Stolterman propose mean different things within the three different design research activities (Fallman and Stolterman 2010).

Returning to Frayling, the mapping combines research for design (including the incursions into other fields) and research into design (including the reflections on design research) whilst making it clear that the emphasis is research through design. Design research is being applied to research into augmentative and alternative communication.

Exploration and trade

Having begun with exploration as an evocative metaphor for research, exchanging knowledge between disciplines alludes even more closely to trade, whatever it is that is exchanged between the parties. The circulation around the *Interaction Design Research Triangle* brings to mind the ancient Mediterranean trade-routes of the Phoenicians. "We could say of ancient Phoenicia that it was an early version of a world-economy, surrounded by great empires" (Braudel 1984: 25). "Maritime trade, not territory, defined their sphere" (Abulafia 2011: 64).

An analogy might be made with design, amongst other disciplines, by positioning design in the space between other disciplines, without laying claim to their territories (Figure 5.9). At the same time, this advocates that design research can play a unique role in interdisciplinary research. Perhaps this role for design research might even be described as *Medidisciplinary*.

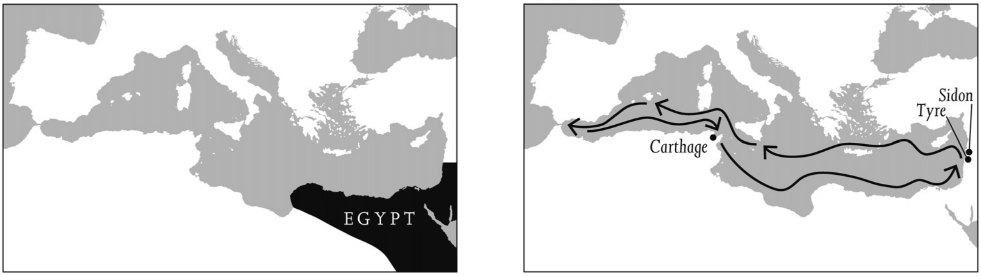

Figure 5.9 Mapping ancient civilisations – ancient Egypt, defined by its territory, as an analogy for a traditional specialist discipline (left); Ancient Phoenicia, defined by its Mediterranean trade routes – a possible analogy for design research? (right)

Any mention of trade brings with it consideration of fair trade, of giving something of equal value in return; ethical rather than exploitative. And in the current academic climate, beyond traditional citations, evidence of 'impact' – particularly influence in *other* fields and public-facing activities – is of value in representing the value of research. In the case of the *Six Speaking Chairs* it is certainly not just that disciplines such as phonetics and linguistics are being mined for raw materials to be brought into design itself: these insights become valuable when conveyed to the communities of augmentative and alternative communication and even back to speech technology. Design research is not just playing a collaborative role but a mediating role.

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6

EXPLORING RESEARCH SPACE IN FASHION

The fluidity of knowledge between designers, individuals and society

Harah Chon

Introduction

Research involving fashion theory, or the consumption and use of fashion products, requires a study into material culture as the communication of symbolic values. Within the study of fashion, material culture is defined as a meaning-making process developed through the exchange of symbolic values embedded within fashion objects (Crane & Bovone, 2006). While the perception of fashion, as a social phenomenon, has been positioned by users and researchers in relation to modernity, its social relevance is beginning to see a shift from an over-emphasis on interactions towards adaptability and longevity within diverse social groups (Buckley & Clark, 2012). This chapter addresses the interdisciplinary roots of fashion studies and introduces a research framework proposing the meaning-making process as a step towards achieving relevance and longevity. Following a sociological approach to fashion research, the role of fashion objects in everyday life is discussed as communicating design intent and extending into the construction of new meanings.

Overview of framework

Fashion is synonymous with change and assumes an extensive scope of operation that cannot be limited to or centred in the study of costume and adornment (Blumer, 1969). It needs, as defined by Simmel's (1971) widely adopted theory of fashion, to examine the social implications of fashion objects as an influence over individual forms of self-expression and freedom. In order to discuss the situational context of fashion research, the framework is separated into three distinct spaces for inquiry. The framework reviews design practice, the social implications of fashion, and the influences of culture within three simulated spaces – *problem space*, *fluid space*, and *research space*. Within these three areas, the conversational aspect of fashion is introduced as a vehicle for design knowledge exchange. Although design knowledge is often associated with creative activities or the thinking processes of designers, it is suggested here that this knowledge is not strictly contained within the domains of design or designers. The role of the fashion object is examined as a tangible representation of design knowledge, instrumental in communicating symbolic meanings and significance.

Design knowledge – as residing in designers, design activities, and design objects – offers a connection between designers and individuals within their shared social worlds. The sources and domains of design knowledge are introduced within the context of fashion and this knowledge is defined by fluidity, in how it is shared and exchanged across the different levels and dimensions of interaction. Design knowledge is further related to the tensions involving the problem space of the design, fashion, and cultural systems. These tensions are identified as the problems of fashion, as they encase the conflicts between internal and external forces of the situation. How design knowledge affects the problem space, particularly in how it affords the individual with the fashion experience, is explored through the research space. The research space elaborates on the transmission, representation, and reinterpretation of design knowledge. Through the transactional system, the conversational activity of fashion culminates in the exchange of embedded, constructed, and co-created meanings.

Supported by a comprehensive review of existing literature, this chapter proposes a framework for fashion research that explores knowledge flow as a meaning-making process involving designers, individuals, and society.

Fluid space: design knowledge

Designers, as individuals, transform perception into a form of common knowledge to construct understandings and guide behaviours. Literature on design knowledge is discussed to define the role of objects in transferring knowledge from producer to consumer.

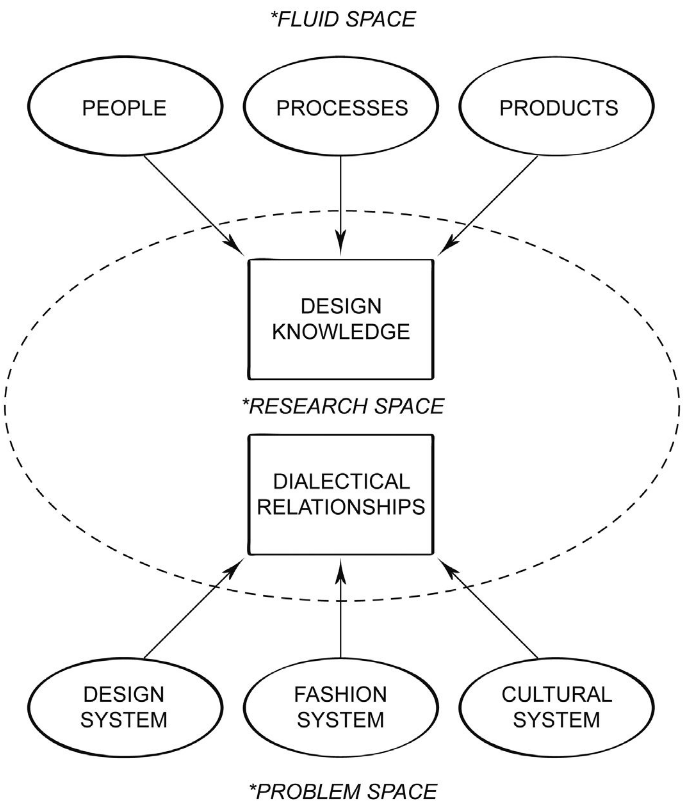

Figure 6.1 Framework of investigation

Domains of design knowledge

Design requires what is known as 'projective ability' – the ability to understand the relationship between human beings and objects to create a social context (Narvaez, 2000). Relying on the designer's own experiences, activities within design practice require a combination of skills, expertise, and knowledge to conceptualise artifacts relevant to the social environment (Friedman, 2000). The epistemological dimension of this knowledge shifts from tacit to explicit forms, moving and transforming thought into action, to question *what* designers know and *how* they come about knowing. Design knowledge, which is qualitatively different from knowledge in other disciplines, relies on experience, practice, and iteration to move tacit knowledge into explicit knowledge (Hoadley & Cox, 2009). Friedman (2000) defines designers as thinkers who move thought into action, and, further moving from *doing* to *knowing* requires the ability of designers to apply critical thinking and reflection. Following this practice or process of designing, designers increase their existing knowledge from "knowing through making or doing" to contribute to what is known as design knowledge (Olsen & Heaton, 2010, p. 81).

Cross (2006) defines these *ways of knowing* as embodied in the designer, the processes of designing, and in its products. Design ability is not strictly contained within the practice of designing nor is knowledge of design exclusive to professional designers. By acknowledging the rhetorical nature of design and the conversational aspect of design activity, design knowledge initiates a type of dialogue when transferred from designers to non-designers. Cross (1999) defines three sources of design knowledge:

- *Design Epistemology* – residing in people as the natural human ability of designers and of everyone, developing understandings for how people design, and conducting empirical studies of designer behaviour and design ability.
- *Design Praxiology* – residing in processes of designing, and in the development and application of techniques for design.
- *Design Phenomenology* – residing in products, in the forms, materials, and finishes of design objects.

Narvaez (2000) defines design's own knowledge as the result of the subject-object relationship that generates multiple perceptions of the world to become the intuitive knowledge of a society. The object represents the tangible materialisation of a design, becoming the object of knowledge to the perceiver in its ability to communicate an interpretation of a social reality. Knowledge produced by the design object can be classified as follows (Narvaez, 2000):

- *Empirical-Analytical* – analysis of the object as a physical element, in itself and its properties.
- *Hermeneutical-Historical* – the object as a social and historical entity within an interacting system, producing symbolic and social significance through communication.
- *Sociocritical* – the object as a social evoker-transformer, generating social and individual changes to attitudes, habits, and values.

Design knowledge can be defined as reflecting the perceptions and experiences of the designer, through the process of designing, and transforming into a material object. The design object contains knowledge of the designer and communicates this knowledge to the perceivable user by reflecting emotional, volitional, and cognitive interests (Narvaez, 2000). Users engage and experience the object, which assumes the role of communicating the specific ideas or functions created and shaped by designers (Kazmierczak, 2003). The object is cognisable and able to convey its existence when consumed and used by the individual. Therefore, increased

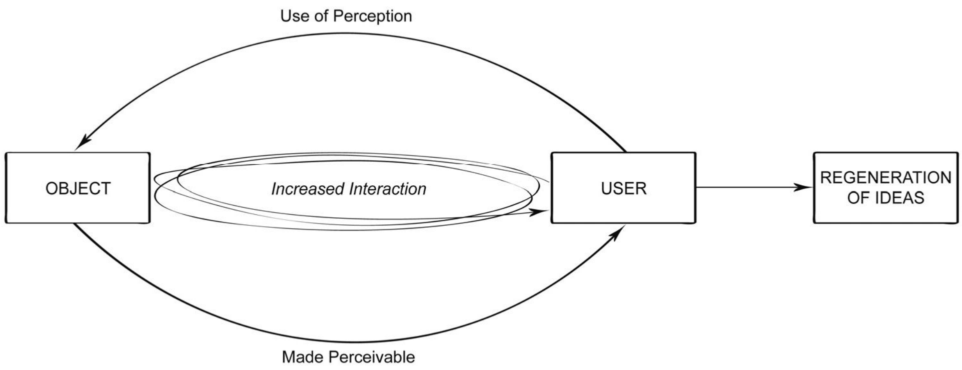

Figure 6.2 The user as perceivable being

interactions affect the extent to which users, as perceptive beings, perceive knowledge of the object. The user is implicated as being shaped by perception, allowing the ability to transform experience into creating a personal stock of knowledge. Through increased interactions with the object, knowledge embedded within the object encounters the user's existing stock of knowledge to produce and regenerate as new ideas.

Domains of fashion knowledge

Fashion knowledge is a form of expert knowledge that is socially constructed and culturally accumulated, embedded in the space of social networks framing the boundaries of interactions (Weller, 2007). Within the space of fashion, knowledge is increasingly difficult to constrain as social interactions accelerate its fluidity as a homogenising force in dispersing trends across global markets. The transgressive and fluid nature of knowledge links producers of knowledge to its users in a socially integrated and distributed process (Nowotny, 2000). Socially robust knowledge is significant for the study of social situations, as it initiates changes to the knowledge culture by establishing relevance for future designs (Olsen & Heaton, 2010). Culture incorporates the material process of symbolic production in human beings and the nonmaterial process of knowledge production existing in members of society (Narvaez, 2000). As a socially constituted practice, fashion and dress require individual members to acquire knowledge of cultural norms and expectations (Entwistle, 2000). It is only within these norms that individuals are able to construct a space of personal freedom and develop knowledge of the inner self while complying with fashion's standards (Nedelmann, 1990).

The fashion system contains the ongoing dialectic between imitation and differentiation which elicits the incessant changing nature of fashion (Simmel, 1971). This tension is reflected in the hierarchal network of fashion designers and brands, where the diffusion of trends and styles flows down from key innovators and leaders to the masses. Fashion's cyclical pattern is driven by elite groups, made up of designers and consumers, seeking to set themselves apart from the non-elite (Blumer, 1969). However, developments in fashion media have widened the influential roles of bloggers, editors, celebrities, stylists, and various style icons, further increasing the complexities of the fashion cycle. Design knowledge residing at the expert level, the core knowledge leading and sanctioning stylistic direction, becomes diluted when it is reproduced or imitated by followers. As fashion spreads from the elite to the masses, its knowledge becomes less viscous and fluid by moving into less complex social contexts (Weller, 2007). This signifies the distinction between design knowledge, the tacit form created and used by designers, and common knowledge, the codified or informal knowledge.

Problem space: dialectical relationships

This section presents three systems affecting design, fashion, and culture. Each of these systems contains tensions between the micro-internal and macro-external levels, as they are mediated by the respective roles of artifact, product, and values. Owing to the constant changing nature of the three systems, they represent the problem space.

The design system

Design's significance lies in its process of being produced, received, and used within a social context to prescribe social relations (Dilnot, 1984). Its implications do not lie internally within the profession of design but in the social world that produces the conditions within which designers work. Design can be defined as the socially differentiated transformation of the designer (Hillier, et al., 1984) and the design process can be seen as the pragmatic activity through which designers relate to the world framing their existence (Olsen & Heaton, 2010). This frame of reference is actualised within a specific social context, constructing and contributing to new social relations. Therefore, the different perspectives and perceptions of designers influence the process of design to affect or result in socially integrated outcomes. A designer's ability to perceive the world and frame it into an activity forms the connection between the designer and the external world. The designer's "concern with how things ought to be" produces artifacts that serve as the interface between their inner and outer environments (Simon, 1996, p. 133). It is through these artifacts that the designer is confronted by social systems of symbolic production.

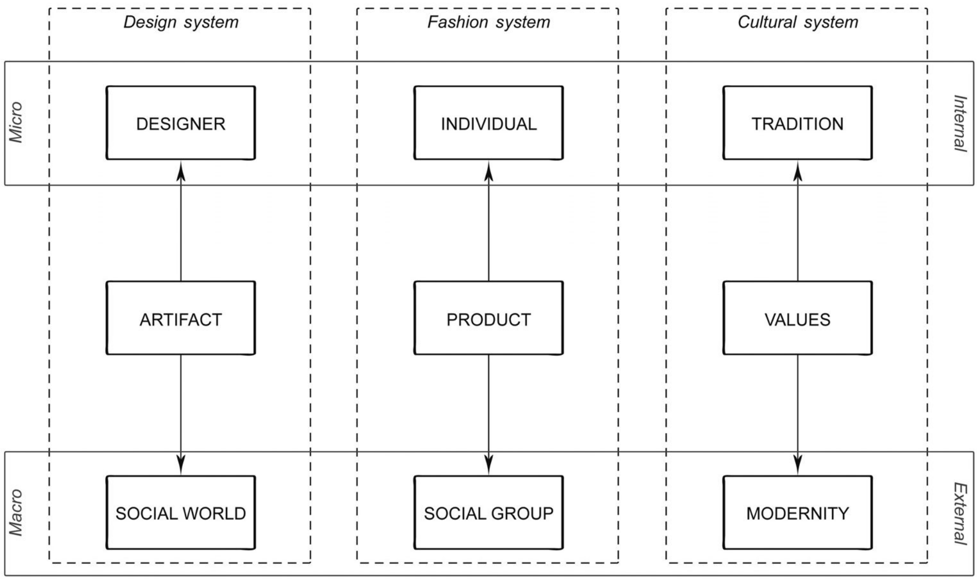

Figure 6.3 Dialectical relationships

The materialising process of design results in the production of artifacts which rely on the receptivity of individuals in a social situation. Designers rely on their own experiences to serve as interpretations of the world and utilise these perspectives in how they develop solutions for perceivable problems. This implicates the social world as either passive recipients of design solutions or the stimulating force influencing the designer's situated existence. Designers, as members of society, are positioned as part of the social world by sharing in common past and current experiences. However, in the role of producer, their activities place them outside of this world through their ability to contribute to and disrupt future situations. This creates the tension within the design system, which positions the designer and the social world on opposing poles. The designer's influence in creating artifacts for the social world is challenged by its dependency on society's acceptance of possible design solutions. Within this system, the artifact mediates the exchange of power and influence by forging a transactional connection between designers and the social world.

The fashion system

Fashion is a phenomenon that evolves over the course of time and, at the height of its appeal, becomes an indication of the present (Nedelmann, 1990). It is a mechanism or process of collective selection that involves innovators, leaders, followers, and participants (Blumer, 1969). Dominant fashions can be defined as high or popular fashion that is adopted and reproduced into mass fashion (Rocamora, 2002). As a social activity, the continuity of fashion relies on *innovators* or *leaders* who establish or produce high levels of taste and *followers* or *participants* to standardise the judgement of this predetermined taste. Therefore, the individual is faced with the decision to follow fashion norms and achieve union in achieving group uniformity or to deviate from social standards into segregation and exclusion (Simmel, 1957). The adoption of a prevailing style forces the individual to choose between imitation and distinction, emphasising the social impact of fashion.

Blumer (1969) defined fashion as establishing social relevance in its indifference to criticism, demand for adherence, and exclusion of those who fail to abide by its area of operation. In a recent study, it was determined that in most cases while individuals are highly knowledgeable about matters of taste, they resort to social and institutional supports to reassure themselves in regards to aesthetic choice (Clarke & Miller, 2002). According to Simmel (1957), the individual exists between antagonistic forces of a dualistic nature that influence the natural tendency towards uniformity, similarity, and imitation. Following this perspective, fashion represents the imitation of a given example and forces the individual into satisfying a preset social condition. Individual choice to adopt or imitate a style becomes a calculating act, characteristic of a social happening wherein individuals develop common sensitivities and similar appreciations through experiences in a shared world of intense stimulation (Blumer, 1969). The fashion object assumes a central role in reconciling the coexistence of exclusivity and standardisation within the dialectic of the fashion system (Crane & Bovone, 2006). Through the object, the conflict between imitation and differentiation shifts into a process of social interaction (Nedelmann, 1990).

Fashion, in terms of dress in everyday life, is the form by which individuals project a configuration of the self, representing one's existence in a particular time or history (Buckley & Clark, 2012). This implicates the act of dress as the presentation of self, embodying a performance that is as much an individual activity as it is social (Entwistle, 2000). The fashion system can be defined as containing the ongoing negotiation between individuals and society through the assigning of meaning and significance to design objects. Within this system, individuals are positioned at the boundary between expressing a personal representation of self and imitating the social standards for what is fashionable. The expression of self-identity constitutes the social group while simultaneously reflecting the group's influences on aesthetic choice and taste, indicating challenges to the social order of power and dominance over the individual. This ongoing tension represents the dialectic between the freedom of individuals and the pressures of society within the fashion system.

The cultural system

Culture provides clues of the phenomenal world to determine the types of objects available (Csikszentmihalyi & Rochberg-Halton, 1981). The fashion object embodies cultural phenomenon by contributing to the production and reproduction of society through shared experiences, values, and beliefs (Barnard, 1996). Defining the social world as being made up of dressed bodies, the activity of dressing becomes the expression of social relations in producing recognisable and meaningful cultural codes (Entwistle, 2000). It is through culture that individuals are able to divide and categorise the phenomenal world, by assigning significance to objects (McCracken, 1986). The impact of culture on the social forms of dress is best seen in the case of the Mao-Era, during China's Cultural Revolution, when aesthetic principles were overlooked and reflected a breach in the expression of beauty to enforce the non-existence of fashion (Barthes, 2006).

Culture is affected by social movements in creating a state of self-dissatisfaction that confronts the individual into changing and reevaluating values, attitudes, and behaviours (Ball-Rokeach & Tallman, 1979). The natural instinct of human experience, guided by perception, imagination, recollection and judgement, is to assign value to objects (Rinofner-Kreidl, 2012). Cultural meanings fulfill the needs of individuals by establishing values contributing to the construction of self (McCracken, 1986). Encasing the opposing forces of tradition and modernity, the cultural system influences changes affecting cultural values and the accumulation of meanings.

In the example of Mainland China, having undergone rapid economic developments and social reforms within the past three decades, the cultural system is conflicted as values are caught between the continuity of traditional inheritances and the adoption of western influences. The changing values within this cultural system are further complicated by differences found between generational cohorts (Dou, et al., 2006), particularly concerning those born after 1978 who have formed a unique generation of single-child adults (Smith & Hill, 2009). Cultural production concerns the process of meaning construction, requiring an examination of a group's collective actions and beliefs (Johnston & Klandermans, 1995). Therefore, the conflicts affecting cultural values will significantly impact the way that individuals or societies consume and understand design objects. The cultural system is dynamic in its organisation and reorganisation of shared values and serves as the backdrop and context for the study of fashion.

Research space: the role of design knowledge

The research framework was developed as part of an ongoing investigation into the changing situation of Chinese fashion. Focusing intently on the post-1980s and 1990s generation (those born after the One-Child Policy of 1978), it was determined that young Chinese are actively involved in the local fashion culture as designers and consumers. The growing number of fashion designers belonging to this generational cohort supports Buckley & Clark's (2012) proposal for focusing on the fashion of the everyday – the insignificant, the ordinary, and the overlooked. Interviews with several young fashion designers in Shanghai (*Zhang Da*[1], *Niki Qin*[2], *Yilei Wu*[3]) revealed insights into how fashion research can be applied more critically for humanistic inquiry.

Although each of the designers differs in design approach and business scale, they expressed similar views and sentiments in regards to Chinese fashion:

- *Chinese consumers need to be re-educated on taste.*
  Historical events prematurely stopped the development of traditional Chinese clothing, as western styles were widely adopted. Chinese fashion designers in the 1990s were focused on meeting the standards of Paris and Milan. In more recent years, designers have been returning to the roots of Chinese aesthetics and reintroducing consumers to traditional Chinese design. It is about finding new ways for Chinese design and creating a new language for fashion.
- *Clothing is a way of expressing feelings to convey a story for each emotion or occasion.*
  This requires an understanding of the consumer and providing the opportunity for consumers to understand the products. Clothing facilitates the ability to transform a wearer into the designer's vision. However, consumers should freely 'play' with the designs in new ways to inspire designers with their creative interpretations. Dressing is, therefore, a type of silent communication.
- *Sharing the same culture is an advantage for designers targeting local consumers.*
  If clothing is how individuals present themselves and experience the world, then designers need to understand the specific lifestyles of users. In order to have influence on the local creative community of designers and users, it is necessary to have knowledge of local aesthetics, culture, tradition, and communication styles.

In response to these insights, the research space is presented as the transactional system of exchange between users, objects, and the role of design knowledge. As objects are consumed by users, knowledge shifts into the transmission, representation, and reinterpretation of meanings. This phenomenological perspective of design knowledge concerns relationships between products and contexts, presenting the research space of meanings. The transactional

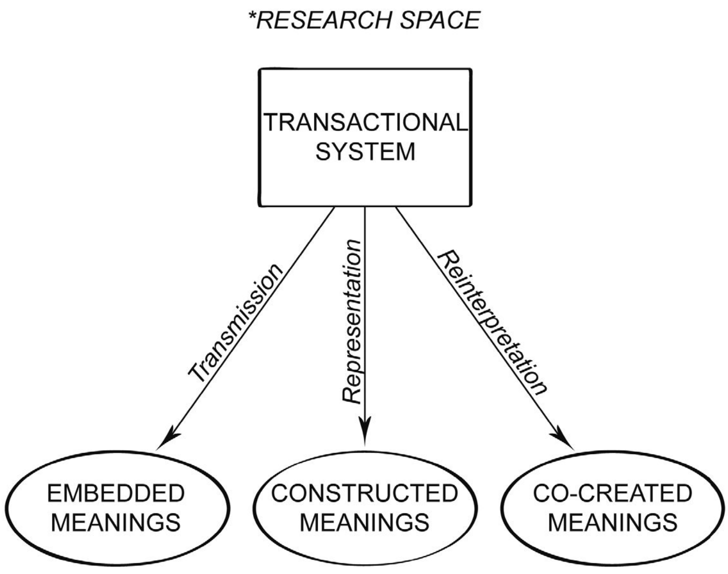

Figure 6.4 Research space

system presents a more detailed space for exploring how fashion facilitates the conversational form of knowledge exchange through the following:

- *Transmission of embedded meanings* – relationship between designers and objects
- *Representation of constructed meanings* – relationship between individuals and society
- *Reinterpretation of co-created meanings* – relationship between designers and individuals

Embedded meanings (transmission – designers and objects)

Knowledge created by designers belongs within the domain of designers, becoming design knowledge and thereby owned by designers. This knowledge is further cultivated and expanded through the design process and transmitted into the physical attributes of the finished object. The fashion object is a product of material culture that acts as the filter between the individual and the social world (Crane & Bovone, 2006). These objects are meaningful and knowledge-rich, transmitting knowledge across spatio-temporal patterns originating from designers through the mass production system and into consumer perceptions (Weller, 2007). Designers work from local knowledge communities that are defined by physical, geographical, cultural or industrial boundaries. By collecting, recycling, and borrowing ideas from these communities, they transform their tacit understandings into creative activities and processes to produce a knowledge base. This form of expert knowledge is encoded into objects through intentional choices in materials, colours, silhouettes, and details. The fashion object, therefore, acts as the vessel carrying and transferring knowledge between designers and users. It materialises the semiotic content and function of meaning, embedding design qualities that stimulate emotional responses leading to consumption.

Designers are the direct producers of material objects which contain symbolic meanings that are received and used by consumers (Rocamora, 2002). As the consumption process becomes less concerned with competing for the possession of goods, it shifts into the actualisation of the self through a form of self-fulfillment (Baudrillard, 1988). To consume the product is to consume its meaning and, therefore, the knowledge transmitted by the designer. The design object connects the designer to the individual, communicating the designer's knowledge in the form of conceptual meaning and intent. Therefore, it is the role of the designer to make content, information, data, meaning, and message perceptually accessible and translatable (Kazmierczak, 2003).

Constructed meanings (representation – individuals and society)

The mode of being-in-the-world marks man's existence, in the manner that one can "name, modify, and change his environment through the manipulation of the body" (Kim, 2001, p. 73). This schema defines the body as the unity of mind and self, relatable to other people and things, while the physical outline of the body demarcates the internal and external worlds. Accepting that one does not exist alone in the world, the body presents a common link between the unique perspectives of individuals in social situations (Scheler, 1973). Through the act of

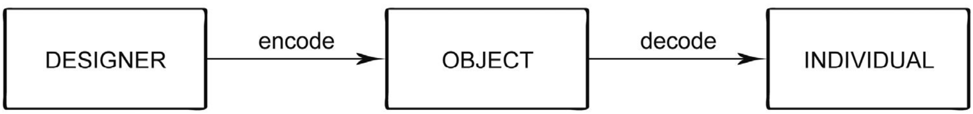

Figure 6.5 Semiotic function of the design object

sensing, one is able to "transfer other types of conscious states to perceivable bodies, depending on the complexity of their behaviors and their relations to the environment" (Heinamaa, 2012, p. 228). The body is, therefore, the means by which one experiences the world and is made known and relatable to others. If clothing represents the human persona, then it connects the relationships between *(wo)man and body* to *body and society* (Barthes, 2006). The transactional relationship between the individual and object mobilises design knowledge, as it comes into contact with the individual's existing knowledge and perception, to be further disrupted when reinterpreted onto the surface of the physical body and presented to others.

According to Barthes (2006), fashion is a system that creates value in the arrangement of garments on a wearer. The conscious effort of the individual, through dress, translates the actualisation of meaning that shifts with the reorganisation of garments on the body. Each object forms one component of the system, which can be ordered in any number of combinations, and the linking of different objects is what constitutes the structure of dressing as the medium for self-expression. Fashion becomes a conversational activity, of projecting one's appearance as a representation of the self onto the external world, connecting one individual to another. The act of dressing becomes a language by which human beings relate, establishing commonalities while delineating one's sense of individuality.

The physical arrangement of clothing on the body demarcates the individual's inner and outer worlds to "transform flesh into something recognizable and meaningful to a culture" (Entwistle, 2000, p. 8). Dressing becomes the activity connecting the individual and society by projecting a configuration of the self to be read and interpreted by others. Vieira (2009) defines the process of design as a tactile experience that serves both functional and ornamental needs, while clothing creates a code or visual language conveying a form of social identity. The decision to adopt a fashion is to represent one's identity, emphasising the relationship between personal values and the perceived value of the fashion object. In the hierarchal system of style selection, the individual's decision in the selection process is influenced by the intrinsic value of the fashion object. However, this meaning evolves and transforms through increased interactions between the individual and object.

Weller (2007) defines consumption as the intersection where individuals and fashion knowledge meet, providing a common platform for transforming the perceived value of the fashion product. If the semiotic function of the design object operates symbolically to generate meanings, then it is only fully realised through the active participation of a receiver (Kazmierczak, 2003). The individual, as a receiver of meaning, reconstructs the object's meaning and assumes ownership over its new significance. The consumption process allows the individual to reconcile the tensions imposed by society, created from pressures to conform to its standards, by satisfying self needs in addition to attaining group acceptance (Baudrillard, 1988). This signifies the point of consumption as a means for individual and collective expression, where the sensory connections between the individual and fashion object function as symbolic representations of self-identity (Workman & Caldwell, 2007).

The consumption of the fashion object reinstates power and freedom to the individual, who assigns new significance or meaning, and the object assumes a new representation. This

Figure 6.6 Transactional relationship through the design object

understanding replaces the original intent or codes of knowledge embedded by the designer, reiterating the fluidity of design knowledge in its ability to regenerate through increased interaction. The constantly changing nature of fashion can be seen as leading the individual to alter their perception of self and reinvent themselves through the extrinsic values associated with the fashion object.

Co-created meanings (reinterpretation – individuals and designers)

As a social phenomenon, fashion can be studied as a 'meaning-making process' of expressing symbolic values in cultural contexts (Crane & Bovone, 2006). Meaning, when confronted and intervened by the individual's own perception, assumes a new representational form (McCracken, 1986). This implicates the mercurial nature of the fashion object, which shifts meanings across different social contexts and cultural perspectives, as being dependent on how its end-user decodes and represents its knowledge or significance. Fashion's trend cycles have distributed knowledge from the elite social groups to the non-elite masses, reconciling social differences through the standardisation of dress. Fashion allows the individual a sense of freedom, to separate oneself from any possibility of comparison by emphasising one's distinction through clothing (Barthes, 2006). However, this freedom is opposed by the dominant influences of fashion leaders who dictate socially acceptable standards of style and taste. The individual is, therefore, placed in a position to not only modify and personalise the object's meaning but to transfer its significance to others.

Perception, requiring cultivation, is a precondition of meaning creation in the transaction between people and things (Csikszentmihalyi & Rochberg-Halton, 1981). Design objects provide cognitive interfaces within society to function as an interpretive structure mediated by signs pointing to meanings (Kazmierczak, 2003). Although the meaning transforms once received, it requires some comprehension of the designer's original intent for the success and effectiveness of the design. This demonstrates the shared responsibility of designers and individuals to allow the design object to maintain its proper meaning and reach a socially accepted meaning. It is in this way that meaning creation becomes a co-creative effort between individuals and designers.

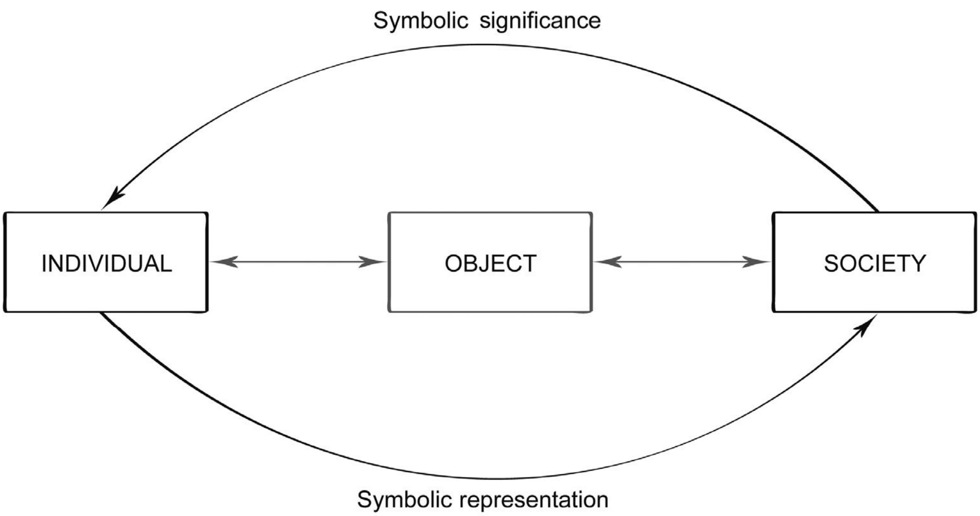

Figure 6.7 Reinterpretation of meanings

Taking the traditional example of fashion, the designer creates an object containing aesthetic or conceptual purpose. This is then adopted by a social group, usually made up of fashion elite, who standardise trends by demanding mutual imitation from its members (Simmel, 1957). The space of individual expression and representation of fashion becomes limited and constrained within the styles and trends set by society. While the traditional model follows a top-down dissemination of fashion knowledge flowing from key designers or brands, abstract forms of knowledge are fluid and able to spread contagiously which suggests that fashion norms are no longer restricted by a given example (Weller, 2007). Therefore, there is a need to explore the function of meaning creation in how the individual understands the fashion object, how these reinterpretations are related back to designers, and how the reverse flow of knowledge affects future creative processes of designers.

The designer and individual co-exist in the social world, often sharing in similar cultural backgrounds to establish commonalities leading towards the universality of design. Through the process of designing, the designer intentionally explicates specific affordances to communicate intentions to the user (Almquist & Lupton, 2010). Although the individual is given freedom to reinterpret the meaning or utility of the artifact, clues are given to transfer its original meaning. The designer's own knowledge, while embedded in the object, is redirected into a neutral space allowing it to develop new meanings. This can be illustrated with the example of fashion, where the designer's knowledge is used for the creation of new innovations in style. As this knowledge moves down the hierarchy of the fashion system, it becomes "less prestigious, less complex, less lavishly produced, less valued in the eyes of consumers, and less expensive in the market" (Weller, 2007, p. 57). The negative social impact on a passing or dying trend stimulates the need for individuals to reinterpret the fashion object to reinstate its significance and relevance. By refashioning or reconfiguring its meaning, the individual is exercising autonomy in the cultivation of a personal style. The continual negotiation of meanings serves as the connection between individuals and designers, changing the perception of fashion objects and contributing to new values.

Research space of fashion

Design objects function as semiotic tools for establishing symbolic and significant meanings. The interpretive nature of design objects suggests the need to focus less on designing things and more on designing the inferences leading to meaning-making (Kazmierczak, 2003). In a system like fashion that is characterised by rapid movements and changes in adopting or discarding styles, the design object's life span is increasingly shortened. This questions the instrumental role and ability of fashion designers to act as an influence for consumer perceptions and understandings of design. Technological changes and advances in media communication flatten geographical differences, accelerating codified forms of fashion knowledge transfer by flowing impersonally and non-specifically (Weller, 2007). When these fashion codes are no longer confined by time or space, the knowledge loses viscosity by transcending the previously demarcated boundaries between leaders and followers. The former position of designers, as influential producers and contributors of material culture, is challenged by the dynamic interplay between users who define new rules towards or against conformity. Consumption, therefore, becomes a transactional system of exchange where users set in motion new symbolic meanings that trigger social responses.

Review of framework

The domains of design knowledge are defined as originating from people, processes, and products. Design, as a conversational activity, involves the different perceptions of designers who engage in reflective dialogues. According to Schon (1983), practitioners accumulate tacit knowledge and intuitive knowing through critical reflections on experience. The repetitive nature of practice facilitates the conversation-like activity of design, producing expertise in judgements for uncertain situations. Knowledge residing within the domains of design epistemology, praxiology, and phenomenology is contained within the fluid space of inquiry. The fluidity of this space is suggested by the way in which knowledge shifts from tacit to explicit forms and is able to be communicated.

The three separate systems of ongoing dialectics are introduced as the problem space of fashion, which involves design, fashion, and culture. Within the design system, the role of designers is opposed by the influences of the social world. Similarly within the fashion system, the freedom of individuals is challenged by style norms determined from various social groups. Therefore, the fashion system exists only in relation to the design system and is actualised against the context of culture. Taking the current situation of China, movements in the social environment have affected the value systems of individuals to effect changes in behavioural norms and social interactions (Smith & Hill, 2009). The cultural system is specifically introduced here to provide the context for designers and users, within a shared cultural background, undergoing similar shifts in cultural values from traditional to modern.

Buckley & Clark (2012, p. 28) propose the case-study approach to "research the things, people, and ideas that have remained unobserved, to locate and interpret the intimate." This places fashion research at the intersection of the personal and social, leading to the study of social forms of knowledge; a perspective supported by the research space of this chapter's proposed framework. The research space, as a system of meaning-making, results from how design knowledge affects the dialectical relationships of the problem space. Knowledge of designers are transferred and communicated into the creation of objects, which are consumed and adopted by users. The ways in which users integrate fashion objects into their everyday lives is explored within the transactional system, producing a more localised and personal approach for researching the social functions of fashion.

Fashion research as humanistic inquiry

Designers, as active members in this shared sociocultural context, are uniquely positioned as being influenced by external forces of change while simultaneously influencing change through

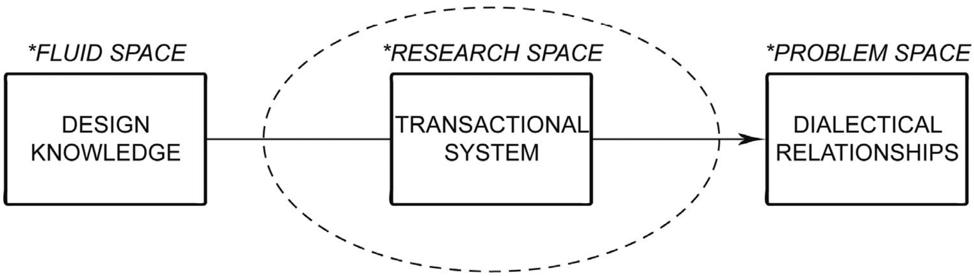

Figure 6.8 Relationship between spaces of inquiry

design activities. This significantly affects the fashion system, as movements towards individuality and independent thinking begin to disrupt the tension encased in the dialectic between imitation and distinction. Within this new cultural environment, designs begin to take on new meanings, which affect how designers use their own perceptions to develop foresight in designing. The design, fashion, and cultural systems are, therefore, interdependent in how they relate and interact.

Design knowledge increases in fluidity through interactions between individuals and social groups, creating a mobilising effect. The fashion object, containing knowledge encoded by the designer, provokes individuals to reassign its symbolic significance in relation to their own self-perceptions and social contexts. This form of design knowledge instigates changes altering the individual's position in the world, not as passive recipients of knowledge but as active participants in the process of meaning-making. In this way, fashion research extends into the humanistic inquiry of individuals and the methods through which they can establish meaningfulness in design.

This chapter supports the study and research of fashion against historical and sociological perspectives. However, the rapid movements defining the fashion system greatly decrease the personal value and relevance of fashion objects. This leads to questions of whether fashion objects can increase relevance and longevity at the individual level if design knowledge is more effectively integrated into the consumption process. This chapter introduces a framework relating design knowledge to the systems of design, fashion, and culture. The implications of this framework expand on the ways that design knowledge, as containing meanings, is further communicated in the relationships between designers–objects, individuals–society, and designers–individuals. Adopting a humanistic approach to research is proposed to better comprehend the specific cultural situations within which the fashion phenomenon takes place, developing a more defined understanding of how fashion facilitates the communication and process of meaning-making.

Notes

1 Zhang Da is one of the leaders of Chinese fashion design, with his own atelier in Shanghai.
2 Niki Qin is the founder and design director of Moodbox.
3 Yilei Wu is owner and designer of ½ Eternity.

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7

SEEKING TO BUILD GRAPHIC THEORY *FROM* GRAPHIC DESIGN RESEARCH

Robert Harland

Introduction

Graphic design is a popular subject in art and design higher education, yet it does not have a research culture of its own. Other disciplinary perspectives provide an extended context for graphic design to borrow from but these seldom acknowledge the investigational craft skills associated with conceiving, planning and making graphic objects. They often apply a distant different disciplinary perspective that adds complexity and confusion in language use. For example, semioticians use of the words 'sign' and 'image' in critical theory and cultural studies is ambiguous. Where there might be close graphic synergies with geography, mathematics and engineering, these are overlooked.

In this section, I explore some of the issues that may contribute to establishing a foundation for graphic design research. The aim is to differentiate between theory *for* graphic design and theory *from* graphic design by challenging assumptions that graphic design has no meaningful belief system. Two definitions of graphic design are exposed as offering not much more than a generic name for an integrative activity. These have insufficient depth but overlook the core of the subject.

The nature of visual images, as discussed in visual culture, is compared with discourse about graphic images in critical theory, leading to an attempt to define the graphic object from a design rather than art perspective. The graphic object within an ensemble of form and context provides a final focus on the distinctive qualities that determine graphicness. This provides the basis for recommending that graphic design research should seek to understand the relationship between form and context by utilising research into, through and for graphic design.

The inauguration of graphic design research

Nearly one hundred years after graphic design's baptism as "a suitable blending of common sense with artistic talent" (Dwiggins, 1922/1999: 14–18), its potential for generating new knowledge as well as products is dawning. The inception of the name 'graphic design' is widely attributed to W. A. Dwiggins in 1922 in an article published in a special supplement of the *Boston Evening Transcript*. His intention was to raise the awareness and standards of graphic artisans and artists working for commercial clients by encouraging the fulfilment of their own artistic need in the face of what Dwiggins called a 'mechanical revolution'. Significantly, he referred to 'advertising art' as a 'form' of 'graphic design', without stating explicitly what the others might be. In this sense, graphic design is not merely about persuasion and commerce, but also other forms. Since then, with the exception of a few projects that acknowledge the 'formal' use of research towards graphic designed objects, graphic design and research have been distant entities.

One example of how the process of graphic design has integrated research is the British road sign system by Jock Kinneir and Margaret Calvert (see Figure 7.1). Tests by the Road Research Laboratory and the practicalities of "illumination, construction, maintenance, siting and clutter" led to approval of the system in 1964 (Baines, 1999: 32). This is an exception and the correlation between graphic design and research is only now being recognised as graphic design matures (Davis, 2012: 234) and the need to add research to the traditional skills associated with training graphic design students is gaining in recognition (Heller, 2006).

A simple definition of research is what Ellen Lupton states as "looking for something in a focused and systematic way" (Bestley and Noble, 2011: 7). This suffices as a description of something graphic designers do as a part of professional practice: research *for* graphic design (after Frayling, 1993/4: 5). A few examples of what this may comprise aligned with academic research (see Denscombe, 2007) include picture research (e.g. fieldwork observation), typeface evaluation (e.g. empirical observation and measurement, documentary research), scrutinising client briefs (e.g. interviewing, content analysis), analysing market research (quantitative and qualitative data analysis) and generating images (e.g. image-based research). But research in the context of a client relationship has no obligation to disseminate results beyond the boundary of the project. A difference between research done for this purpose, and research undertaken in a university, is that the latter is usually disseminated publicly. Traditionally, industry has required products from graphic design. Research in universities requires the production and dissemination of knowledge, derived not only from practice but also from asking questions in a systematic way that leads to theorising and inquiry (Friedman, 2005: 7). For graphic design to prosper in academia it must grasp this tradition for more reasons than simply acquiring a new skill. It must also explain with theorising "to speculate and construct explanations about the world and our relationship with it" (Crouch and Pearce, 2012: 35).

In recent years, four books proffer a wide range of considerations that link graphic design, research and theory: *Design studies: theory and research in graphic design* (Bennett, 2006), *Graphic design theory: readings from the field* (Armstrong, 2009), *Visual research: an introduction to research methodologies in graphic design* (Bestley and Noble, 2011) and *Graphic design theory* (Davis, 2012).

Figure 7.1 Examples of the British road sign system. Author's photograph

From the wider discipline of design studies, Bennett (2006: 21) aspires to "instil in graphic designers a research orientated practice". Armstrong (2009) takes an evolutionary approach charting the theoretical importance of Futurism, Constructivism, the Bauhaus, the International Style, Modernism, New Wave and Postmodernism, and Contemporary Design. Bestley and Noble (2011) introduce concepts and methods in the guise of visual research, and in the most recent and largest tome, Davis (2012) provides the widest array of theoretical perspectives. All offer excellent insight into theory related to graphic design and much material is drawn from other disciplines, for example, gestalt theory from cognitive psychology (Bestley and Noble, 2011: 28–29, Davis, 2012: 62–66). Other phrases also feature such as communication design and visual design (Bennett, 2006), and communication models (Davis, 2012). Bestley and Noble integrate the widest ranging examples of graphic design output with an emphasis on "making and doing" whilst others emphasise more "reading and writing" (2011: 7).

These books give the impression of an interdisciplinary research field wishing to add social, cultural and political awareness to the technical, economic and historical contexts already known. Davis claims graphic design to be "inherently interdisciplinary" and "still exploring the extent of its domain", evident in her acknowledgement of a link to humanities and social science (2012: 234). However, despite a significant acknowledgement of other disciplinary perspectives, there remain notable omissions such as graphicacy, a key method in geography, graph theory from mathematics, or the engineer's use of graphical statics. Davis concludes by questioning if graphic design "will meet its contemporary challenges by borrowing from other disciplines or by constructing its own paradigms and theoretical knowledge" (2012: 234). From this it can be deduced that a shift from theory *for* graphic design to theory *from* graphic design may strengthen its disciplinary credentials. For this to happen, we must ask what is at the core of the subject that might provide a unique perspective that other disciplines do not.

What is at the core of graphic design?

Graphic design is difficult to define due to the "conflicting descriptions" of practice (van der Waarde, 2009: 7–12). It is said to have "no ideology of its own" (Moles, 1989: 122), suggesting a borrowed system of ideas and ideals. Yet, it is in itself an evolved idea from the "cradle of civilisation" and the development of early Sumerian pictographic writing, aligned to the emergence of the city in Mesopotamia in the fourth millennium BC (Meggs and Purvis, 2006: 6). Social, cultural, economical and political forces indirectly 'shape' graphic communication, to the extent that now representations that emerge from graphic design touch "on nearly every aspect of communication, from film and television titles to street signs and soup cans" (Blauvelt and Lupton, 2011: 9). As a system of representation, graphic design is a system of thought and expression of beliefs that do not exist without visual representation.

"Representation" here is a borrowed term from *Cultural Studies* (Hall, 1997). It is therefore not surprising that two definitions of graphic design, written in the midst of a significant period of change for the subject with the advent of digital technology, make no mention of representation:

> Generic term for the activity of combining typography, illustration, photography and printing for the purposes of persuasion, information and instruction.
>
> *Livingston and Livingston, 1992: 90*

> the generic title 'graphic design' is understood to apply to the broad range of specialism's contributing to visual design for communication media, whether printed or electronic,

> static or time-based. The media include print (e.g. books, magazines and promotional material) and electronic media (e.g. computer graphics and video). The technical specialisms include illustration, typography and photography. Its applications may be informative, persuasive or recreational, and include information design, advertising design, corporate identity design, packaging design and publishing design.
>
> *CNAA, 1990: 13*

The first of these describe graphic design as a combination of tangible object and intangible subject. Typography, photography and illustration attempt to define its properties, printing is the medium and persuasion, information and instruction the function. The second is clearly more expansive, not media specific, still identifying illustration, typography and photography but as technical specialisms, and frames its purpose as application through design categories. Both generalise the subject and lack the subtlety that distinguishes, say, typography from lettering. They omit any reference to artistic taste (one of the overlooked key aspirations for Dwiggins). Neither description fully acknowledges the role of 'function'. Graphic design is offered as a genus that groups a diversity of activities that in professional terms have been categorised as "visual elements", "visual goals" and "effects" (van der Waarde, 2009: 19–27) (see Table 7.1). These may all contribute to shaping the graphic object, technically, intentionally and strategically but none can claim superiority over another.

This range of diverse activities suggests graphic design cannot have a single disciplinary perspective. It is not typography, though may be typographic. It is not animation, though may be animatic. It is not marketing, though may use marketing. This clearly makes any aspiration for a research culture difficult to fathom, more so because definitions of this kind also overlook the subject's origin in drawing and writing (graphein) allied to planning and organisation. This is the commonality between the visual elements, visual goals and effects. Without the physical manifestation of what Mitchell refers to as "graphic image" (1986: 9–14), thoughts, and therefore meaning, remain in our heads.

A critical distinction to introduce here is what Hall (1997: 17–18) calls "systems of representation", of which there is said to be two. The first he describes as "*mental representations*" (original italics) by which we connect "all sorts of objects, people and events" in our heads as

Table 7.1 The essence of the professional field of graphic design

Visual elements	*Visual goals*	*Effects*
Illustration	Film production	Marketing
Photography	Website design	Communication strategy
Typography	Graphic art	Usability
Copywriting	Spatial design	End user research
Image processing	Advertising	Visual research
Animation	House style design	Visual strategy
Audio-video		Concept development
Programming		House style management
Author		Project organisation
Infographics		
Font design		
Desktop publishing		

Source: Adapted from van der Waarde, 2009: 19–27 "concepts and images" representing the world. This provides the means to "refer to things both inside and outside our heads". He uses the phrase "conceptual map" but this has also been referred to as "cognitive map" or "cognitive collage" (Tversky, 1993: 14–24). A second system of representation involves the exchange of "meaning and concepts" through what Hall calls "common language", a wide ranging reference to "written words, spoken signs or visual images" collectively known as "*signs*" (1997: 17–18, original italics).

These distinctions are insufficient for our purpose here because the first emphasises the cognitive relationship between entities and the second is concerned with transference. Neither explicitly deals with the creation of new ways to represent thoughts and feelings as ideas and concepts. That said, the reference to visual images provides some scope for discussion. Visual image implies sighted object. Interpreted through the lens of visual culture:

> Sight is never experienced in the pure state as something that might be called 'the' visual but is always rendered as vision, involving not just sensory data but the modulating frames of psychology, whether in terms of the conscious or unconscious mind.
>
> *Mirzoeff, 2009: 4*

Visual images are looked at, but studying these in "visual culture" is more a comparative than object-based pursuit, and said to be everywhere and nowhere (Mirzoeff, 2009: 1). Everywhere, visual images appear as "screens on computers, games consoles, iPods, handheld devices and televisions . . . cameras" as "visual media" (Mirzoeff, 2009: 2). Rose calls these "visual technologies" and lists "photography, film, video, digital graphics, television, acrylics" as "TV programmes, advertisements, snapshots, Facebook pages, public sculpture, movies, closed circuit television footage, newspaper pictures, paintings" (2012: 2). Two- and three-dimensional static and dynamic visual images are ubiquitous.

> Today images seem to inhabit every part of our lives, and everything seems to be or have an image. Our eyes are bombarded by visual images, most obviously those produced and disseminated by commercial entertainment and information media, from advertising billboards, newspaper photography, the internet, television, films and computer games. The urban environment is replete with the visual displays of architectural design, interior décor, landscape, shop and business fronts, and traffic signals. Print culture has gradually expanded its ability to include many visual images along with text at relatively low cost, in technical instruction manuals, educational publications, tourist brochures, magazines and shopping catalogues, to name but a few.
>
> *Manghani et al., 2006: 1*

Visual culture is also considered nowhere; suggesting visual images are equally elusive as multimedia composites. "All mediatized representations are mixed", meaning that film is usually accompanied with a soundtrack, or a painting or sculpture embodies haptic qualities from the artist (Mirzoeff, 2009: 3). The existence of image as a concrete phenomenon is undermined when questioning what image stands for. Mitchell lists "pictures, statues, optical illusions, maps, diagrams, dreams, hallucinations, spectacles, projections, poems, patterns, memories, and even ideas as images" (1986: 9). That said, his analysis of institutional discourse about different usage offers a family tree (see Figure 7.2). Within this the graphic and optical image stand for the "real, proper" kind but any further clarification of what the graphic image is beyond the "pictures", "statues" and "designs" studied by art historians lack clarity, reinforcing the complexity of the matter.

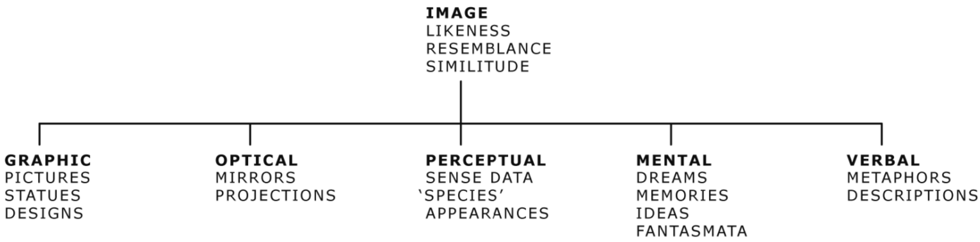

Figure 7.2 W.J.T. Mitchell's family of images

Source: Mitchell, 1986: 10 (redrawn by the author)

The graphic image is object-based and, like the optical image, an external entity. It has a tangible materiality more concrete than the other four categories. We may further imbue "graphic" with an aspiration towards "visual art" depicting "clear and vividly explicit details" (Soanes and Stevenson, 2005: 755). This suggests a heightened sense of visual experience than the everyday associated with visual culture's interpretation of the visual image. Within the discourse on representation, image can mean an internal mental or external material construct that depicts or envisions (see Figure 7.3). Image may stand for object, language, sign, idea, concept, thought or feeling (Hall, 1997: 1–30). The ambiguity associated with this leads us to think of graphic more as a tangible 'object', purposeful and focused, in preference to *language* and its obvious association with literacy, or sign and its adoption by semioticians.

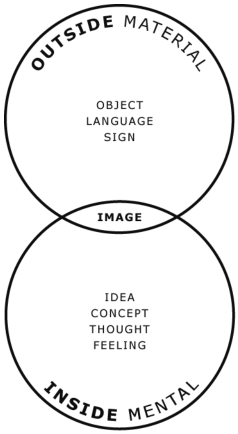

Figure 7.3 The internal-mental external-material domains of image

Source: Author's diagram

What is a graphic object?

In the art of Mira Schendel, graphic objects combine paper, lettering, poetry, acrylic laminate mounts, transparency and philosophy in "abstract aesthetic" rather than "readable, meaning making" compositions (Williams, 2013). These are art objects. By comparison, graphic design is more concerned with the latter. Like the universality of images studied in visual culture, Jessica Helfland (2001) incorporates an assorted array of tangible and intangible objects, relationships and intentions reflecting the pervading influence of graphic design on human behaviour:

> Graphic design is everywhere, touching everything we do, everything we see, everything we buy: we see it on billboards and in Bibles, on taxi receipts and on Websites, on birth certificates and on gift certificates, on the folded circulars tucked inside jars of aspirin and on the thick pages of children's chubby board books. Graphic design is the boldly directions arrows on street signs and the blurred, frenetic typography on the title sequence to 'E.R.' It is the bright green logo for the New York Jets and the monochromatic front page of *The Wall Street Journal*. It is hang-tags in clothing stores, playbills in theatres, timetables in train stations, postage stamps and cereal box packaging, fascist propaganda posters, and junk mail. It is complex combinations of words and pictures, numbers and charts, photographs and illustrations that, in order to succeed, demand the clear thinking of a particularly thoughtful individual who can

> orchestrate these elements so they all add up to something distinctive, or useful, or playful, or surprising, or subversive, or in some way truly memorable. Graphic design is a popular art, an applied art and an ancient art. Simply put, it is the art of visualizing ideas.
>
> *Helfland, 2001: 137*

And what about the proliferation of graphic objects that feature as part of extraordinary displays of human endeavour, such as the stars and stripes flag in photographic images of the first moon landing in 1969 or the "stop and stare" stainless steel Art Deco motifs that adorn New York's Chrysler Building (Moore, 2012)? What about the skyline of New York itself as a graphic object; the yellow jersey worn by the leader of the Tour de France; Christmas lights on Oxford Street, London; an ice cream van; Alan Moore's *V for Vendetta* protest mask; Amy Winehouse's eye make-up!? These are all vivid examples of graphic objects, but not all have communication as their primary objective. For example, a flag's primary function is communication, whereas a building must first shelter people.

The function of the graphic object is part of a system of objects that incorporate what Jean Baudrillard refers to as "discourse-as-object" in the context of advertising ([1968] 2005: 178–215). By this he means how advertising is a cultural object for consumption as well as the intended consumption of objects it seeks to promote. However, the function of the graphic object is not limited to persuasive communication. The graphic object has many functions invariably listed as identification, information, presentation and promotion, referential, emotive, connotative, poetic/aesthetic, metalinguistic, phatic, persuasion, education, administration, decoration, magic, representation, orientation and systematic (van der Waarde, 2009: 23). Abraham Moles recognises this when he suggests that symbolic graphic representation of things or actions exemplifies how communication achieves supremacy over materiality in a legible world. His interpretation of the functions of graphic design list: information, propaganda, social consciousness, consonance of humans with their goals, and an autodidactic function, conveyed through an [a]esthetic message. Whichever of these functions one chooses to prioritise, the variations provide ways to understand the motives of graphic objects as a discourse that influences human behaviour through *graphic affect*.

One possible answer to the question *What is a graphic object?* might therefore be: any product, system or action that privileges communication over materiality through graphic affect. For example, consider a photograph of people assembled to watch a carnival parade (see Figure 7.4). In the picture, two barriers constrain the crowd. One permanent barrier in black in the bottom right corner of the image supports a road sign directing motorists to Corby. The road sign is a typical graphic object known as a product of graphic design and part of the system of road signs

Figure 7.4 Temporary barriers as graphic objects privilege communication over materiality by restraining a crowd who possess the ability to disregard the structure and overcome it if necessary. Author's photograph

designed by Kinneir and Calvert, as noted earlier. A second type of barrier is temporary and extends the permanent structure to follow the kerb around the bend in the road. These are coloured red with black footings. This is an untypical graphic object. The temporary barrier privileges communication over materiality in that the barrier could easily be overturned by the crowd standing behind it but they do not. There is a perceived rather than physical restriction. Psychologists call this *affordance* (Norman, [1988] 2002: 9–12) that "result from the mental interpretation of things, based on our past knowledge and experience applied to our perception of the things about us" ([1988] 2002: 219). Clearly in the case of the temporary barrier, the public utilise their prior knowledge to influence their behaviour. Graphic objects influence their behaviour.

Graphic objects influence behaviour. But they must be designed to communicate intentions by arranging and combining different visual elements. These include: line, shape, tone, colour, texture, form, scale, space and light (Cohen and Anderson, 2006: 9) as "visual appearance properties" that when held in a "configurational pattern" help connect the mind to the world (Pylyshyn, 2007: 19). This is at the core of graphic design and it is the infinite number of possible permutations that provides the impetus and desire to experiment and contextualise permutations. These – experimentation and contextualisation – are arguably the first and second principles of graphic design research in an academic sense. Benefitting from Frayling's (1993/4: 5) categories of research in art and design, the first can be called research *through* graphic design and may comprise "material research", "developmental work" or "action research". The second is more research *into* graphic design and may include "historical research", aesthetic and perceptual research or "research into a variety of theoretical perspectives . . . –social, economic, political, ethical, cultural, iconographic, technical, material, structural" and more.

By comparison with architecture, the difference between the first and second principles relate to what Christopher Alexander (1964) calls a relationship between 'form' and 'context':

> The form is a part of the world over which we have control, and which we decide to shape while leaving the rest of the world as it is. The context is that part of the world which puts demands on this form; anything in the world that makes demands of the form is context.
>
> *Alexander, 1964: 18–19*

In this discussion, the graphic object is the form, and it may be designed to 'fit' or 'misfit' with context depending on the need for harmony or discord (see Figure 7.5). Together, form and context comprise an ensemble (Alexander, 1964: 16–17). Graphic objects each have an unknown set of infinite relations between form and context that determine the extent of fitness. Alexander describes the difference between the two using the metaphor of a tie: "one tie goes well with a certain suit, another less well" (1964: 16). Conversely,

> If a man wears eighteenth century dress today, or wears his hair down to his shoulders, or builds gothic mansions, we very likely call his behaviour odd; it does not fit our time [1964]. Yet it is such departures from the norm which stand out in our minds, rather than the norm itself.
>
> *Alexander, 1964: 22*

The continuum between fit and misfit represents the degree to which a graphic object is understated or overstated in its intention. Figure 7.5 attempts to illustrate this whereby the hexagon representing the graphic object is aligned or misaligned to the hexagon representing the context.

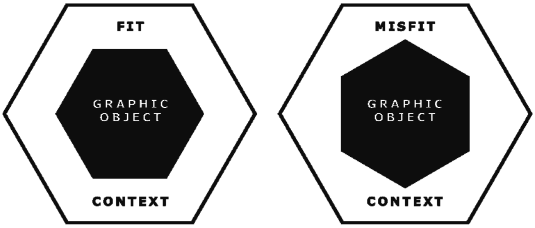

Figure 7.5 The fit and misfit ensemble of graphic object and context. Author's diagrams

Discussion

Graphic designers have traditionally used their knowledge, understanding, cognitive skills and practical skills – allied to project management – to build a portfolio of project work. Throughout the second half of the twentieth century they identified and developed systems that allowed a practice to grow in size and popularity to combine craft, culture and commerce on a global scale. This unprecedented growth did not allow much time for critical reflection and the development of theory, although a history of graphic design has established itself and continues to evolve. Rarely, if at all, has graphic design incorporated research for the purpose of building theory, more often preferring to adopt the work of other disciplines such as communication theory from telecommunications or semiotics from linguistics and philosophy, to illuminate processes and products.

Such theories developed in the twentieth century, as did graphic design. These are classified by Meredith Davis (2012) as 'graphic design theory', a title that may be construed as misleading if some believe it to mean theory generated by graphic design. These are theories *for* understanding graphic design, but not theories that originate *from* graphic design. This is an important distinction because theory that might have the potential to emerge from an understanding of graphic design poses the challenge to generate theory from within, a desirable aspiration for a University-taught discipline. This has not historically been the intention of education in graphic design.

Similarly, research has been a neglected pursuit in graphic design. Yet, the prevalence of research-driven data in the form of graphical images in the service of research and theory development presents much opportunity for the graphic designer wishing to follow a different career path in a subject that has an increasingly elevated position in academia, professional practice and everyday life.

Graphical devices are said to be a third component for theorising, alongside language and mathematics. This suggests that in the way writers and mathematicians theorise, graphic designers can also. The question, therefore, arises about whether graphic design can develop a capacity for research and theorising that leads rather than follows. It was suggested earlier that experimentation and contextualisation might be the first and second principles of graphic design research. This coupling links the core properties of graphic design to the context within which it resides. To see these two activities as stages of development, as Andrew Blauvelt suggests, is to deprive graphic design research of the thing that makes it distinct: the investigational craft skills associated with the properties of making graphic objects: line, shape, tone, colour, texture, form, scale, space and light. Blauvelt (2008) suggests that "[a]fter 100 years of experiments in form and content, design now explores the realm of context in all its manifestations – social, cultural, political, geographic, technological, philosophical, informatic, etc." A concern with this is that not only are the number of permutations associated with form-giving infinite (Alexander, 1964: 24–25), but exploring the realm of context is also endless. Alexander states that "when we speak of design, the real object of discussion is not form alone, but the ensemble comprising the form and its context" (1964: 16). The same may be said of graphic design research.

Conclusion

Graphic design as it exists in art and design higher education does not yet appear to have a research culture, despite the imposition of theory from other disciplines and in some cases the claim of graphic design theory. The subject is yet to offer something back to other disciplines and on that basis is arguably not yet even in its infancy. This is in part due to the ambiguity of language use and definitions that position it as an integrative or interdisciplinary activity, often overlooking its image-making and organisational capacities that define it as method for professional practice as well as tool for research. Allied to this, the combination of common sense with artistic talent has rarely been recognised, and therefore devalues its aesthetic power as a potential motive for research. Graphic design, graphic art and graphic science (Harland, 2012) are prevalent across the academy and graphic devices are acknowledged as a central component in theorising. This suggests a foundation is already in place for graphic design research and the building of graphic theory.

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PART II

How do we embark on design research?

Formulating research questions; conducting a literature search and review; developing a research plan

Part II is concerned with how one might embark on a design research project. The chapters in this part address issues on how a research question might be formulated, how a research plan is developed and how methods are chosen. Some of the chapters are focused on a specific aspect, for example exploring how research questions might be proposed and explored (Davis) while others (Matthews and Brereton) offer guidance on the various methodological concerns faced by a novice design researcher looking to decide which methods to use. Many of the chapters in this part touch on the philosophical standpoint determined by the research topic, questions, plan and methods chosen. Heylighen and Nijs' chapter offers an apt starting point for this part as it calls for design researchers to keep the arguments and evidence of 'designerly ways of knowing' open by adopting pluralistic approaches and epistemologies in their investigations. They attempt to illustrate this point by examining the very notion of design itself, challenging common perceptions and understanding of design through their study of an architect who continues to design after losing his sight. This re-articulation of design research, both epistemological and methodological, is both important and relevant in that it stresses a non-dogmatic approach to design research.

Following Heylighen and Nijs' chapter, the part turns to Sangiorgi and Scott's piece, which aims to inform and provide guidance for designers and design researchers embarking on projects aimed at enacting systemic change. Through examples, they describe four contemporary design research approaches focused on processes of social change and highlights differences in the conception of change, focus of intervention, guiding principles and methodology. We then turn to a personal piece written by Davis who draws on her substantial experience to offer practical advice on what makes a good research question. She highlights potential pitfalls to avoid in developing a research question and offers six guidelines to writing a good research question in design. The guidance model is further extended in Luck's chapter where she attempts to help students grapple with a number of fundamental starting points, including the topic of the research and the core conceptual underpinnings to their research. She highlights a useful strategy in asking a reflexive question at the start of a research project: 'what is the question that your research can answer?' in order to elicit what the research is trying to accomplish by using the methods employed.

The chapters in this book illustrate the diversity (in approaches, methods, disciplines) present in design research today. While this diversity is a reflection of a healthy discipline, methodological diversity can also result in multiple points of confusion for researchers about to embark on a design research project. To help with this 'methodological mire', Matthews and Brereton present two strategies aimed at helping practising researchers make sense of, and navigate through, this collective methodological morass. This diversity in approach is also evident in the final four chapters of this part, starting with P.J. Stappers and colleagues, who describe the roles that prototypes and frameworks for structuring explorations by research through design projects play. They draw on a series of design research projects, carried out over several years, in which designing played a prominent part.

The part moves on to research where the act of designing is significant to research where the focus is on theory building and theory testing. Cash and Culley's chapter highlights the role experimental studies play in design research and present a critical discussion on how experimental methods and methodology is applied in design. To help design researchers develop greater scientific rigour and improve the use of experimental methods and methodology, they discuss how the issues of experimental effects, placebo control and linking laboratory and practice can be made more appropriate for design research. In contrast, and more closely linked to design research utilised in professional practice, Evans' chapter explores the role of design and the designer in researching the future. Design's propositional nature requires that designers find ways to anticipate future technological and social trends. Evans presents approaches that design can utilise in researching the future as well as a framework that supports designers when researching the future. The final chapter in the part by Bremner and Roxburgh presents a cautionary tale for design researchers looking to embark on a project using methods from other disciplines. They highlight the increasing use of ethnographic research methods in the past two decades especially in the area of user-based, participatory and co-design areas. This 'ethnographic turn', as they call it, should be handled with care since there are key differences between the purpose of observational research such as ethnography (which is primarily descriptive) and design (which is generally transformative). Echoing views from other authors in this book, the adoption of other methods should be carefully considered by fully understanding the differences between the intent of the original method with the intent of design research.

8

RE-ARTICULATING PREVAILING NOTIONS OF DESIGN

About designing in the absence of sight and other alternative design realities

Ann Heylighen and Greg Nijs

Introduction

Key to design ability is said to be a characteristic form of cognition, generally described as 'visual thinking': designers are particularly visually aware and sensitive, and use models and codes that heavily rely on graphic images. In designing architecture, for instance, the visual seems so important that architecture students are characterised as "the vis kids of architecture" (Goldschmidt 1994: 158). Even authors who argue that this visual mode of thinking in design is a philosophical construct that can be dispensed with acknowledge that this does not undermine the significance of the visual dimension (Moore 2003).

Given the central role of 'visual thinking' in design, it seems hard to imagine that someone can design in the absence of sight. Blindness seems at odds with the visual modes of thinking and communicating that are considered to be at the core of design ability. Even more so, designing might even seem *impossible* without sight, as the key 'tool' to assist design cognition – the traditional sketch – loses its power.

Several studies have emphasised freehand sketching's inherent power to facilitate the uncertain, ambiguous and exploratory nature of conceptual design activity. Sketching is found to be tied-in very closely with generating and exploring tentative solution concepts and recognising emergent features and properties (e.g. Goldschmidt 1991; Goel 1995; Cross 2006). In the absence of sight, making a sketch may still be possible to some extent, yet recognising emergent features by reading off information from it is certainly not.

Nevertheless, this chapter builds upon a study of an architect who lost his sight and continues designing (Heylighen 2011; Vermeersch & Heylighen 2011, 2013; Vermeersch 2013). Studying his work offers a unique opportunity to expand our understanding of design and design research. The fact that this architect does design in the absence of sight raises questions as to what extent 'visual thinking' – or other prevailing notions of design ability, for that matter – may be complemented with alternatively articulated propositions about design. Moreover, combined with other studies, it raises questions about sketching as the key 'tool' to assist design cognition, and about whether other 'tools' may be central in assisting it too.

Therefore, the first section of this chapter investigates where design researchers' outspoken attention for these aspects comes from and addresses both how human cognition is understood in most design research – i.e. in a predominantly cognitivist way – and how designing is researched, thereby pointing at the, in some respects, ill-articulated statements it comes with.

The observation that other, more contemporary understandings of cognition and approaches to research receive relatively little attention from design researchers in turn raises questions about how design research is produced, which are addressed in the second section of this chapter. In view of this, we call for a better articulation in researching design, both epistemologically and methodologically.

By presenting three studies that allow for and enact alternative design realities (third section), we invite researchers to conduct design research that keeps the discussion open by staying 'available' (cf. Despret 2004) to register or become sensible to differences in new and unexpected ways (Latour 2004), and thus allowing for other articulations of what design *may* or *can* be – be it by adopting other epistemologies or by researching in other ways.

Prevailing notions of design

In this chapter we are interested in why we might find it surprising that an architect continues designing in the absence of sight. To think about this, we first try to trace back where design researchers' outspoken attention for 'visual thinking' and its support by sketching comes from, and what it comes with. In the past, design research was the subject of enquiry, both qualitative (e.g. Cross 1982, 2007) and quantitative (e.g. Chai & Xiao 2012). While we acknowledge the on-going epistemological and methodological debates among design researchers, taking a closer look at these enquiries suggests that prevailing notions of design and ways of studying it resonate with a predominantly cognitivist understanding of human cognition and corresponding mode of enquiry, while other understandings and methods seem to receive relatively little attention.

Borrowing from computer techniques

The emergence of design research is commonly associated with the launch of the design methods movement in the 1960s. Nigel Cross (2007: 1) situates its origins further back "in the application of novel, 'scientific' methods to the novel and pressing problems of the 2nd World War – from which came operational research and management decision-making techniques – and in the development of creativity techniques in the 1950s". These origins, combined with the beginnings of computer programs for problem solving in the 1960s, challenged prevailing notions of design at that time. As Bruce Archer (1965) observed: "The most fundamental challenge to conventional ideas on design has been the growing advocacy of systematic methods of problem solving, borrowed from computer techniques and management theory, for the assessment of design problems and the development of design solutions".

In the 1970s, however, design methods movement pioneers turned their back on this challenge. John Christopher Jones expressed his critique as follows:

> I DISLIKE THE MACHINE LANGUAGE THE BEHAVIOURISM, THE CONTINUAL ATTEMPT TO FIX THE WHOLE OF LIFE INTO A LOGICAL FRAMEWORK
>
> *Jones 1977: 57*

These critiques echoed evolutions in psychology, where behaviourism had raised the objection that, as a theory, it was incomplete: "the simple linkage of stimulus and response was considered insufficient to account for the knowledgeability of actors or the productivity of their actions" (Ingold 2000: 165). Moreover, fundamental issues were raised by Horst Rittel and Melvin Webber (1973) who characterised design problems as 'wicked', fundamentally un-amenable to the techniques of science and engineering, which dealt with 'tame' problems. Rittel

(1973) therefore suggested that, after the 'first generation' methods of the 1960s, a 'second generation' was emerging, moving away from the desire to 'scientise' design towards the ambition to understand design in its own terms (Cross 1982, 2007).

Computational theory of mind

The founding axiom of this 'second generation' was formulated by Bruce Archer: "Design has its own distinct things to know, ways of knowing them and ways of finding out about them" (RCA 1979), distinct from the commonly recognised scientific and scholarly ones. At the core of design, Archer situated the 'language' of 'modelling', equivalent to the 'language' of the sciences (numeracy) and humanities (literacy). Nigel Cross advanced this axiom as the 'touch-stone theory' around which the 'research programme' he called for would build "a 'defensive' network of related theories, ideas and knowledge":

> We need more research and enquiry: first into the designerly ways of knowing; second into the scope, limits and nature of innate cognitive abilities relevant to design; and third into the ways of enhancing and developing these abilities through education.
>
> *Cross 1982: 226*

Cross's article was part of a series aiming at establishing the theoretical bases for treating design as a coherent discipline of study. In the next decades, the second generation's contributions to this discipline strongly resonated with developments in cognitive science, which meanwhile had emerged alongside the development of the digital computer, and promised a way out of behaviourism's incompleteness. The founding axiom of the doctrinaire view within cognitive science, dubbed 'cognitivism' (Dreyfus 1992), is:

> that people come to know what is 'out there' in the world by representing it in the mind, in the form of 'mental models', and that such representations are the result of a computational process working upon information received by the senses.
>
> *Ingold 2000: 163*

Epistemologically and methodologically, adopting this axiom implies a "focus on the individual cognizer in isolation from the 'real world', which is studied most effectively with controlled laboratory research design" (Osbeck 2009: 17).

Cognitivism was quickly adopted by design researchers, especially in the form of Allen Newell and Herbert Simon's (1972) Information Processing Theory (Goel 1995 provides an overview of studies from different design domains). This adoption, we argue, may explain at least partially design researchers' outspoken attention for 'visual thinking'. As anthropologist Tim Ingold (2000: 15) points out, basic to cognitivism's entire project is Cartesian ontology:

> an ontology that divorces the activity of the mind from that of the body in the world. Thus the body continues to be regarded as nothing more than an input device whose role is to receive information to be 'processed' by the mind, rather than playing any part in cognition itself.

Although cognitivism suggests that, in principle, all sensory organs could receive information to be processed into 'mental models', in Western thought the eye was attributed the objectifying qualities deemed necessary for this task (Ingold 2000: 253). These qualities are not inherent to the visual sense, however. Rather, they are imposed onto it. Because of its alleged characteristics of distance and directionality, vision is often contrasted with hearing and touching, which are attributed subjective qualities because of their encompassing nature or proximity respectively (Vermeersch 2013: 12). Yet, as Ingold (2000) points out, vision can be considered as a subjective sense, as much as the other senses can be understood as objectifying. Consequently, vision's alleged superiority over other senses is not so much that of one sense over another, but that of cognition over sensation (ibid.: 255). If design researchers consider 'visual thinking' as key to design ability, questions thus arise as to what extent this key role is inherent to the nature of design, or infused by the superiority of cognition over sensation that comes with adopting a cognitivist view of cognition and corresponding mode of enquiry.

Cognitivism challenged

Over the past decades, however, cognitive science transformed considerably. Criticisms on, amongst others, the individualistic framework and dualist implications following from the study of mind in isolation, and shortcomings of the experimental protocols required for isolating cognitive mechanisms, instigated important work on the situated nature of cognition (Osbeck 2009). Approaches to human cognition, such as situated cognition (Suchman 1987, Lave 1988, Lave & Wenger 1991), embodied cognition (Lakoff & Johnson 1999, Brooks 1999), or distributed cognition (Hutchins 1995, Kirsh 1995, Clark 1997, Clark & Chalmers 1998), all extend the models of the cognitive processes that characterise learning, memory and intelligence from the individual brain to the surrounding socio-material environment.

To start with, the ontological internal/external split between mind, body and world is replaced by understanding cognition as anchored in our sensory-motor and bodily engagement with the world; and thus not fundamentally cut off from perception and action (i.e. the body). Second, cognition is understood as distributed in that its properties are not that of an isolated individual mind, but that of a group, which is often involved with sense making and striving for shared meaning. Moreover, it is always situated in and distributed over a socio-material environment inhabited not only by other co-implied participants, but also by the material artefacts engaged and the physical structure of the space wherein the situation takes place.

In tracing the implications for design research of these transformations in cognitive science, we rely on a recent study which investigated the core themes, evolution and future trends in design research through a comprehensive bibliometric analysis (Chai & Xiao 2012). By analysing citations of papers in *Design Studies*, the authors identified the core literature in design research for three time periods (1996–2000, 2001–5, 2006–10). Three 'top publications' – Schön 1983, Goel 1995 and Goldschmidt 1991 – and the research method of protocol analysis (Suwa & Tversky, 1997) are highly cited across all three periods.

Interestingly, the oldest 'top publication' advances an understanding of cognition as situated. One year after Cross's article, Donald Schön (1983) published a study of a desk 'crit' – a conversation between design tutor Quist and architecture student Petra. It was the right study at the right time, so it seems, as it explicitly challenged the positivist doctrine underlying much of the first generation's work, which yielded disappointing results so far, and offered a constructivist paradigm instead. Based on his observations of the desk 'crit', Schön comments that, through sketches, "[the designer] shapes the situation, in accordance with his initial appreciation of it; the situation 'talks back', and he responds to the backtalk" (1983: 79). In his analysis, Schön studies the practice of thinking, perceiving *and* doing (instead of disconnecting mind and body), shows an outspoken attention for the situation in which the design process unfolds, *c.q.*, a design studio, and acknowledges the mediating role of objects in this practice. By introducing the notion of 'backtalk', he underlines that objects play more than an intermediary role: they add something to designers' thought processes, and have the capacity to transform them.

In another 'top publication', Gabriela Goldschmidt (1991) investigated what kind of reasoning is represented by freehand sketching in architectural design. To this end, she asked designers to 'think aloud' while sketching, making recordings and transcribing these. Analysis of the transcripts together with the sketches produced makes Goldschmidt (1991: 140) conclude that, at least in architectural design, "the inherently creative process of form-production [. . .] seems to result from a special systematic, causal relationship between two modalities of visual reasoning, induced by sketching", i.e. 'seeing as' and 'seeing that'. Compared to Schön's study, Goldschmidt's aligns more with a cognitivist understanding of cognition, in both its rather narrow, de-contextualised focus on the cognitive mechanisms introduced by freehand sketching, and its laboratory-style experimental research design required for isolating these.

The same holds true for the third 'top publication', Vinod Goel's *Sketches of Thought* (1995). Goel starts his study by criticising the computational theory of mind for its inability to accommodate imprecise, ambiguous, fluid, amorphous, indeterminate thoughts. Yet, because "it is the only game in town" (1995: xii), he does not question this theory as such, but rather the properties of the mental representations it is committed to. His resolution, therefore, is not to articulate cognition in an alternative way, but to go as far with the computational theory of mind as possible, and to reconstruct the notions of computation and representation such that they can do justice to the full range of human symbolic activity. To this end, Goel focuses on variables like the type of problem being tackled (*c.q.*, ill-structured and well-structured) and relies, like Goldschmidt, on single-subject 'think aloud' (or 'talk aloud', according to Goel) protocol studies, which both reflect a cognitivist stance.

Goldschmidt and Goel are not the only researchers using protocol analysis to investigate the nature of design, however (Chai & Xiao 2012). In collecting information about the course of the cognitive processes, many design researchers use this experimental technique to "probe the subjects' internal states by verbal methods" (Ericsson & Simon 1993[1984]: 1). Although it is claimed that verbal protocol data can be collected *in situ* without necessarily interfering with task performance, design researchers typically use it to understand single-person cognition in socially impoverished environments, rather than multi-agent cognition in full-blown people-rich environments (Ball & Ormerod 2000: 148), i.e. real-world design practice. This experimental isolation, it can be argued, poorly articulates design activity. The cognitivist mode of understanding and studying cognition actually disconnects the agent under study from the real-world design situation and the aspects it is made up of. That is, design is poorly articulated in terms of designers' bodies (i.e. as disembodied vision rather than *multi*sensory embodiment), their richly structured environment (which is replaced by an environment provided for by the design researcher, who decides a priori what the environment contains), the other human agents present in the design situation (who literally stay absent from the account of the situation) and, to some extent, the agency of the representational artefacts they use (which are allowed to speak only through human interpretation, not 'by themselves'). As such, design researchers' typical use of protocol analysis further substantiates our claim that design research is predominated by a cognitivist stance, which, as we argued, may help to explain design researchers' outspoken attention for 'visual thinking'.

Producing design research

Tracing back where prevailing notions of design and ways of studying it come from in turn raises questions about how design research is produced and how to sort out different research epistemologies and methodologies.

The hinterland of design research

Design researchers' outspoken attention for 'visual thinking' and its central support by sketching is but one example of how the nature of design activity and design cognition is stabilised in particular models, and not others. As demonstrated above, in the past decades considerable effort has been put into empirically nailing down how designers work through laboratory-style experimental studies and with approaches like 'think aloud' protocol analysis. These have led to statements about what design reality is.

This should not be a problem as long as the prevailing notions of design produced are not presented as neutral reports on the reality 'out there', as statements representing objective 'matters of fact'. Sociologist John Law points out that in scientific practice, statements are not made in a vacuum: "if a statement is to last it needs to draw on – and perhaps contribute to – an appropriate hinterland" (2004: 28). The 'hinterland' of a scientific statement is made up of other related statements, but also involves a network of inscription devices, i.e. technologies, instruments or other sets of arrangements for labelling, naming and counting. Law goes on to point out that since such apparatuses are already in place, scientific reality is relatively stable.

Certain consequences follow, which are particularly relevant here. First, if the apparatuses in place – the 'hinterland' – produce more or less stable realities and statements about those realities, countless other realities are being *un-made* at the same time: "there are a whole lot of realities that are not, so to speak, real, that would indeed have been so if the apparatus of reality-production had been very slightly different" (Law 2004: 33–34). Furthermore, Law points out:

> the hinterland produces certain *classes* of realities and reality-statements – but not others. [. . .] Some classes of [reality-]possibilities are made thinkable and real. Some are made less thinkable and less real. And yet others are rendered completely unthinkable and completely unreal.
>
> *Law 2004: 34, original emphasis*

This, then, may help explain why we might find it surprising, even unthinkable, that an architect designs in the absence of sight. One could say that statements about 'visual thinking' being key to design ability, and the sketch being the key 'tool' to assist design thinking, have become unqualified and have stabilised. They are part and parcel of design researchers' 'hinterland' today.

Furthermore, analogous to studies of other scientific practices, it can be suggested that creating new inscription devices, statements and realities by building on these unqualified statements, is easier and cheaper for design researchers than bringing into being other, alternative realities. Imagine that Petra in the desk 'crit' Schön studied had made a foam model instead of a sketch to show Quist her preliminary design. Imagine that, subsequently, Goldschmidt had set out to investigate what kind of reasoning is represented by model making in architectural design, and had come to the conclusion that model making induces a unique dynamic between two modalities of haptic[1] reasoning, i.e. 'feeling as' and 'feeling that'. How different would the 'hinterland' of design research look today?

This is not to say that the statements about 'visual thinking' in design or its support by freehand sketching are wrong. As Law (2004: 39) points out: "[t]o say that something has been 'constructed' along the way is not to deny that it is real". The point we want to make here is that these statements – and, for that matter, any other unqualified, stabilised statements about design – enable and constrain any work in design research: they set limits to conditions of design research possibility.

Methodology

The same holds for the research methods used to produce these statements. Because, as Law (2004: 143) reminds us: "[m]ethod is not [. . .] a more or less successful set of procedures for reporting on a given reality. Rather it is performative. It helps to produce realities". If method is performative, different methods will bring into being different (design) realities. But the more a particular set of methods is used, *c.q.*, those supporting and building on the prevailing notions of design, the more a certain design reality is brought into being. While making this and not that reality, other realities are *un*-made, up to the point that they may seem unreasonable, invalid, not significant, or worse, unthinkable.

As mentioned, protocol analysis was found to be the most cited research method in design research (Chai & Xiao 2012). Given the growing understanding of cognition as embodied, distributed and situated (see above), we agree with Ball and Ormerod (2000: 148) that "it remains paradoxical that so many studies of design expertise have ignored the role of situational and social factors in design in preference to carrying out laboratory-style investigations in which such factors are controlled for". Using protocol analysis to study single-person cognition in socio-materially impoverished environments isolates designers from their richly structured design situation and the other agents present in it. By consequence, it hardly allows researchers to register new and unexpected differences in social and situational factors in design.

Other research methods, however, do allow for such registration. Ethnography, for instance, seeks to provide accounts of activity as perceived and recognised by those present within the real-world situation (Ball & Ormerod 2000: 148). Characteristic features of ethnography include its *situatedness* – data are collected by a participant observer located within the everyday context of interest (e.g. a design studio); *participant autonomy* – observers are not required to comply in pre-determined study arrangements; and *openness* – observers remain open to the discovery of novel or unexpected issues that may come to light as a study progresses (ibid.: 150). Ethnography has been used in social scientific research, and to a limited extent in design research (e.g. Cuff 1992, Bucciarelli 1994). As we will demonstrate in the third section of this chapter, such methods might indeed usefully be employed in design research for researchers to stay available to these real-world social and situational factors in design, and to align with more contemporary, situated understandings of cognition. Before we do so, however, we briefly address what these understandings imply for how design research is evaluated.

Accuracy versus articulation

Consider again design researchers' decades-long effort to empirically nail down how designers work, resulting in statements about what design reality is. In traditional epistemology, the normative question to ask regarding these statements is how accurate they are, in other words, whether or not they represent a state of affairs. Once the ontological internal/external split between mind, body and world is given up, as contemporary understandings of cognition do, this question seems to lose its meaning, however. As philosopher of science and technology Bruno Latour (1999: 303) points out, "[t]he question is no longer whether or not statements refer to a state of affairs, but only whether or not propositions are well articulated".

An important distinction Latour draws our attention to here is that between accuracy and articulation. In the traditional picture, subjects register the world through accurate statements about it, which are expected to converge into one single version of the world (Latour 2004: 211). Once the correspondence between statement and state of affairs has been validated, it is the end of the story. Articulation, by contrast, is what occupies the position left empty by the dichotomy between mind and external world, between subject and object (Latour 1999: 303). Rather than being able to talk with authority, for Latour (2004: 5) articulation means *being affected by differences*. Its decisive advantage over accuracy, he points out, is that it "does not expect accounts to *converge* into one single version that will *close* the discussion with a statement that would be nothing but a mere replication of the original" (ibid.: 211, emphasis added). Thus, where there is an end to accuracy, there is no end to articulation.

To describe *what* is articulated, Latour uses the term 'propositions', which conjugates three crucial elements: "(a) it denotes obstinacy (position), that (b) has no definitive authority (it is a pro-position only), and (c) it may accept negotiating itself into a com-position without losing its solidity" (ibid.: 212). These distinguish propositions from the idea of "statements referring to matters of fact through correspondence". To clarify the difference between well- and poorly articulated propositions, Latour suggests a new normative touchstone by drawing on the work of philosophers Isabelle Stengers and Vinciane Despret. Of the eight criteria he advances, three are especially worth mentioning here: to be scientific, 1) propositions have to be interesting, i.e. they should be able to put the theory at risk; 2) we should devise our inquiries so that they maximise the recalcitrance of those we interrogate; and 3) we should render talkative what was until then mute.

With this normative touchstone in mind we now turn, by way of example, to three studies whose researchers stayed available for other articulations of design. Rather than creating new statements by building upon the stabilised hinterland of design research, all three made the effort and expenses to account for and enact other, alternative design realities. And by doing so, made accounts of what design can (also) be, risking their questions to be requalified by the human and nonhuman actors under study (cf. Latour 2004).

Alternative articulations of design

We start with our study of a blind architect, which triggered the questions addressed in this chapter in the first place, and complement it with two studies by other design researchers.

Designing in the absence of sight

After studying architecture, and working with famous architects, Carlos Mourão Pereira established his own architecture firm and started teaching design in an architecture school. Eight years later he lost his sight and since then maintains his professional activity, in practice, teaching and research. The work he designed after his sight loss attracted international attention. We studied his design practice based on a focused ethnography, which compensates for shorter periods of time in the field with a more thorough preparation beforehand in getting to know the subject, the use of audio-visual recording devices to capture activities and a more iterative data analysis (Knoblauch 2005, Schubert 2006).

What is striking in Pereira's practice is his outspoken attention for non-visual qualities of buildings and sites. When visiting a building site, he pays attention to its visual qualities (which his co-workers describe for him), but also to its smells, sounds and haptic qualities. For example, Pereira points out during one of our interviews, "it is very important to touch all the place". To transport the site's qualities to the office, he takes along not only pictures, but also aspects corresponding to other, non-visual sensory modalities. His co-workers capture the acoustic qualities through sound recordings that he can listen to at the office. Pereira himself records haptic qualities of, e.g. door stills, handrails, or transitions between building elements, by moulding with his fingers a lead wire over the parts considered so as to take 'a sample of the building'. The wire is put into a cardboard folder to be transported without deformation and, once at the office, can be copied onto paper through drawing or digitalised through scanning. The site thus first gets known in a non-visual (*c.q.*, auditory/haptic) way, and this knowledge is transported within its own sensory idiom (through audio recordings/a moulded lead wire, rather than visual representations of the auditory or haptic qualities), so that it can serve to assess qualities of the site differently and ground possible design decisions. This is combined with visual apprehension – for pictures are taken, and design decisions are also based on visual assessment. Through our observation of his practice, we (as researchers) thus needed to extend the traditional representational, visual epistemology into a performative, composite epistemology, i.e. one that includes a visuo-auditory or visuo-haptic knowledge practice.

This first aspect of Pereira's practice already hints at a second one: more often than not, Pereira designs together with a co-worker. When visiting a site, we mentioned, the co-worker takes pictures. At home, s/he describes what is in the pictures taken. Making meaning of the picture thus becomes a collaborative, interactional endeavour instead of a dyadic relation between a designer and a photograph. And when Pereira forms his hands in a given shape to represent (part of) a design, the co-worker points to design aspects on his hand, or manipulates it to change its shape. This offers a telling example of collective knowledge practice, wherein the hands (instead of a representational artefact) become the model, and touching (instead of seeing and pointing) becomes a means to transfer knowledge. This intensive co-work made us, researchers, expand the focus of our study from individual to social and distributed cognition, from the individual designer to the group of collaborators and the artefacts involved (e.g. photographs), and from disembodied representational to embodied performative cognition (e.g. communicating through touch on models formed by the designer's hands).

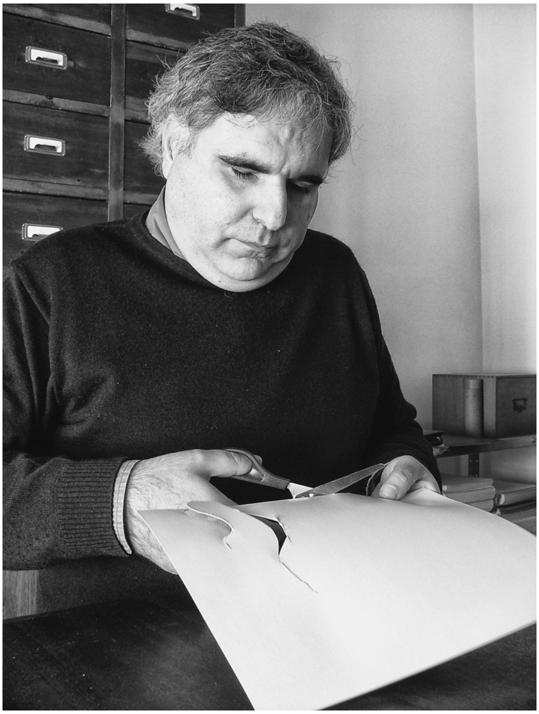

Figure 8.1 'Cardboard sketch' cut out of 1mm cardboard © Carlos Mourão Pereira

Third, Pereira accumulated several less common tools for transporting non-visual qualities of a building site, but also for supporting 'quick design cognition' (Yaneva 2009a, 2009b), i.e. quickly testing design ideas under discussion and receiving external 'backtalk'. We already mentioned how he shapes his hands to form (part of) a design, but he also uses Lego® and clay, or makes 'cardboard sketches' by cutting the forms and design ideas under discussion with scissors out of 1mm cardboard (see Figure 8.1). Imagine that we had chosen an experimental setup to study his way of working, would we know what to provide? Not only would it be difficult to provide him with these tools, it would seem more interesting to allow him to provide us with these new tools and to inquire how they emerge from his real-world design practice; allowing him to requalify what we take design to be.

Designing in the absence of dichotomies

Another ethnographic study allowing for other, alternative articulations of design is the one by Catherine Elsen and colleagues (2011). Elsen observed the industrial practices of a professional design team – five designers and three draughtsmen – designing high quality heating devices. These observations undermined the assumption that freehand sketches always precede Computer Aided Design (CAD) drawings, and that the latter represent increasingly stabilised knowledge, thus forcing the researchers to rearticulate what design can also be.

Much research on design tools is motivated by what are considered the respective strengths and weaknesses of sketches and CAD tools: unqualified statements like "sketches are powerful for preliminary design, CAD tools for detailed design" (ibid.: 58) seem to have stabilised, to the extent that many design researchers take them for granted and draw upon them. Elsen's observations, however, suggest that these statements may not hold in all or as many situations as design researchers tend to assume: the dichotomy between 'sketch in a preliminary phase' and 'CAD in a detailed phase' needs to be revised. The authors write:

> *Surprisingly* the designers can use CAD tools as a 'rough' formal tool and then come back to sketches in order to solve a more technical point for instance. Consequently there is a need to distinguish 'rough' sketches and 'rough' CAD models or representations (that stay ambiguous and support ideation), from 'technical' sketches and 'detailed' CAD models (that focus on a more specific sub-problem).
>
> *Elsen et al.: 66, emphasis added*

This study thus extends the focus of attention in design research from the more-or-less stabilised 'freehand sketches versus CAD tools' to the variegated set of 'mediating objects' that happen to feature in real-world design practices: "In addition to the physical tools (the pen, the computer, the prototyping machine, . . .), the mediating objects include the external representations linked to them (respectively the free-hand sketch; the 3D model or print, the physical model, . . .)" (ibid.: 56). As such, the study opens the door for a whole range of articulations of design that used to be less thinkable before.

Models supporting 'quick design cognition'

A third ethnographic study worth mentioning here is Albena Yaneva's (2005, 2009a, 2009b) two-year-long observation of the design process in the Office for Metropolitan Architecture (OMA). In this period, she observed that in the OMA architects work primarily with foam models where they 'normally' would work with freehand sketches, as suggested by unqualified statements about sketching as the key 'tool' to assist design cognition.

Yaneva follows architects as they fabricate foam models to make an extension to the Whitney Museum of Art in New York knowable, "to 'obtain' [the] building" (2005: 889). This attention for physical models creates other – in this case non-visual – design realities than building upon the huge hinterland of statements about sketches would do:

> Thanks to the physical models the Whitney building is not only observable, but can also be experienced in a *tactile* manner. [. . .] Since architects can *touch* physical models and turn around them, they can *sense* them; and the models can tell them more. The Whitney building as an ultimately overwhelming reality is first conceived as a tiny *graspable* piece. The *tactile*, *sensual* and easily modifiable physical models are much more

> powerful tools for sparking the architects' imagination than other *visuals* in the design studio.
>
> *Yaneva 2009a: 138–139, emphasis added*

The interesting observation we want to draw attention to here is not so much *that* architects use scale models, but *how* they use them, namely to support 'quick design cognition'. Instead of a visual sensory-motor sequence of seeing-drawing-seeing (cf. Schön 1992), OMA's architects design by feeling-cutting-feeling. What distinguishes this practice (and its ethnographic account) from traditional freehand sketching is not only that it departs from a representationalist "epistemological straight jacket" (Latour & Yaneva 2008: 86), by moving towards a performative 'epistemology of the hand', but also that it allows for the manipulated modelling material – in this case foam – to 'talk' where it would have stayed mute before. In her account, Yaneva articulates design differently by rendering talkative "[a]rchitectural design's complex conglomerate of many surprising agencies that are rarely taken into account" (ibid.). As such, her ethnographic account *adds* both representational artefacts' agency, and their non-visual sensory engagement and cognitive capacities to what design can be.

Discussion and conclusion

Triggered by our study of an architect who lost his sight and continues designing, we questioned why we might find it surprising that someone designs in the absence of sight. To this end, we attempted to trace back where the outspoken attention for 'visual thinking' and its support by sketching in design research comes from. These aspects, so it seems, can be understood in the context of the research programme to "build a network of arguments and evidence for these 'designerly ways of knowing'" (Cross 2006: v). Statements about their importance – and that of other aspects of design, for that matter – seem to have achieved relative stability in the sense that they have become part of the 'hinterland' in design research, that it is much easier or costs less effort to create new statements that build upon them than to create alternative ones.

In reflecting upon this attempt, we called in Law's work to show that questions can be raised about current methods in design research (as in other research fields). "Current methods", Law argues, "have many strengths, but they are also blinkered. [. . .] they both presuppose and enact a specific set of metaphysical assumptions—assumptions that can and (or so I suggest) should be eroded" (2004: 251).

But what does this mean in practice, in our practice – the practice of design research? According to Law,

> [t]he answer, of course, is that there *is* no single answer. There *could* be no single answer. And, indeed, it is also that the ability to pose the question is at least as important as any particular answers we might come up with.
>
> *Law 2004*

Rather than trying to formulate particular answers, we call for a double re-articulation in design research, both epistemological and methodological. Our suggestion is to complement the predominant cognitivist stance and its laboratory-style experimental methods with a more situated stance and corresponding mode of enquiry, i.e. through ethnographic research. We showed how applying the latter made us and other researchers re-articulate prevailing notions of design, and bring into being another design reality. In drawing attention to these efforts to account for and enact alternative design realities, we present design researchers with an invitation: an invitation to keep this "network of arguments and evidence for the 'designerly ways of knowing'" (Cross 2006: v) 'open', by not pursuing a singular, unambiguous way to nail down what design is – be it by adopting other epistemologies or by researching in other ways; an invitation that applies to the network of arguments and evidence built upon in this chapter as well. Not everyone may be willing to accept it, as is evident from the continuing efforts to straightjacket design research. However, if we are to enrich our understanding of design, and be more articulate about its nature, it seems at least worth the effort.

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Note

1 'Haptic perception' refers to "tactual perception in which both the cutaneous sense and kinaesthesia convey significant information about distal objects and events" (Loomis & Lederman 1986: 31.3). Variations in cutaneous stimulation provide information about the temperature or texture of materials through receptors in the skin. Variations in kinaesthetic stimulation provide information about dynamic and static body posture by the relative positioning of the head, torso and limbs. Most of our everyday tactual perception and tactually controlled performance falls under haptic perception.

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9

CONDUCTING DESIGN RESEARCH IN AND FOR A COMPLEX WORLD

Daniela Sangiorgi and Kakee Scott

Introduction

Design work today is increasingly moving well beyond the conventional concerns of form, function and style to address difficult societal challenges, a development discussed in much contemporary literature about design (Buchanan 2001; Thackara 2005; Burns et al. 2006; Manzini 2008). The term 'wicked problems' has become a popular reference for the kinds of ill-defined, interconnected problems that constantly change dimensions and grow in scale. Such problems typically have no clear solution, responses depend on how situations are framed and interpreted according to the conflicting interests of diverse stakeholders, and interventions can result in problem shifting rather than problem solving. Wicked problems are often related to major contemporary challenges such as those raised by demographic changes, for example, designing for an ageing population, or by climate change, for example, designing for more sustainable consumption behaviours and production systems.

When designers widen the scope or system boundaries of a project to incorporate broader societal challenges, they must contend with questions of system level change, even if working on smaller and more manageable manifestations of the wider scale phenomenon. In response, design approaches are undergoing a sort of re-tooling to adapt. This has led to increased interest in design research, which draws on approaches from the social sciences developed over a longer history of addressing systemic societal challenges.

While adopting and adapting theoretical frameworks and methodologies from other disciplines, we consider the potentials, specificity and eventual limitations of design contributions to social change. We share the concern of Jonas (2006: 2) who asks: "How can design establish its own genuine research paradigm (independent from the sciences, the humanities and the arts) that is appropriate for dealing with purposeful change in ill-defined (therefore called 'complex') real-world situations?"

A clear distinction between designerly and science-based approaches has been described and debated: "In contrast to the scientific focus on the universal and the existing, design deals with the *specific*, *intentional* and *nonexisting*" (Stolterman 2008: 59). Cross (2007: 51) suggests that "method may be vital to the practice of science (where it validates the results) but not to the practice of design (where results do not have to be repeatable, and in most cases, must not be repeated, or copied)". We agree that it is not by reducing complexity or adopting a predefined step-by-step approach that designers can improve their mode of action and achieve positive social impact. We stress instead the importance of establishing guiding frameworks and developing critical mind-sets to help contextualise and evaluate one's work within wider social dynamics of change.

This chapter reviews four contemporary design research approaches focused on processes of social change:

1) *critical practices in design* stemming from critical approaches in social sciences;
2) *design for social practices* informed by sociological studies of consumption and socio-technical change;
3) *transformation design* and its resonance with action research methodology; and
4) *design for social innovation* relying on recent innovation and behavioural change studies.

This review is intended to identify how these four approaches vary in terms of conception of change, focus of intervention, guiding principles and methodology and so to inform and provide some basic guidance to designers and design researchers entering into projects aimed at effecting systemic social change.

Design research approaches to social change

The four approaches reviewed in this chapter share an understanding of design practice as a "site and medium" for research (Saikaly 2005), and can be assimilated to the general debate about the nature and scope of practice-based design research, also called 'practice-led design research' or 'research through design' (Archer 1995; Frayling 1993; Rust et al. 2007; Frankel and Racine 2010).

Design research has been described as a particular form of research that is distinct from the forms practised in the sciences and humanities (Saikaly 2005). This way of conducting research is strictly related to a 'designerly way of knowing' (Cross 2007) which is characteristic of design practice itself. In general, design experimentations have grown at the core of design research, where "design work becomes inseparable from research" (Koskinen et al. 2009: 4).

Practice-based design research uses design projects as a research strategy to enable exploratory investigations of indeterminate ('fuzzy') research problems or multivariate ('messy') situations where specific research questions emerge only as the practical work develops. 'Research through design' is also described as a way to advance the practice of design to generate social change and improve society at large, which is charged with ethical considerations (Zimmerman et al. 2007). It is described as "the process of iteratively designing artefacts as a creative way of investigating what a potential future might be" (Zimmerman et al. 2010: 313).

The nature of both the theory and methodologies generated by these forms of design research continues to be a central point of discussion; Zimmerman et al. (2007) suggest two main kinds of theories that research through design can develop: 'theory for design' (i.e. conceptual frameworks, guiding philosophies or design implications) and 'theory on design' (knowledge on the design process). In this chapter, we are particularly interested in the methodological side, illustrating examples of practice-based design research approaches that are specifically aimed at social change and sustainability.

We begin our review with a discussion on critical practices in design and how these draw from critical theory.

Critical practices in design

Critical approaches in the social sciences are meant, very generally, to address systemic social problems by exposing and weakening prevailing ideologies thought to underlie and sustain those problems, typically introducing alternative conceptualisations in order that new resolutions or systems might emerge. According to a broad interpretation of critical theory, a researcher introduces to their field of study a form of conceptual intervention, sometimes called 'framing', a pragmatic use of social theory to promote constructive reflection. Because of this interventionist aim, critical social sciences relinquish claims of objectivity and adopt a stance of reflexivity, in which researchers recognise that their own understandings and ideologies, and the influence of these within the studied arena, must come under scrutiny as part of the research. The notion of reflexivity has been translated into forms of reflective practice, in which practitioners in a field, such as design, integrate processes of reflection into their work to continuously re-examine their own perspective and impact with a critical eye (Schön 1983). Framing is used by designers in many ways to help interrogate design questions from different perspectives and produce new insights (Cross 2011: 120). Designers' frames may originate from a variety of sources, and may or may not take a critical approach.

Critical practices in design have been developed to pay special attention to critical frames and how these can be applied within, rather than simply about, design practices. Therefore, the concept of change for these approaches is centred on ideological exposure and reflection, which is derived from the principles of critical theory. There are several sub-categories of critical practice in design, which fall within the broader genre of conceptual design. The most commonly referenced of these is critical design (Dunne and Raby 2001; Mazé and Redström 2007), but there is also reflective design and critical technical practice (Sengers et al. 2005), interrogative design (Interrogative Design Group), critical artefact methodology (Bowen 2009), and speculative design, often referred to as 'design fiction' (Grand 2012; Dunne and Raby 2013). The unifying characteristic of these approaches is their methodological use of designed objects and systems to elicit critical reflection among users, observers and the designers themselves. Early definitions of critical design were expressed in contradiction to mainstream design practices, labelled 'affirmative design', to highlight tendencies to affirm dominant or status quo ideologies (Dunne and Raby 2001). Sengers et al. (2005: 52) stress the purpose of defamiliarisation, arguing that critical technical practice "synthesizes critical reflection with technology production as a way of highlighting and altering unconsciously-held assumptions that are hindering progress in a technical field". By embedding critique in tangible, visual, semi-functional, material form, critical designs are meant to communicate messages in ways that ordinary language cannot. For example, a critical design artefact might be created by playfully tweaking familiar forms in order to make subversive statements or to cause viewers to experience an ambiguity between what is taken for granted and what is provocatively novel (Gaver et al. 2003). Blurring the boundary that separates presumed fact from fiction helps to expose and undermine dominant, normative understandings of reality and possibility.

Three examples are shown in Figures 9.1, 9.2 and 9.3. In Figure 9.1, the Erratic Radio from the Interactive Institute's Static! Project calls into question the ways energy becomes taken for granted in household activities by generating irregular feedback noise in response to increased levels of energy use. In Figure 9.2, Elliott Montgomery's Symbiotic Households highlights multiple controversies and possibilities related to the mental health effects of climate change, bio-engineering and medicalised emotional management, by proposing a speculative system in which bites from engineered mosquitos deliver mood enhancers to patients. In Figure 9.3, Kevin Grennan's Robotic Armpit emits a synthetic human-like body odour, a satirical form that raises

Figure 9.1 Interactive Institute Static! Erratic Radio. Project team: Anders Ernevi, Samuel Palm, Johan Redström; Evaluation: Sara Routarinne (University of Art and Design, Helsinki)

Figure 9.2 Symbiotic Households, Elliott Montgomery

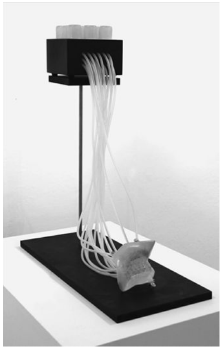

Figure 9.3 Robotic Armpit, project and photo by Kevin Grennan

questions about efforts to produce anthropomorphic robots, potential effects of encounters with artificial intelligence on how humans perceive each other, and ways in which synthetic scents that mimic natural olfactory triggers might be used to manipulate emotions and behaviour.

The critical aim is important because these forms are not mere commentary. There is some presumption that a new direction is desired, that the introduction of these conceptual objects is meant to lead to and aid some kind of productive change. However, the intention is generally not to prescribe a specific direction or solution; rather, as argued by Mazé and Redström (2007: 8), critical designs are used methodologically to "shift from problem solving to problem finding" so that "as the products – conceptual or material – of design practice enter the world, proposed ideas, values and uses become open to deliberation and interpretation". This intention is based on traditions in critical theory that promote reflection for the sake of invoking new perspectives, as Mazé and Redström explain (2007: 10), to "critically rethink the parameters of the problem itself. In such terms, neither design nor research may be about solving problems or reducing uncertainty, but opening up complexity and criticality".

In both critical social science and critical design, there is an implicit assumption that 'thinking differently' can lead to 'acting differently', that revealing ideologies leads to overcoming their effects. This raises an age-old question: does awareness really bring freedom? If change is the goal, critical practices in design must consider the intention of the critique to affect actions as well as ideologies, and to recognise the interplay between the two. In what ways do critical design artefacts act as conceptual interventions or as practical interventions; to what extent do they provoke a discussion, influence action, or both? One way this is expressed is through the notion that critical designs help 'prime' users, to introduce radical elements to make them more open and willing to accept alternatives, and to begin to enact alternatives in small ways (Bowen 2009).

While there is an ideal for critical design objects to be inserted into the context of application specified in the design, many examples of critical design are more likely to be found in museums, galleries and books. It is useful to highlight particular efforts in which such subversive, inquisitive forms are inserted in their 'usual' context. The Hypothetical Development Organization project

Figure 9.4 Hypothetical Development Organization: Founders Rob Walker and Ellen Susan. Image credits: Morris Brum (left); New Orleans edition partner G.K. Darby. Image credits: Dave Pinter (right)

developed playful, speculative proposals for derelict urban lots in post-Katrina New Orleans, calling attention both to the potential use of those spaces and other concerns of societal development, and presented the proposals on placards at the site in the same way an actual proposed development would post future building plans for public view. Shown in Figure 9.4, the 'Museum of the Self' proposal satirises the predominance of individualistic narratives, poking fun at how this plays out in social media, while prompting discourse about the future of a city whose demographics, economy and cultural character have been transformed by natural disaster and shifting power relations.

Slow and Steady Wins the Race is a line of clothing and accessories created by Mary Ping that brings into view the normative standards of the fashion industry by offering items that defy these standards in various ways relating to materials, forms, production schedules and marketing strategies. Shown in Figure 9.5, Bodega bag from Slow and Steady Wins the Races borrows the form of the common disposable plastic bag, reproduced in fine fabrics like suede, velvet and satin. The Slow and Steady Wins the Race wedding dress, in Figure 9.6, highlights the extravagance of weddings by stripping away ornamentation and presenting a bare but classic form with an auspiciously low price.

Indeed, a concern for critical practices in design is the remaining question of where such materialised critiques might lead. In the next section, we introduce design for social practices as an area of design research where attempts are being made to consider the influence of design interventions on the development of ordinary practices in everyday life.

Design for social practices and socio-technical change

Within science and technology studies, innovation studies and studies of consumption, various conceptual models and theories of socio-technical change highlight the dynamic and interdependent development of social and technological systems. Demonstrating that socio-technical systems undergo change through interwoven, non-linear patterns of co-evolution that other approaches do not adequately account for, these theories can help to reframe the sorts of wicked problems designers and design students are being asked to tackle. Of these, theories of practice have been frequently applied in studies of consumption and proposed for assisting design and policy efforts aimed at addressing growing levels of resource consumption "as a by-product

Far left: *Figure 9.5*
Bodega bag, Slow and Steady Wins the Race. Image credit: Mary Ping

Left: *Figure 9.6*
Wedding dress for $100, Slow and Steady Wins the Race. Image credit: Mary Ping

of everyday life" (Strengers 2010: 5). (To clarify, 'practice' here refers generally to all forms of practice, not only design practice, from ordinary practices like laundering or eating-out to professional practices like bus-driving or conference-calling.)

Arising from theories of practice is an argument that designed technologies, services and systems matter only if and because they are implicated in the enactment of practices, and therefore it is the practices that should take centre-stage in research and in efforts to intervene (Julier 2007; Ingram et al. 2007; Kimbell 2012). Like critical design, practice-oriented approaches tend to take issue with mainstream approaches like user-centred design as essentially uncritical efforts to meet supposed needs that arise from past experiences rather than to "(challenge) the purposes, norms and conventions around which contemporary concepts of need are built" (Shove 2003: 203).

In particular, an understanding of how practices change over time is key to supporting the development of relevant interventions. Practices appear to persist because they are repeatedly enacted or performed. However, they are also fundamentally "dynamic by virtue of their own internal logic of operation, as people in myriad situations adapt, improvise and experiment" and therefore practices, in routine performance, "contain the seeds of constant change" (Warde 2005: 141). While change can be catalysed by a significant crisis, if for example infrastructures or resources are no longer available, there are more subtle shifts that occur continuously in ways of doing and understanding a practice.

Both persistence and change depend upon the dynamic interplay between individual actions and collective norms, between particular performances of a practice and the standards that emerge as the practice spreads among larger numbers of people, "continually making and remaking ideas and visions of normal society through their routinized actions and practices" (Shove 2003: 203). Through subtle social interactions of sharing and learning, and subtle differences in performance enacted by individuals, practices develop through a fundamentally creative process. This is significant for designers to understand that the design process continues as the designers' supposed solutions are put into use (Kimbell 2012).

Attempts have been made in recent literature on practices to clarify what a practice is and of what it consists, settling on a simple model with three linked elements: materials, competences and meanings (Shove et al. 2008; Arsel and Bean 2012). These three elements are shorthand for a wider range of implications. *Materials* may include not only artefacts and technologies, but also spaces, infrastructures, living organisms and even processes of biology, chemistry and physics. *Competences* may include highly technical skills as for piloting an airplane, very ordinary skills for walking or listening, skills that are encoded in the functions of artefacts and technologies, and skills that are employed through cooperation between groups of people, material things and organisational systems. *Meanings* may include the emotions people connect to practices like listening to music, the social understandings that are expressed through certain aesthetics or behaviours as in one's way of dressing or facial expression, the personal connection one has to a practice of bathing, or the expectations people have for each other's actions in certain situations, like the quiet crowding of a commuter train. The distinctions between these three elements matter less than the constantly changing interrelations between them, holding practices together or causing them to dissolve in the linking and de-linking of the elements. Additionally, practices cannot be isolated from each other, as they are tangled up in interdependent networks, 'bundles', 'clusters' and 'regimes' of practices that are continuously interacting and co-evolving (Shove et al. 2012; Arsel and Bean 2012).

While these theoretical principles have been fortified in a growing body of recent literature, efforts to put the principles of practice theories to use methodologically, in design practices, are still in early development. In taking practice as the focus of the design process, design researchers have developed practice-oriented approaches to design in several ways: considering what it means to prototype a practice (Kuijer et al. 2013); using practice theory to frame ethnographic inquiry and a collaborative ideation workshop (Hielscher et al. 2008); facilitating practice experiments in a co-design approach (Scott et al. 2012); incorporating practice theoretical principles within a scenario development methodology (Munnecke 2007); recognising the ways consumers and designers use style and taste to give coherence to new practices, signifying new ideas with familiar terms (Tonkinwise 2011; Arsel and Bean 2012); and using practice theory to provide a foundation for discussions of 'design thinking' (Kimbell 2012).

Several included images illustrate how Kuijer et al. (2013) explore various forms of practice-oriented prototyping methods, in which artefacts are employed and actions are roughly prototyped and employed in experimental performances. As shown in Figure 9.7 (left), a method of 'generative "improv" performance' invites trained improvisational actors to perform a variety of alternative bathing practices as if they were routine and normal, and thereby generate a range of possible configurations and actions. In Figure 9.7 (middle), these practices are mapped into a set of actions that are later catalogued into a library of possible bathing activities. As shown in Figure 9.7 (right), an experimental design for an alternative bathing practice is developed, combining artefacts with instructions, through several iterations in collaboration with study participants who perform the experiments in their homes and return feedback and new insights to the designer.

In searching for appropriate forms of intervention, some efforts have paid attention to "critical moments" in which embryonic "proto-practices" (Shove et al. 2012: 15) are born into active practices. This gives rise to the question of how to initiate the occurrence of such critical moments. 'Critical' in this sense means disrupting the flow and catalysing change not just through questioning and promoting reflection, but through interventions that suggest new models of practice, including new objects, understandings and ways of doing. In the parlance of practice theory, aware, explicit, intentional, explainable forms of reflection on a practice are enacted within "discursive consciousness", and unreflective, more tacit and routine ways of acting out a practice can be described as being enacted within "practical consciousness" (Jackson 2004: 90–91). If predominant forms of critical design might be seen to create moments of discursive consciousness, change can only become manifest in the performance of the practice through practical consciousness. This is addressed in the application of critical 'triggers' (Scott et al. 2012), which may include ideas or stories, or 'trigger-products', (Kuijer and de Jong 2012)

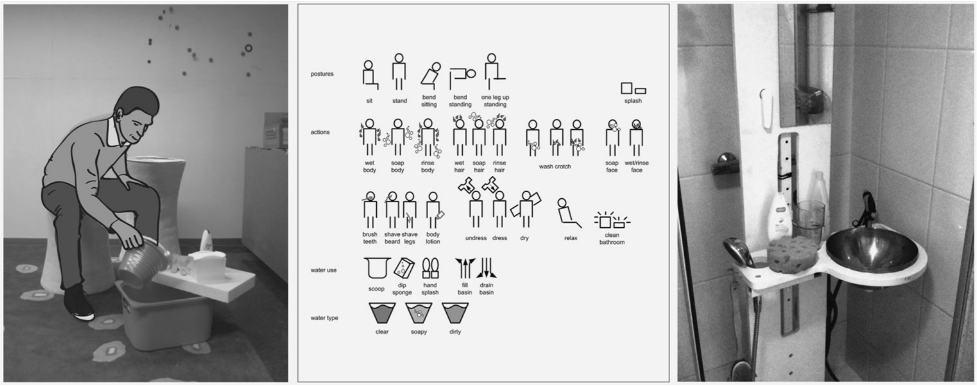

Figure 9.7 Practice-oriented prototyping

Source: Kuijer et al. (2013)

to spark changes in practice through an active experimentation by participants within a design study. Much like critical artefacts (Bowen 2009), these formats use critical disruptions within a design study, but are perhaps more focused on enactments than perceptions. Another concern of practice-oriented design is how to capture critical moments before or as they emerge. One response is to take a strategic approach by looking for leverage points within observed practices, where there are vulnerabilities, strengths, quirks and other apparent opportunities that might somehow be leveraged for the development of alternative practices (Scott et al. 2012).

Beyond these initiations of new practices within critical moments, there is also a functional principle that practice-oriented design must be geared to the ongoing processes of co-evolution, adaptation and normalisation of practices. This has been addressed in the notion of 'open-scripted' design (Shove 2006), allowing for future practices to emerge rather than prescribing particular practices in the design process. This is reflected in an open-ended, iterative model for incubating practices (Scott et al. 2012). This model fits well with the approach to iterative reflection and action as explained in the next section on action research, and with creative communities and living labs as discussed in the section 'Design for social innovation and long-term change'. The ultimate concern that spans these next sections is how to connect incremental changes within practices to the development of long-term, radical and often large-scale change.

Transformation design and action research

Recently designers have been increasingly engaging with organisational or social change projects, whose aim is not only to create a final solution to an existing problem (designing for), but to work with and within organisations and communities to create capacity and capabilities for lasting change (designing with). This design approach to change was defined by the RED Design Group of the Design Council, as 'transformation design' (Burns et al. 2006: 21):

> Because organisations now operate in an environment of constant change, the challenge is not how to design a response to a current issue, but how to design a means of continually responding, adapting and innovating. Transformation design seeks to leave behind not only the shape of a new solution, but the tools, skills and organisational capacity for ongoing change.

Burns et al. (2006) suggest how design can be applied to radically change public and community services for socially progressive ends, working within organisations to trigger change by embedding a more human-centred approach to innovation. Transformation design is focused beyond incremental change towards what in 'organisational development' studies is described as paradigmatic change, meaning a change in the core assumptions and world-view of an organisation or community (Levy 1986). This deep change requires participatory design approaches to include users and staff, giving them ownership of the final results as well as the capacities and skills for a lasting transformation. For this reason, transformation design projects often result in the co-design of novel service models where users are active participants in service performance, while the design specifications are close to what Shove (2006) describes as 'open-scripted' design: a loose set of roles, tools and enabling platforms that allow people to engage in self-organised activities.

As an example, the RED Design Group project on The Diabetes Agenda developed ideas to support diabetes management, designing a set of cards to enhance doctor–patient consultations (tools), expert patients as diabetes coaches (roles) and a diabetes blog (platform) to customise support for individual patients and enhance their learning in self-management.

Transforming service models and behaviours requires transforming organisations and their innovation cultures. Regarding the current economic climate, the tightening of budgets in public sector organisations is causing a shift in the kind of requests service and social design agencies are acting on; instead of buying one-off interventions, public sector organisations are increasingly asking designers to work with them to train personnel to think and act differently or to help establish design-driven innovation labs.

By participating in transformational projects, designers have been entering the fields of organisational development and social change, but with limited background knowledge of the respective theories and principles in these fields. Additionally, when designers work with vulnerable communities they take on a greater responsibility, which demands a more systematic methodology and reflexivity on their practice (Sangiorgi 2011: 31). The search for a more rigorous approach to transformational change has led design researchers to look into the principles and practice of action research, which originated with the experimental work of Kurt Lewin in the 1940s on social democracy and organisational change. Kurt Lewin said once that "if you want to understand a phenomenon, try to change it" (French et al. 2005: 106). Action research has been applied to a variety of fields such as organisation development, anthropology, education, economics, psychology, sociology and management. Transformation design, with its emphasis on participation and empowerment, can be related to action research; here, criticality manifests within research projects as a systematic reflection on the relationships between knowledge generation, power and change. Action research has been defined as a:

> Participatory, democratic process concerned with developing practical knowing in the pursuit of worthwhile human purposes . . . It seeks to bring together action and reflection, theory and practice, in participation with others, in the pursuit of practical solutions to issues of pressing concern to people. And more generally the flourishing of individual persons and their communities.
>
> *Reason and Bradbury 2001: 1*

Some key characteristics of action research are, as described by Reason (2006): pursuing a worthwhile purpose, adopting a democratic and participatory approach, developing practical knowledge relevant to action and engaging in an emergent process where the act of inquiry is as valuable as its outcome. Action research is about generating practical knowledge that can help improve the wellbeing of individuals and communities, where what is considered worthwhile to achieve is constantly negotiated along the process and among the participants. For this reason, knowledge generation is perceived as socially constructed, and not as an objective and value-free process as conceived in the natural sciences; action research is described as "an explicitly political, socially engaged, and democratic practice" (Brydon-Miller et al. 2003: 13).

When applied in transformational projects with communities, three guiding principles of action research are to:

1) include multiple partners from the community in the research process and generate research partnerships;
2) be guided by locally defined priorities and be committed to social justice; and
3) aim at community education and empowerment by encouraging people to learn new skills, reflect on their social and economic conditions, and act in their own self interest (Ozanne and Anderson 2010).

Action research does not have a predefined process or a unique methodology, but is rather "a family of practical methodologies for engaging people in dealing with key issues in their lives" (Reason 2006: 198). Typical of an action research process are the cycles of action and reflection that spiral within a systematic and documented study (Kolb 1984). This iterative and spiral process reminds us of what Donald Schön (1983) defined as 'reflection-in-action' and 'reflection-on-action' within design processes.

Examples of applications of action-research principles and spiral processes within design research can be found in the field of *design for local development* (Figure 9.8) (Villari 2012) where:

> the aim of the design activity at a territorial level is thus to set up actions that improve the quantity, the quality, the accessibility, the distribution of local material and immaterial resources (physical or human resources, of knowledge, of relations) that constitute the territorial capital.
>
> *Maffei and Villari 2004: 91*

When designers work at this level, the emphasis is on building skills and capabilities to support growth and development, enabling a social process of learning, facilitating exchanges and sharing experiences within the designing community (ibid.).

Comparing design research to action research, Swann (2002) argues that the emancipatory aim of participation and the systematic reflection and documentation of action research have not been traditionally part of designers' way of working. Similarly, Sangiorgi (2011) has been questioning the preparedness of designers to work in transformational projects and has proposed seven key principles that aim to unify and inform transformative practices in design regarding organisational development and community action research. These principles are:

1) active citizens: citizens are considered agents and resources within change processes;
2) intervention at community scale: large-scale change requires shifting focus from the individual/user to the community;
3) building capacities and project partnerships: trusting research partnerships and building participants' skills and capacities are key for sustainable change;
4) redistributing power: 'researchers' and 'subjects' of study are equal participants and experts in their own fields;

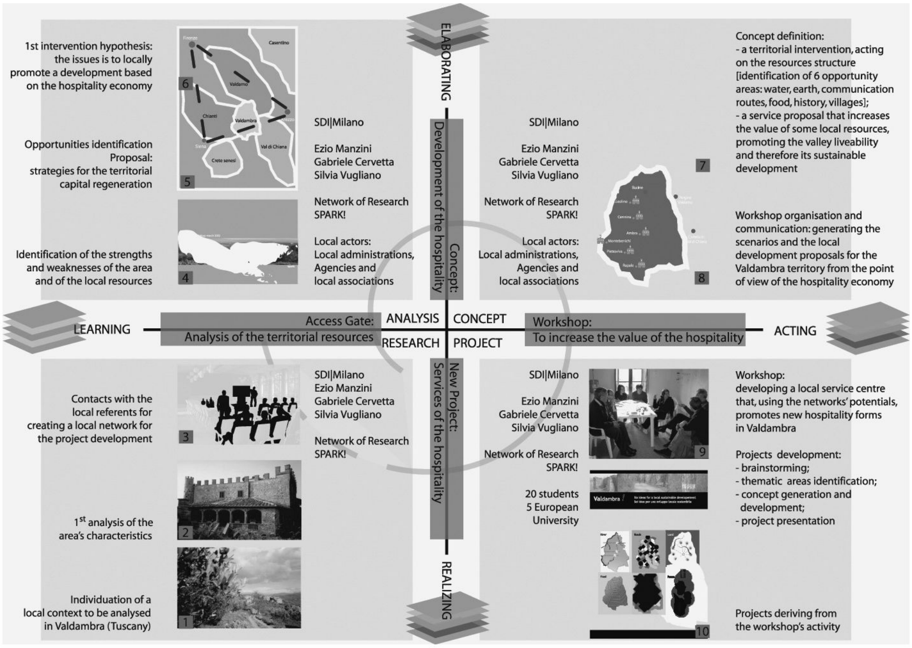

Figure 9.8 Example of a spiral action-research process for the revitalisation of Valdambra Valley in Italy as applied in ME.design, a research project coordinated by Politecnico di Milano and co-funded by the Italian Ministry of University and Scientific and Technological Research

Source: Vignati et al. 2005

5) designing infrastructures and enabling platforms: emphasis is on co-creating sustainable, locally grown solutions and enabling platforms that communities are willing to use and maintain;
6) enhancing imagination and hope: change needs a vision and trust in the capacity to achieve it; and
7) evaluating success and impact: defining ways to measure legacy and long-term impact is key in transformational projects.

These general principles and the related design methodology are still in their infancy and need further development, in particular at this moment in time when designers are increasingly asked to document, evaluate and prove the efficacy and sustainability of their interventions.

The following section takes these considerations further by addressing the next question: when enabling transformational change in a specific community, organisation or territory, what happens when this radical change needs to be replicated in other contexts as required by the pressing demands of our society and economy?

Design for social innovation and long-term change

An approach to social change that attends to wider system transformation can be seen in the expansion of efforts to support social innovation. 'Social innovation' refers to change driven by people in their daily lives in an attempt to answer to unattended societal needs. Criticality here is inherent in the practical and social actions and solutions that are developed against or as an alternative to the status quo. This kind of innovation has gained an increasing recognition as a promising strategy to deal with growing social challenges in a period of major budgetary constraints.

> Social innovations are innovations that are social in both their ends and their means. Specifically, we define social innovations as new ideas (products, services and models) that simultaneously meet social needs (more effectively than alternatives) and create new social relationships or collaborations. They are innovations that are not only good for society but also enhance society's capacity to act.
>
> *BEPA 2011: 9*

The Bureau of European Policy Advisers (BEPA) (2011) describes social innovation as potentially operating at three interdependent levels: 1) dealing with social demands for the most vulnerable groups that are not addressed by existing solutions; 2) addressing societal challenges that concern all society; and 3) working towards the reform of society enhancing participation, wellbeing and sustainability.

Social innovation has been recognised as a fertile territory for locating promising practices for sustainable futures that can be identified, supported and replicated through design (Meroni 2007). Social innovation initiatives are conceived of as innovations within local systems that "challenge traditional ways of doing things and introduce a set of new, very different (and intrinsically more sustainable) ones" (ibid.: 14). As its focus of intervention, design for social innovation therefore works within 'creative communities' to help the shaping of ideas and convergence of different actors, to support creative communities in making their solutions more accessible, effective and attractive so that they can grow in scale or be replicated in different contexts (Jégou and Manzini 2008). When social innovation is connected with distributed systems and social networking, local innovative practices can converge into a single dynamic process of social change. In this vision 'small' and 'local' are not small and local any more if considered in the global networks: 'small, local, open and connected' are the qualities of promising solutions (Manzini 2010).

The value of small projects is also proposed in recent strategies aiming at large-scale sustainable changes, called 'planning by projects' or 'acupunctural planning'. The inspiration for this comes from urban planning and architecture approaches (Lerner 2003) that apply the concept of urban acupuncture as a way to address change in big systems, like cities, while starting from smaller initiatives. Jégou and Vincent (2010) transfer this approach to design projects aiming at a systemic transition towards sustainability while working at regional and urban levels. In an acupunctural approach, the focus is not on solving or 'curing' problems, but on encouraging healthy situations. In particular, Jégou (2010, paraphrased) proposes an approach made up of four main kinds of activities:

1) *highlight potentials*: investigating and mapping social innovation;
2) *engage stakeholders*: identifying and engaging local stakeholders in a collaborative dialogue for transformative change;
3) *transformative visions*: co-developing scenarios based on a wider strategy and a network of individual projects that work in synergy;
4) *network projects*: implementing a progressive transformation process based on a permanent experimentation with connected local communities.

Exemplifying this approach is an experiment between the foresight and sustainable development (D2PI) of Nord Pas-de-Calais region and the ENSCI Les Ateliers design school, in which students were asked to develop a vision for sustainable suburban living for the North of France. A series of proposals for commuting, food, leisure and social life were presented together as new lifestyles in a mosaic form as a way to identify opportunities and activate the territory in the long term (Figure 9.9).

A specific approach used in these kinds of transformational projects is based on the 'designer residencies' methodology (Jégou and Vincent 2010), where a multidisciplinary team led by designers spend a long period of time within an organisation, a community or an initiative to activate experimentations on agreed issues. This approach, which is based on ethnography and participatory design approaches, aims to create a permanent state of interconnected experiments that work in synergy to address bigger visions of social change. The overall vision and platforms that connect these individual projects have been called a 'framework project'; an example of a framework project is Design of The Time (Thackara 2005), a Design Council funded programme aiming at bringing together local communities with designers to improve the way they live towards more sustainable lifestyles.

Another documented approach for social innovation is the 'living lab' method. The original idea of living lab, attributed to Professor William Mitchell at MIT Media Lab, was initially applied to the study of smart and future homes. Living lab has been defined as "a user-centric research methodology for sensing, prototyping, validating and refining complex solutions in multiple and evolving real life contexts" (Eriksson et al. 2005: 4). Living labs can be thought of as user-centric environments for open innovation (Chesbourgh 2003; Schaffers et al. 2007), linked back to participatory design approaches for user involvement, but with a shift from the workplace to the public sphere, from 'democracy at work' to 'democratic innovation' (Björgvinsson et al. 2010).

The aim of living labs is to establish "an open innovation milieu where new constellations, issues and ideas evolve from bottom-up long-term collaborations amongst diverse stakeholders"

Figure 9.9 Social Innovation and Regional Ecology Workshop lead by François Jégou at ENSCI Les Ateliers, Paris in partnership with foresight and sustainable development (D2PI) of Nord Pas-de-Calais Region, France, March 2010

Source: Jégou 2010

(ibid.: 1). In this sense, the 'living lab' method is both described as an approach and as a system for innovation. To work, a living lab needs to be able to attract a very heterogeneous set of actors with different competences, resources and needs: "an environment that attracts organisations, researchers, students, cases, funding, and innovations, and is efficient in delivering new knowledge and innovations relevant to the actors involved" (Levén and Holmström 2008: 5).

Living labs aim to activate social innovation and focus on designing 'things', which in its etymological origin means an assembly around matters of concern (Björgvinsson et al. 2010). According to Björgvinsson et al. (2010), living labs aim to converge people around 'matters of concern' to facilitate the creative alignment of controversies that can generate and open up new opportunities and behaviours. Here, the role of designers is "facilitating the building of arenas consisting of heterogeneous participants, legitimizing those marginalized, maintaining network constellations, and leaving behind repertoires of how to organize socio-materially when conducting innovative transformations" (ibid.: 10).

Overview and guidance

The four main approaches illustrated here present slightly different understandings and builds on different theories and assumptions about what can trigger and sustain social and systemic change as well as what designers can do within these processes (see Table 9.1). Even if all acknowledge the importance of being conscious of and critical towards mainstream ideologies and current socio-economic models and conditions, these four approaches differ in the way this critical consciousness is developed and applied:

1) *critical practices in design*: objects become the provocative materialisation of a critical reflection conducted by the designer and are considered as the medium to elicit a similar critical reflection and possibly behaviour in users and observers;
2) *design for social practices*: the critical reflection is instead at the basis of any kind of practice-oriented design intervention as it helps to recognise the elements that constitute and perpetuate existing practices and possibly inspire ways to 'de-link' them and trigger change;
3) *transformation design*: here the critical approach and reflexivity are qualities that both designers, as facilitators, and project participants need to develop to challenge existing power relationships and develop the knowledge and skills to envision, initiate and sustain change processes;
4) *design for social innovation*: here designers identify and support promising practices and open innovation processes, that manifest, sometimes in an implicit way, critical perspectives towards the current modes of production and consumption as well as towards existing power structures in decision making.

In all of these approaches a critical reflection and attitude, developed and applied through the act of 'designing', becomes the source for the development of 'practical knowledge' and 'emancipatory processes' where participants develop both discursive and practical consciousness to challenge the status quo. Change, then, is conceived as happening at different levels from the individual artefact and behaviour to the related and overarching practice (or clusters of practices), from individual communities or organisations to networks of small promising and interconnected initiatives.

A key aspect of these four main approaches is how they each apply 'critical framing' in the design process. We would recommend that, when approaching a change project, designers

Table 9.1 Synthetic description of the four design research approaches for social change

Approach	*Concept of change*	*Focus of intervention*	*Methodology or approach*	*Guiding principles*
Critical design	Through ideological exposure, reflection	Artefacts, concepts and individuals	Critical concepts in material form, problem finding	Critical theory, reflexivity
Design for social practices	Continuity and change depend on routinised enactments	Everyday life practices, routines	Experimentation, triggers, leverage points, practice prototyping	Socio-technical co-evolution, discursive and practical consciousness
Transformation design	Radical change in the capability to innovate and deal with problems	Community or organisation	Participatory design, action research	Participation, empowerment and learning
Design for social innovation	Change in the way of living	Small initiatives within wider change frameworks	Acupunctural planning, design residencies and living labs	Support and connect promising initiatives; facilitate encounters among heterogeneous participants

should make this framing more explicit: they should question how they will enhance and use criticality as an individual or collective resource to promote learning and trigger change; also, they should question which level of change they are aiming to initiate and how change could be implemented and sustained in the longer term. Enhancing awareness and reflexivity at the start and within social change projects is a fundamental precondition for a more responsible and accountable contribution.

Designers are entering a new era in which the work they do and the roles they play are undergoing dramatic changes to cope with the systemic challenges of the day and to build more sustainable models for future users, businesses, communities, economies and societies at large. While drawing from the resources of the social sciences, these various approaches reviewed here, and practice-led design research more generally, should be recognised as forms of inquiry in their own right that must be validated in accordance with the unique nature of design practices. This review provides some initial tools to help reflect upon where these changes are heading and what this means for design research now.

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10

WHAT IS A 'RESEARCH QUESTION' IN DESIGN?

Meredith Davis

In design, as in other fields, research begins with a question that reflects a desire to know something or something that arises from an observation that some situation is unresolved or could benefit from deeper understanding. The question may originate with the design researcher or come to the attention of the researcher through someone who presents a challenge. Framing the research question sets the stage for everything that follows in a research study or in a research-driven design process used to solve a practical problem. The selection of appropriate literature; theories that form the conceptual grounding for the study or the basis of design action; methods for investigation; people to be studied; criteria for interpreting research findings; and potential applications of research all depend on how the question is constructed.

What do we mean by 'research'?

There are several ways to think about design research: first, as the discovery of fundamental knowledge from which the discipline articulates general principles and theories of action; second, as knowledge gained about application in design practice; and third, as knowledge that guides designers' decisions in executing work for a specific context or group of users. The second type of research involves systematic inquiry into the application of design theories on the effects of design. The third type of research only goes far enough to suggest which of several possible directions the designer should take in addressing practical problems. Its intent is not to influence the practice of others but to clarify the most effective course of action on a particular project.

These types of research are not mutually exclusive in the content they address. For example, knowing how people interpret meaningful relationships between text and diagrams, or think spatially when navigating screen-based information, adds to the disciplinary body of knowledge about the role of visualisation and visual thinking. But similar concepts are also the subjects of research in practice. For example, researchers might investigate the role diagrams play in shaping voter opinion on a particular policy issue. Or they might evaluate people's success in using new spatial metaphors for cellphone interfaces. When such studies follow rigorous research protocols, they can inform future practice and designers' approaches to similar problems. When research methods are less formal, results are less likely to be statistically significant or *generalisable* (that is, extendable from a specific population to the population at large or from one setting to another). Instead, they either confirm or contradict the designer's instincts so that he/she can proceed with greater confidence about design decisions. All three types of research are useful but they respond to different goals, require different standards for evidence, and support different kinds of claims.

In addition to the distinction between research intended to expand knowledge in the discipline and research focused on practical application, there are different philosophical approaches to research. These approaches influence the framing of research questions and reflect the interpretive position of the researcher in the study.

One type of research takes an evidence-based, scientific approach to the study of design. The intent of this approach is to describe, as factually as possible, what can be observed and measured about design and its effects. While there is recognition that the perspective of the researcher will influence such observations to some degree, the goal is to be as objective as possible. For example, a researcher may collect information about the ages of people who sit on park benches and the average durations of their stay. To ensure objectivity, the researcher gathers information in several ways – by photographic documentation, survey completion, and behaviour mapping – comparing findings under each method to see if the results are similar. This information may eventually inform a variety of decisions about the design of parks, park furniture, and park activities or tell us something about the behaviour of a particular group, but its overall intent is to describe patterns in ways that are verifiable.

Another approach to design research seeks meaning in the lived experiences of individuals in an effort to understand a particular phenomenon. Admittedly, these experiences are subjective, but the researcher attempts to apprehend the nature of the phenomenon by what a number of people describe as common across their individual experiences. For example, a design researcher may seek information about the attributes people believe are necessary to qualify a consumer product as 'eco-friendly', or about what people find disturbing about the protocols and environments in hospital emergency rooms. One individual's report may not be significant, but repeated patient concern over a lack of acoustical privacy in hospitals, for example, may be a strong indicator that patients and their families feel especially vulnerable when asked for personal information in public waiting rooms.

A third research approach assumes there is no single truth and that people attach different meanings to things based on their own view of reality. Relativism accepts that the researcher has a perspective that influences findings. For example, an entrepreneurial product designer may conduct a *case study* to see how young children respond to a new backpack design. The researcher observes the use of the backpack throughout the day and by differently sized children, how boys and girls personalise its design, and how easily it fits into school and bus storage bins. The outcomes of this personal research informs changes in the design of the product, but there is no attempt to minimise the role of the researcher as an observer or to subject the backpack to rigorous testing. Neither would the results of the study inform the design of backpack standards or report on the behaviour of children who carry backpacks. Instead, the purpose of the research is for the designer to understand the use of the object holistically in order to make better decisions about backpack design.

What should design research be about?

Decisions about the approach to design research depend largely on what the designer sees as the content of the study and the expected use of findings. If the intent of the research is to understand how people develop shared rules for social interaction in networked technology, for example, then knowing the role technology plays in their social lives is important; testing accuracy in the use of technological features and functions may not be enough. On the other hand, if the research purpose is to determine how well an office chair accommodates the physical differences among various users or if people still turn on office lights when daylighting solutions provide adequate illumination, users' lives outside of work may be less relevant to the study. In this way, the research question defines the scope of the investigation.

The content of design research addresses several categories of interest to the field:[1]

How designers think is the focus of many studies. Recent attention to design thinking and innovation by business and education builds on interest in design thinking from the 1980s, particularly the research of Nigel Cross and Bryan Lawson. Their work attempted to define design as a third domain of knowledge, different in many ways from art and science. Understanding how designers think offers insight into issues such as the nature of innovation, the conditions that foster critical and creative thinking, and the most productive combinations of expertise needed to solve complex problems.

What people want and need is the concern of all designers, especially in the formative stages of a project. Market research is related to design research in this respect, but has greater interest in what people will buy. Designers want to know the ways in which communication, products, and environments are useful, usable, and desirable. Donald Norman and Elizabeth Sanders are cognitive psychologists who have deep careers in user-centred design research. Computer scientist Gerhard Fischer's work challenges our traditional notions of where people might participate in the design process to ensure wants and needs are met. And Bonnie Nardi and Victor Kaptelinin trace the contemporary importance of work by Russian psychologists in the 1920s in activity theory. Such knowledge directs choices about what to make and the attributes that people value in their interactions with the material and virtual worlds. It is equally important in determining how design responds to modulations in the culture, as well as in business.

What the context demands is slightly different from what individuals want and need. People may not identify sustainability or the health of a local economy as important when expressing their 'must haves' for communication, products, and environments. Yet, clearly, these are important concerns. Similarly, the messages we circulate may meet the needs of clients but not have positive benefits for the larger culture over time. Design research often addresses 'grand challenges' in which solutions are in the public interest. Institute of Design professor Charles Owens, for example, is known for asking graduate students to take on massive problems, such as global warming.

How design is planned, produced, and distributed addresses the methods and strategies by which design solutions are organisationally sustainable, technologically feasible, and economically viable. David and Tom Kelley at IDEO, Hugh Dubberly, and Shelley Evenson are practitioners known for writing about their work and the changing context for design in deep ways that extend the work of others. Researchable issues range from interdisciplinary collaboration, to the role of prototyping, to materials testing and manufacturing, and to the design of service ecologies.

The consequences of design action include individual interactions with communication, products, and environments, as well as historical, cultural, and social implications of design that are interpreted over time and through changes in the surrounding context. Such research informs the project-level decisions of designers but also accounts for the broader influences of design and perceptions of design as adding value.

Tools and methods for studying these issues are necessary for the growth of design research. To date, many research methods are borrowed from other fields: ethnography from anthropology; case studies from business; experimental methods from psychology. Bruce Hanington has catalogued current design research methods in his book, *Universal Methods of Design*

(Hanington and Martin, 2012). What does and does not work in the context of design practice, standards of evidence, and how research is integrated with the traditional processes of design are areas that present opportunities for further research. Technologies, such as sensor and locational computing, also introduce new tools for user-centred research.

The search for original and meaningful territory is not the problem in design research, as it often is in the sciences and humanities. Compared to more established research disciplines, little has been done in design and the real task is to decide among all the concerns of the discipline and practice, what actually matters in the grand scheme of things.

What makes a good research question?

Research questions, therefore, suggest methodological and philosophical approaches and identify the people, concepts, and circumstances to be studied. There are, however, a number of additional qualities shared by good research questions.

The wording of a research question implies a hierarchy among aspects of the research problem. For example, a question that asks, "*In what ways do families want to use personal computers in the home?*" is very different from one that asks, "*What do families want to do in the home (for which the personal computer might be a solution)?*". The former question concentrates study around a specific technology, while the latter emphasises people and their motives for engaging in particular activities. It is easy to imagine the differences in what researchers observe or ask about in the two studies. Ultimately, either study may be of interest to a technology developer, but the second question is likely to yield deeper understanding of what people want and need. Further, the second question opens possibilities for new technologies that the researcher may not have anticipated, while the first implies to participants and to researchers that existing technological features and functions are appropriate.

In implying a hierarchy among concepts, the wording of a research question also reflects the necessary qualifications of the researcher for conducting the study. For example, a question that asks, "*Why do elderly patients make mistakes when taking multiple medications?*" requires different expertise than a question that asks, "*How can changes in the physical and informational attributes of prescription vials reduce elderly patient error in taking multiple medications?*". The first question requires the expertise of a social scientist, not a design researcher; it relies primarily on understanding of human behaviour and the physical and cognitive limitations of older patients. A social science researcher might conclude that information on prescription vials is a contributing factor to patient confusion, but is less likely to hypothesise about changes that would improve patient compliance with medication regimens. The second question clearly suggests that some responsibility for patient confusion results from the design of prescription vials and proceeds from there to ask if changing the design will reduce error. This places the study squarely within the realm of design knowledge and the design researcher is qualified to probe within theories of how users interpret form.

Researchers devote considerable time to framing research questions in language that accurately reflects their interests and expertise. As research unfolds, it may shift the focus of a study, requiring new language that better reflects the emerging purpose of the investigation. In any case, the initial wording of a research question is critical to defining the scope of the investigation.

Good research questions include definitions of terms. Even when terms have common definitions, it is necessary to define how they are being used in the study. For example, Mihaly Csikszentmihalyi investigated the significance people assigned to material possessions in their homes (1981). Among the possessions – which included furniture, plants, and photographs –

was a group of items he called 'visual art'. Csikszentmihalyi was intentionally broad in defining potential members of this category; he stated that:

> the object did not have to be the work of an artist, or a bona fide recognized work of art. Any two-dimensional representation other than a photograph was included . . . as long as the respondent referred to the picture as being special.
>
> *Csikszentmihalyi, 1981: 63*

The category, under this definition, could include an original Renoir painting and a poorly printed picture of dogs playing poker. By declaring how he used the term, the researcher not only told the reader what attributes qualified objects for consideration, but also avoided making his own distinctions regarding the artistic merit of various works. At the same time, he excluded items with these qualities unless participants in the study verbally declared that the objects held special significance for them. This further implied no personal judgement on the part of the researcher – there was little argument regarding the presence or absence of participants' declarations – and the definition was consistent with the purpose of the study to determine the value individuals place on their possessions. In this sense, the definition of 'visual art' was *operational*; the researcher defined the object or concept in terms of what he intended to measure, not according to some cultural standard outside the scope of the investigation.

Definitions are crucial when working in areas likely to be of concern to multiple disciplines. The term 'usability', for example, means one thing to a programmer and another to an interaction designer. The programmer is likely to subject software to human factors testing in laboratories, while the designer may consider its use in various settings and in satisfaction of a variety of user motives. The programmer approaches the problem as optimisation of existing navigation conventions, while the designer often challenges tradition strategies for user interaction. The engineer may see the goal as the efficiency of use, while the designer values the pleasure of use. Unless the two experts agree on what they mean by 'usability', the criteria for judging results will be unclear.

Behind a research question there is a working theory that underpins the question. This working theory often takes the form of a hypothesis, which is a statement of expectations. For example, master's student Laura Rodriguez hypothesised that "[i]f a design system presents college students with an analysis of the content and amount of personal information they share online, they will monitor and change their social networking behavior" (Rodriguez, 2011). The research that follows either confirms or contradicts the hypothesis. Or it argues for a new hypothesis. In the social networking example, research could show that subjecting Facebook text to 'sentiment analysis' (that is, to a computer application that analyses natural language and extracts subjective information from text), does nothing to discourage the user from sharing photographs with questionable content. If so, then a new hypothesis is necessary to address two kinds of information: textual and visual.

In other cases, the research question may build upon the working theory of another researcher. For example, master's student Alberto Rigau asked the question, "In what ways can design address excessive credit use through [just-in-time] tools that help consumers manage and personalize fiscal activities?" (Rigau, 2009). Rigau's question was prompted by the work of behavioural economist Dan Ariely, who suggested that rational people are predictably irrational with respect to certain activities (Ariely, 2009). Rigau used Ariely's theory to account for excessive credit card debt but he was open to where and how design might intervene in the irrational behaviour of overspending. He eventually developed an application for the iPhone that displays the consumer's current debt at the time of a purchase and a visual 'wish list' of other items he/she hopes to buy. When the consumer uses the phone to charge a purchase, they are reminded of limits set in more rational moments. Rigau's working theory was that narrowing the distance between the rational thought of budgeting and the emotional activity of purchasing would produce more responsible consumer behaviour.

In another example, master's student T.J. Blanchflower asked the question, "In what ways can interactive media provide feedback that supports counseling relationships and non-medication treatments for young adult Attention Deficit Hyperactive Disorder patients?" (Blanchflower, 2011). Blanchflower's hypothesis was that visualisation of the times and conditions under which the ADHD student loses focus reveals to the patient and counsellor recurring patterns in activities for which additional counselling is necessary, thus optimising the working relationship between the student and an overworked college counsellor. The research project resulted in a wrist-mounted Nano, which the patient taps when his attention drifts from the task at hand. Taps are recorded on the counsellor's desktop display of the patient's daily schedule, indicating the number of times, activities, and settings in which he lost focus. Other functions visualise typical behaviour patterns of ADHD students, such as procrastination. The working theory was that such visualisation would allow the counsellor to target specific conditions for the development of treatment strategies and would reduce the amount of time the student spends in the counsellor's office.

In these examples, the hypothesis informed the development of prototypes. In other words, the working theory directed the designer's efforts towards producing software ideas through which effects could be measured in future testing.

Good research questions define a realistic scope of investigation. It is common for beginning researchers to frame questions so large that it would take a lifetime to study them. Novices are afraid something will be lost by narrowing the investigation or by ranking various aspects of the problem by importance. Too large a scope of investigation makes the next step in the research process unclear; it is difficult to determine appropriate methods and criteria for interpreting findings if there are not limits on what the study will address.

For example, master's student Valentina Miosuro was interested in the medication and lifestyle behaviours of patients with type 2 diabetes. Through a review of literature, Miosuro described four recently diagnosed patient types:

1) *Disheartened patients* do not adhere to regimens because they struggle emotionally with declining health status.
2) *Compliant patients* follow doctors' orders but do not understand the cause/effect relationships of medication, diet, and exercise on glucose readings.
3) *Disease managers* view their health holistically and can regulate their medication and behaviour across changing conditions.
4) *Hyper-managers* allow treating the disease to take over their quality of life.

Miosuro decided these different patient types argued against a single approach to compliance and healthy lifestyles. She chose to address only the problem of moving the non-adherent patient to the status of 'disease manager' by asking the question, "How can training and monitoring devices for Type 2 diabetes patients move disheartened, non-adherent patients toward the profile of disease managers?" (Miosuro, 2008). It is possible to imagine that future studies might address other patient types, but by focusing on one patient profile at a time, Miosuro could discover which strategies are successful in helping any patient type and which strategies serve patients with distinctive characteristics.

Many beginning researchers also conflate more than one variable in a single study. For example, asking "*What is the optimal point size, line spacing, and line length for text designed for beginning readers?*" presents a dilemma for the researcher. Because typography is relational (that is, because point size, line spacing, and line length are co-dependent and change their effects in the presence of other variables, such as typeface and column style), it is impossible to isolate the influence of any single variable on readability. Instead of seeking a single right answer or rule, it would be better to frame the research question as a study of how relationships among variables affect readability, acknowledging co-dependency as inherent in typographic design.

Typically, research questions are followed by three to five sub-questions, that when addressed, contribute to the overall understanding of the primary question. Sub-questions relate directly to the concepts articulated in the primary question and do not introduce content that expands the scope of the investigation. By being more specific, sub-questions can suggest smaller investigations or the application of specific methods. While it is important not to frame sub-questions as procedural steps to be completed, they are often helpful in organising the researcher's allocation of time to specific aspects of the problem.

Master's student Anastasia Tumash was interested in how tourists and newcomers locate and make choices among 'third places' in unfamiliar cities (Tumash, 2012). 'Third places' are social spaces that are neither residential nor work places. Her intent was to design a cellphone application that "facilitated the search for third places and communicated the experiential qualities of place" (ibid.). Her sub-questions addressed the role of travel time and proximity to the user's current location in making the decision to spend time in a third place; features of the surrounding area and route that influence user's choices; acceptable distances between the third place and such features; and physical or sensory characteristics of place that are important in choosing one location over another. Answers to these sub-questions guided the design of features and functions in her prototype. The sub-questions also challenged Tumash to explore how to visualise these different types of information in small screen real estate and the kinds of interaction she could expect of users on the move.

In many cases, through the authorship of sub-questions, beginning researchers find a more appropriate scope for their investigations; a sub-question rises to the level of a primary question. A good indication that the scope of the primary research question is too broad is when the researcher generates more than five sub-questions.

Good research questions anticipate how findings will be used and by whom. In many of the previous examples, research questions informed the development of prototypes by master's students in project-based academic programmes. In these instances, research needed to direct the formal and functional choices of 'makers' in addressing a practical problem. Their research reports generously illustrated prototypes in use. Readers of their research findings are other students of design and future employers. Valentina Miosuro, for example, was hired by a New York design firm to work on taxpayer compliance because interviewers could see the relevance of her research strategy to their client's problem.

Don Norman makes a distinction between the type of research needed in design practice and the work of social scientists:

> Designers are practitioners, which means they are not trying to extend the knowledge base of science but instead, to apply the knowledge. The designer's goal is to have large, important impact. Scientists are interested in truth, often in the distinction between the predictions of two differing theories. The differences they look for are quite small: often statistically significant but in terms of applied impact, quite unimportant. Experiments

> that carefully control for numerous possible biases and that use large numbers of experimental observers are inappropriate for designers.
>
> *Norman, 2010*

Doctoral students and their professors, on the other hand, worry less about reaching conclusions about appropriate form and more about understanding the nature of the problem; how to study it; standards of evidence; and the impact of conclusions on the development of principles and theories. This is not to say that their conclusions cannot influence the tangible properties of communication, products, or environments, but it does suggest that the knowledge they generate is more broadly applicable. Such studies typically hold relevance for more than one application and suggest a variety of experts who might make use of findings.

What does NOT make a good research question?

Rarely are design research questions something that can be answered simply by 'yes' or 'no'. When there are definitive findings, they generally have qualifying conditions that make it difficult to argue that they are applicable in all situations. In other words, there are few 'truths' or 'rules' in design.

The decision to engage in a positivist study – that is, one that is objective and deals only in matters that can be verified by scientific inquiry – should not be taken lightly. Design, by its very nature, is *situated*; most of its effects depend on the setting and people involved. So even in an experimental study, in which there are statistically significant results that describe the influence of one factor on overall outcomes, there should be concern about over-claiming that such results *prove* something that is generalisable to all situations with all people.

The issues of proof and generalisability are also important when thinking about the application of experimental studies from other research disciplines, such as psychology, to design research or as the basis of solutions to design problems. Often such studies go to great lengths to remove the influence of context on outcomes. For example, one study focused on how quickly viewers could estimate the relative size and distance of a donkey and a toaster in several illustrations (varying their relative sizes and placement within an empty picture plane from illustration to illustration). The purpose of the study was to discover, even when the sizes of the two objects were inconsistent with reality, how quickly people could determine the larger or closer object. But how often do we see these two objects together (which may be the point of the study)? And when do they appear in an empty visual field with no other cues about size or distance? In other words, the study produced some interesting results but there is no guarantee that these results hold relevance for the complex visual environment in which communication design takes place. Therefore, when using research findings or methods from other disciplines, designers and design researchers have to be very careful not to make false assumptions about the correspondence between the existing research and a new application.

In an example of the appropriate use of findings from another field by doctoral student Amber Howard, a concept called 'priming' served as the starting point for an experimental study. Her research question was: "To what extent can mobile interaction that primes for a future health-oriented mindset before meal and snack times influence preferences, behaviors, and biases toward healthy eating practices among young adult college students at risk for obesity?" (Howard, 2011).

Priming is a concept from psychology in which exposure to something influences a response to something else a short time later. Howard sent futures-oriented messages by cellphone to one group of participants and random content to another group. She then asked participants a series of questions about the food choices they made at the next meal. The results suggested that the futures-oriented messages most affected participants' future health biases; that there were short-term effects on the perceived desirability of healthy foods; and that there were inconsistent effects on the portions of healthy foods consumed.

Howard's framing of the research question did not seek to prove that priming could change dietary habits; instead, she framed her question in terms of "*To what extent can design influence . . .*" and defined a specific list of perceptions, rather than stating the research problem in terms of "*Does design cause . . .*". And in reporting her findings, Howard made no claims that single messages were lasting or that repeated exposure to messages would produce the same outcomes over time. So while Howard's study was a quantitative, experimental study, her goal was to determine whether the studies of priming in psychology could be replicated through the technological delivery of priming messages, and in this case, in messages related to health habits with college students who are high-level users of mobile technology.

It is easy to imagine how others might build on Howard's work or how she might extend the study to address issues not present in the original research question. But what her research question shows is: focus in her expectations of what is possible in a single study; clarity regarding the perceptions she is prepared to address; and restraint in reporting only the facts of the results.

Similarly, when phrasing questions, researchers should be cautious about using comparative terms (such as better, improved, or more). Questions that seek to compare the outcomes of one design solution to another, even under the same set of conditions, need evidence that is both *valid* (that confirms that the research actually measures what researchers think it measures) and *reliable* (that confirms that measuring the same things over time will produce the same results). Unless methods verify the validity and reliability of findings that one design exceeds another in some respect, it is better to talk about how outcomes resulting from various design solutions are *different* without trying to claim that they surpass results under other conditions. And there are always the inevitable questions: *Better* for whom? *Improved* in what way? *More* for how long? It is also good to avoid absolutes (such as *never*, *always*, *completely*, and *unique*) in phrasing the question. There is likely to be someone who can name the exception.

Research questions are not tasks to be executed. It is tempting to define research sub-questions as steps in a process to be checked off or a list of things to be retrieved from the library. For example, doctoral student Matthew Peterson's research focused on the effects of different image/text relationships in middle school textbooks on students' comprehension of science content (Peterson, 2011). To conduct the study, Peterson needed to choose subject matter for the textbook lesson. His choice met certain criteria for the study, but choosing it was a task, not something to be discovered in response to a research sub-question. Likewise, determining what is meant by 'comprehension' and how it might be tested was not something Peterson needed to invent. Education scholars have defined the concept in great detail and others use that work in support of their studies.

Sub-questions address specific concepts within the study, that when investigated, contribute to overall understanding of the research question. They are as important as the primary question and direct the inquiry of the researcher.

Conclusion

Writing research questions takes practice and many projects go awry because researchers give insufficient attention to framing the investigation before diving into inquiry. Approaches need to be matched to expectations of use and the expertise of the researcher. As design builds a culture of research, there will be greater accountability for the claims of researchers and the relevance of their topics. Every thesis or dissertation by a graduate student in design contributes to shaping exactly what people think design research is about. Research and design professionals demonstrate to the public the potential of design to make a difference in the quality of life and the environment. It is important, therefore, that researchers take on things worth doing and do them well.

Note

1 Donald Norman identified several of these areas of research at the *Doctoral Education in Design Conference* at Hong Kong Polytechnic University on 23 May 2011.

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11

TOWARDS THE FORMULATION OF A RESEARCH QUESTION

Guidance through the glass bead game of research design

Rachael Luck

'Not everything made of steel is a battleship'[1]

The notion that there might be a template, some kind of script detailing a plan for action, which can be transferred from one research project to another, does have some appeal. Research processes, however, are not that prescriptive. Design research, furthermore, straddles very different approaches to research and will ask different kinds of questions when studying: designers in practice, aspects in design history, critical design, research as design and other fields in the design research canon. Each project will have its own *research design*, detailing a researcher's reasoning in the selection and application of theory and methods in a particular way to address a specific *research question*. The notion, then, of applying a model or 'boilerplate' that can be universally mapped onto any research project is misleading, without oversimplifying the work that is involved in the production and presentation of knowledge. Design, like any other field of enquiry, is in the midst of debate in the philosophy of science and, given changes in philosophic fashion, this debate is necessarily incomplete (White, 2011 p. xv, Edwards et al., 1995). Design research, it has also been argued, has its own nature (Archer, 1995, Dilnot, 1998).

What is detailed in this chapter, then, is guidance on the kinds of themes, questions and prompts to steer a design researcher's pathway at the outset of a project, when working towards the research design for a particular study, and draws attention to some features along the way to pay attention to. Presented as a written account, this format does imply a sequence in which things happen, as if there is a pattern to a research process. Again, this sense of order is beguiling. It can only act as a guide and detail one route through a research process, knowing there are others. To illustrate, the sequence in which we work iteratively between reading, writing and studying data is, at different times, characterised as: becoming acquainted with literatures, working *inductively* with theory to provide a footing for a research question and, conversely, working with data *deductively*, towards the building of grounded theory (Dowling and Brown, 2010 p.101 outline differences between theortetical and empirical derivation). Evidently, even the sequence in which a researcher engages with a review of literatures is contingent on the broad methodological category of the research. Positioning where your research sits in this landscape, where the terrain is both varied and contested, may feel like the machinations of a glass bead game are at play:[2]

> All the insights, noble thoughts, and works of art that the human race has produced in its creative eras, all that subsequent periods of scholarly study have reduced to concepts and converted into intellectual property – on all this immense body of intellectual values the Glass Bead Game player plays like the organist on an organ. And this organ has attained an almost unimaginable perfection; its manuals and pedals range over the entire intellectual cosmos; its stops are almost beyond number. Theoretically this instrument is capable of reproducing in the Game the entire intellectual content of the universe. . . . On the other hand, within this fixed structure, or to abide by our image, within the complicated mechanism of this giant organ, a whole universe of possibilities and combinations is available to the individual player. For even two out of a thousand stringently played games to resemble each other more than superficially is hardly possible. Even if it should so happen that two players by chance were to choose precisely the same small assortment of themes for the content of their Game, those two Games could present an entirely different appearance and run an entirely different course, depending on the qualities of mind, character, mood, and virtuosity of the players.
>
> *Hesse, 1943 pp.6–7*

When we take part in art and design research we engage in the intellectual enterprise of knowledge production. We operate within a "current state of ongoing conversations on theory and its impact on how knowledge is conceptualised and expressed" (White, 2011 p. xv). This statement upholds whether we consider there to be universal (design) truths 'out there' to be found, are of a post-positivist disposition, or see a methodological problem in objectivity in design research (Biggs, 2000). This is the machinery, or abiding by our image, the instrument of our research. The scientific machinery can be viewed from different perspectives and there are contested epistemic (*epistemology* is the study of what is taken as true) and ontological (*ontology* is the study of what is taken to be real) positions that co-exist, simultaneously. Moreover, we are institutionally entwined in educational machinery connected to the production of (scientific) knowledge. A researcher's individual game, then, at any level of study, is to navigate through theory and a methodological landscape to situate their research, whilst making some original contribution that is recognised in the award of an educational qualification. At the outset we don't know the rules; we are, however, already a player in the knowledge-production game. So, let's first reflect on the manifestations of this institutional 'machinery' and then outline some preliminary steps on a research pathway.

Design research's machinery

In the second decade of the twenty-first century we have reached a point in time where research-based study underpins art and design research at every turn. It was not always like this. The relationship between research and design was robustly debated at Doctoral Education in Design conferences, the Nature of Design Research and Foundations for the Future (Durling and Friedman, 2000, Buchanan et al., 1998) and with hindsight these events mark a watershed when the importance of research to design was unequivocally voiced by the different art and design disciplines present. A disagreement at the time was defining just what design research is, given contested views of its relationship to practice.[3] Some of these issues had previously been addressed but momentarily forgotten and Professor Bruce Archer and Professor John Langrish were able to provide a longer-term perspective. We need to be *evidently* engaged in scholarly conduct to award a PhD (mandated in the UK since the Council for National Academic Awards) even in what has been termed as 'practitioner' or craft-based fields that draw closely on

Table 11.1 Characteristics in research

Purposive	Based on identification of an issue or problem worthy and capable of investigation
Inquisitive	Seeking to acquire new knowledge
Informed	Conducted from an awareness of previous, related research
Methodical	Planned and carried out in a disciplined manner
Communicable	Generating and reporting results which are feasible and accessible by others

Source: Cross, 2000 p. 98

experiential knowledge (Archer, 2000). Some characteristics that are important to valid research were outlined at the time (Cross, 2000).

We notice that the characteristics of how research is conducted, outlined by Cross (2000) align well with the ways that the outputs from art and design research are now assessed: applying the criterion of originality, significance and rigour, as defined for the Research Excellence Framework Panel D Art and Design: History, Practice and Theory (REF, 2014). In this we see that close connections between research in design and art are institutionally recognised in how the research excellence framework is structured, and with similar research assessment models in other countries (Academy of Finland, 2009). Seemingly, irrespective of our level of engagement with research (in undergraduate and post-graduate dissertations, doctoral studies, as academic researchers or practitioners conducting research through practice) there are tenets or assessment criteria that mediate whether what we are doing is construed as rigorous design research, or as something else. Indeed, the institutional machinery that mediates art and design research includes the ways that universities deliver art and design education, incorporate research training in their programmes, conduct funded research in tune with national and international (scientific) research funding policy and the assessment of research impacts and outputs that are contingent with this. We inherit this machinery even before we begin to open up and inspect what art and design research might be, and the fertile debates on its nature and characteristics.

There is plurality in the ways that design is researched and that design research is identified (Margolin, 2010). While conceptions of what constitutes design research evolve, some of the formative articulations advance our appreciation of motivations for the study of design and, for a researcher, can stimulate research ideas and insights into the kinds of questions and thinking that shape different design research fields. The categories outlined by Frayling (1993) were foundational in shaping relationships between art and design and with research. Research *into* art and design include studies in art and design history. Research *for* design involves pre-design studies of everyday practices to then design a product or service (and can include the everyday practices that are connected with design work, to then re-design the processes and practices connected with how designers conduct this). Research that studies designing in practice is directed towards a better understanding of design through recovering the actions, activities and practices in its conduct. There are several ways that design practices are studied through research (Luck, 2012) and different vantage points from which art and design practice can be construed as research. It is the definition of what constitutes practice-based research that provokes most debate and that attracts much recent attention (Koskinen et. al., 2011). Research *through* art and design, it has been noted, is not always a helpful starting point when incorporating design as a component in research (Mattelmäki and Matthews, 2009). It is, however, in this fertile area that transdisciplinary fields, such as interaction design and social innovation through design, evolve and illustrate that the subjects of design research advance in tune with the changing patterns and uncertainties of everyday life. The remainder of this chapter addresses some of the difficulties in identifying a design research problem, given the diverse manifestations and different strategies of research inquiry. Provided in this chapter is practical guidance for a student working towards the formulation of a research question.

Towards a research design

At the outset of a research project, a student will grapple with a number of fundamental starting points, including the topic of the research and the core conceptual underpinnings to their research. Next, the broad methodological landscape that we as researchers inhabit is introduced and the sections that follow provide a framing for a student to position their own line of research inquiry within this. The three *broad methodological categories* used by White (2011 p. xvii) that describe the *conceptual constructs* for research are: *exegetic*, *empirical* and *qualitative* research.

Exegetic research: exegesis is critical explanation or analysis, drawing meaning from a text. An exegetic research design has an implicit method and an explicit theory. Assuming that the very act of reading is not innocent, there is interplay between drawing/deriving and imposing meaning. Research that, for example, critiques Le Corbusier's conception of the human body examined through his published work might exemplify this kind of enquiry.

Empirical research: empirical research designs have an explicit method and implicit theory. It operates on the process of contemporary scientific methodology (sometimes referred to as quantitative research). It is not to be confused with the philosophical doctrine of empiricism. Working with objects and *concepts* that have measurable attributes, empirical researchers will explain the research methods adopted on positivistic assumptions (implicit theory) that things in the world can be measured. To be clear,

> a concept is anything that can be conceptualised by humans (i.e., practically anything). A construct is a concept that is by nature not directly observable, such as an emotion or an attitude. The special difficulties in measuring unobservable constructs is noteworthy.
>
> *Neuendorf, 2002 p.110*

The genre of writing connected with empirical research is minimally expressive to present phenomena and opinions as objectively as possible. There has been a trajectory of design research in this mode that has examined design conduct, often applying insight from cognitive psychology.

Qualitative research: qualitative research designs have an explicit method and explicit theory. Research that follows a qualitative design will explain what is done (the application of defined research methods) and also what ontologic (view on how the world is) and epistemic (perspective on how knowledge is created in the world) assumptions are being made. Qualitative design research is often exploratory, seeking, for example, to better understand the ways that design is conducted in team meeting settings.

In White's (2011 p. xvii) explanation it is made clear that each methodological category is not considered to be autonomous, nor distinct. Each category exists in relation to one another. To illustrate, it may be easy to align some design studies with the (social) scientific foundations from which their methods are derived. The boundaries become more blurred in the creative blending of methods in the configuration of many co-design research arrangements, and on occasion mixed methods approaches may provide a more apt methodological characterisation. The point being stressed is that a researcher's reasoning in the positioning of their research needs to be accounted for as well as describing what each perspective entails. Indeed, a line of questioning that is often pursued in a *viva voce* examination will probe a student's understanding of the theory that underpins their research, to cross-examine why this perspective was adopted in this particular circumstance (Creswell, 2009 p.49).

'A little theory goes a long way'

There are several ways that '*theory*' features in research and a chapter dedicated to the subject is included in the book *Research design* (Creswell, 2009). The adage that 'a little theory goes a long way' is a reminder that theory is often part of the scene setting for something else to be undertaken through a research project. It usually plays a part in *situating* the research and the *perspectivising* for a project, rather than acting as the main subject for the research. This is not always the case. Research about design theory and research that aims to *generate theory* as a final outcome from a project places theory construction more centrally in the research, for example, with grounded theory approaches.

Qualitative studies in the social sciences are a particularly fertile ground where different theoretical perspectives are debated. The *theoretical lens* that guides a particular research approach will be explicitly defined in qualitative studies. For example, ethnomethodology was the theoretical lens used to study the ways that design was practised in different workplace and educational settings in the *Design Studies* journal special issue 'studying design in practice'.

Arriving at a research topic

The importance of arriving at a research topic that will sustain a student's interest and motivation for the duration of a project is not to be under-estimated. A student will conduct research on their dissertation topic for several months. There will be several years' commitment for doctoral level study. Given this, White (2011 p. 9) draws attention to *axiology*, that is, the study of what can be regarded of value. It features in a research project in several ways, including identifying something of value in the world that makes it a worthwhile subject to study. Indeed, it has been noted: "Design research starts with what we don't know but it would be valuable to know" (Poggenpohl, 2012).

At the outset of a research project, a self-reflective axiology is also advocated. This involves a reflective exercise, questioning what your personal values are, the subjects and issues in the world, in your life and those that in some way relate to design that could act as a starting point for a research project. The germ or seed of an idea, which resonates with personal values, will ideally enthuse and motivate a researcher's sustained interest throughout subsequent stages as they begin to craft and mould the topic, ultimately into a carefully honed research question. This approach to topic selection emphasises the volition and axiology of a researcher. Put simply, "how their worldview shaped the approach to research" (Creswell, 2009 p. 6).

The structure of a university's research training module will also impact on the way that a research topic is selected and how a research question is arrived at. The practice in some universities, especially for undergraduate dissertations, is for the supervisor to put forward several topics for students to select from. This mode of organising dissertation supervision (and PhD studentships) has both advantages and disadvantages. It is a way of demonstrating that a university's research is embedded in its teaching programmes as students, to varying degrees, become involved in the research projects within the department. It may be an efficient way to extend research capacity and the resource at an academic's disposal, which can be especially fruitful when guided literature searches align with a research project that has just started. This mechanism will help in the knowledge-production game but can come at the loss of a student's ownership of the research they are undertaking. There is a balance to be negotiated in the supervision of research between a researcher's *axiology*, their values and interests, and the subject the supervisor would like to develop. A situation we want to avoid is when a student wants to change the topic of their dissertation mid-course. Dissertation supervision is a stewardship task but not at the expense of developing the critical thinking skills of a student or researcher. Of course there will be degrees to this characterisation. Also, differences in opinion on how important it is for the researcher to locate and own the subject they are studying and, furthermore, to set the question for the research that they will be ultimately credited as making a novel knowledge contribution towards.

Another strategy can be to work towards a research topic by exclusion. Being clear in what the research is *not* can help define the scope of a topic and, when stated in an introduction, will sensitise a reader's expectations to what they will discover through the research. A clear example of this can be found in the book *Design research through practice* (Koskinen et al., 2011) in the positioning of *constructive design research*:

> This book looks at one type of contemporary design research. It excludes many other types, including research done in art and design history, aesthetics and philosophy. It skips over work done in the social sciences and design management. It leaves practice-based research integrating art and research to others.
>
> *Koskinen et al., 2011 p. 6*

We are left in no doubt that constructive design research is not to be confused with constructivism in the social sciences.

Establishing the research problem

The introduction to a dissertation is the location to establish the issue or concern that leads to the research problem. The problem the research addresses begins to become clear when we ask: '*What is the need for this study?*' and '*What problem influences the need to undertake this study?*'.

Four characteristics of a qualitative research problem are:

> (a) the concept is 'immature' due to a conspicuous lack of theory and previous research: (b) a notion that the available theory may be inaccurate, inappropriate, incorrect or biased: (c) a need exists to explore and describe the phenomena and to develop theory: or (d) the nature of the phenomenon may not be suited to quantitative measures.
>
> *Morse, 1991 pp.120–123*

Each of these characteristics describes a way to critically examine what is already known about a subject through a review of literatures. In this process, gaps in knowledge can be identified that may lead to the identification of problems, e.g. the problems of missing theory or research in an area, which in turn leads to the adequate description of the phenomena that have been observed. In response, an exploratory or theory building research design may advance our understanding of the range of phenomena that are connected with a subject and also improve our explanatory power of it.

A quantitative problem is addressed by understanding the factors or variables that influence an outcome (Cresswell, 2009 p. 99). In a similar manner, a review of literatures is undertaken to establish what is already known in this subject to then identify questions that need to be answered. Quantitative enquiry seeks to understand the relationships between variables and, more specifically, to measure the strength of the relationship between variables and the direction of the relationship, using statistical methods.

On the formulation of a research question

In design studies we are familiar with the notion that finding the problem is a problem (Lloyd and Scott, 1994) and for a research project it is the process of formulating a research question that we next consider. Drawing on Lawson's insight into how design problems and solutions evolve (Lawson, 2008), Crouch and Pearce consider that research problems and the formulation of research questions behave in a similar way: "[t]he problem and the question move backwards and forwards" (Crouch and Pearce, 2012 p.19). Examining the problem that suburban gardens in Australia consume a lot of water, in a region that has a water shortage, it is questioned, "[i]s the problem the shortage of water, or a gardener's demand for it? . . . the problem is no longer just about the lack of water. It's also about how water might be managed better" (ibid.). At first the problem concerns how to get more water to users, however, by re-framing this and focusing on the eradication of the need for water, the design topic and the research question can take a more nuanced stance. In this we see that working with the problem, and looking at this from different perspectives, there are a series of questions that can be asked and the finesse of the research question can be developed.

There are different kinds of questions and different forms of reasoning that are appropriate depending on the approach to research enquiry. Sometimes this is referred to as the 'logics of enquiry' (Sainton-Rogers, 2006). In empirical research – applying the scientific method – we are working in a hypothetical-deductive mode. This means that we generate a hypothesis, a predictive statement about empirical reality, based on a theoretic rationale or on prior evidence. Variables can be defined, measurements are made and the relationships between them are examined statistically, to test if the predicted relationship is upheld. Hypothetical statements that are predictive express an opinion, that is, they have a direction. When the existing theory is not strong enough to support a predication, one or more research questions can be offered. In the scientific mode, a research question poses a query about relationships between variables. In this deductive mode, both hypothesis and research questions are posed before data is collected.

Qualitative research will use qualitative words such as 'explore', 'understand' and 'discover' to ask questions about the central phenomenon of interest in your research. The first questions asked are key, and pose the most general questions on the subject. Follow-on sub-questions subdivide the central question into more specific topical questions, beginning with words such as 'how' or 'what' in your attempt to 'generate', 'identify' or 'describe' what you are attempting to 'discover'. Asking 'what happened' will help to craft your description – 'what was the meaning of what happened?' – to understand your results and 'what happened over time' to explore the process. Positivistic words such as 'cause', 'effect', 'relate', 'impact' and 'influence' should be avoided.[4]

"Start with a question that identifies something it would be valuable to know" (Poggenpohl, 2012)

There are different ways that we can ask a question. Asking a question that is answerable yet to date has no known answer is a subtle proposition (Poggenpohl, 2012). In Table 11.2 we can see that the way a question is asked can make an association with particular kinds of variables (e.g. location, time etc.), which the questioner has decided it would be valuable to know more about. The way a question is asked can also have stronger associations with qualitative, empiric

Table 11.2 Question frames and focus

Question frame	*Focus*
Who	Identification, audience, user
What	Classification, specification
When	Time, sequence, context
Where	Location
Why	Reason, cause, purpose
How	Process, method, operation
Can	Possibility, probability
Will	Probability, trend
Do	Performance, action
Which	Comparison

Source: Poggenpohl, 2000

and comparative research than others: for example, 'which' questions suggest comparison between things; 'can', 'will' and 'do' impose a direction to the question and strongly relate to empirical research inquires.

To draw this chapter to a close with guidance on setting a research question might seem unusual, as in practice this will happen near the start of a research project. There is, however, another tactic that is helpful when identifying a research question. That is to reverse engineer the task and ask: '*What is the question that your research can answer?*'. This question is reflexive and will elicit judgement on just what 'your research is', that is, its central question, and 'what it does', in other words, what the research accomplishes in the application of the methods described. Put more formally, response to this question will shed light on 'the contribution to new knowledge that will be made through this research'. This approach can be especially useful to check that what is presented in a dissertation (or thesis) actually addresses the central research question. Oddly then, re-examining the research question is also a task to undertake at the end of a project.

'What is the question that this research has answered?'

To conclude, while there is no one route through the machinations of a design research glass bead game, this guidance provides a steer for a researcher in their own game. A design researcher will artfully navigate a personal route, engaging with scientific debate that connects theory and method to advance a particular line of enquiry and address a specific research question.

Notes

1 Bizarre though it may seem, with reference to a paper that questions the logic of *what is* and *what isn't design research*, a short answer is to launch the battleship (engage with the design of your research) to find out whether it's made of steel (to test systematically the rigour of your design research). Drawing on many years of doctoral supervision experience guidance on an outline structure for a thesis is given, separating OBEs (other bugger's efforts) from MBEs 'my' original contribution to knowledge made through research. This argument contributed to lively debate at the time, questioning whether 'research through design' is a form of research at all, and ways to delineate research through design from other forms of design practice. (See Langrish, 2000, *Not everything made of steel is a battleship*.)

2 In the preface to White's book *Mapping your thesis* (2011) he quotes from Dante's inferno, recounting the experience of waking in a dark wood. In comparison this glass bead game analogy is less foreboding but also points out that research pathways are not without challenges.

3 Other disagreements that continue are design's relationship with art and how art-based research is differentiated from fine art, music and theatre studies on one hand, and the practical arts on the other (Schwarz, 2012).

4 A particularly useful source when crafting the *purpose statement* for your research and designing the central *research question* and sub-questions is Creswell's (2009) book on research design. This is a staple text for many research methods courses. It includes many partially completed scripts for a researcher to populate with details particular to their project, to help elucidate and articulate the research design in terms that can be modified to suit qualitative and empirical research enquiry.

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12

NAVIGATING THE METHODOLOGICAL MIRE

Practical epistemology in design research

Ben Matthews and Margot Brereton

The methodological mire

The field of design research is a marketplace of methodological[1] diversity. It isn't just that there are many different research methods in the field, but that there are many different methodological 'foundations' – principles for how research can and should be done, for how contributions to knowledge ought to be pursued. This is not particularly surprising given how broadly 'design' is often conceptualised. Herbert Simon (1996) suggested "the proper study of mankind is the science of design" (p.138); Nigel Cross has identified a principal difference between humankind and the animal kingdom to be our ability to design. In light of such encompassing notions of design it is difficult to imagine how the field of design research should exhibit any less diversity than that found within and among the arts, humanities, the human and the social sciences. A cursory survey of design research can easily identify rich traditions of design inquiry along each of these different lines. For example, some strands of design research are conducted as design history; Boyd Davis' (2012) exposition of the evolution of the timeline as an artefact of graphic design is a recent example. Design research is also pursued in the form of design critique, where various extant artefacts are analysed to identify salient aspects of their form, function, interactivity and the like. Bardzell et al. (2010) give an example of a form of design criticism applied to the design of interactive systems. Research in design is also conducted through experiments, of the kind that have been developed in psychology, where test subjects are asked to perform certain tasks under various experimental constraints as a means of empirically testing hypotheses. For instance, interested in whether 'novel' designs are more aesthetically pleasing than 'typical' ones, Hekkert et al. (2003) devised experiments to explore the relationship between the perceived originality and/or conventionality of the industrial design of artefacts against perceptions of their aesthetics. Other research takes a more naturalistic approach informed by ethnographic sociological or anthropological methods, in order to study e.g. how practising designers accommodate ambiguity and disagreement in interaction (McDonnell 2012), or the ad hoc criteria they rely on in making practical decisions (Lloyd and Busby 2001). A growing proportion of design research is conducted in a manner in which designing is a component of the research method. The subfield of participatory design is a visible body of work that has been undertaken (primarily) through the engagement of the researchers themselves in collaborative design events and activities, often in the mould of action research (e.g. Bødker and Buur 2002). Some design research has no empirical component, relying instead on conceptual arguments, analogies and forms of logical reasoning, as Liddament (2000) lucidly does. This is a very small sample of design research, and yet the breadth of disciplinary allegiances and methods on display is staggering. History, criticism, psychology, sociology, anthropology and philosophy are represented in this spectrum, as are documentary methods, critical analyses, experimental procedures, statistical analyses, interviews, ethnographic 'thick' description, interaction analyses, action research case studies and conceptual analyses. And this ignores the various general philosophical stances that may be implicit to some of the work above such as social constructivism, cognitivism, pragmatism, post-positivism, hermeneutic phenomenology and others. Welcome to the mire of design research.

Variety is not a bad thing, of course, nor do we want to suggest that methodological diversity is a detriment to the development of design research as a discipline. But we do refer to this as a *mire* for several reasons. In our experience, this methodological situation can create multiple points of confusion for those preparing to conduct research in design. There are a number of questions that can seem to receive very different answers depending on where (i.e. from which disciplinary, philosophical or methodological position) the researcher stands, such as:

- what is a good research question?
- how should a study of design be designed?
- what methods are valid?
- how can knowledge about or for design be gained?

These are pressing practical questions for researchers. And lurking nearby is a set of related, thornier concerns:

- how much philosophical 'baggage' accompanies the choice of a research method? For example, do I need to assent to Heidegger's *Sein und Zeit* before I can employ a 'phenomenological' method such as in-depth interviewing?
- how is it possible to compare the results of research that have been advanced under different methodological programmes?
- are the results of carefully controlled experiments automatically at odds with descriptive naturalistic claims, simply by virtue of the fact that they are derived using different methods originating from different knowledge traditions?
- if I use quantitative methods of data collection and analysis am I *ipso facto* a 'positivist' (and thereby subject to the various criticisms of positivism that have been advanced in the past 40 years)?
- can I create my own method?

The parallel existence of many contrasting methodological approaches in the field can make it seem that selecting one among these alternatives automatically calls into question the legitimacy of many of the others (heightened by the fact that positions such as constructivism were largely formulated in opposition to positivism or cognitivism).

These methodological concerns can be paralysing for novice researchers, because it can often seem that either one has to become an expert in comparative philosophy before one can begin to do research, or that one has to commit (blindly if need be) to one methodological tradition of research and work solely within it in order to safely navigate the mire. In this chapter we would like to propose two alternative options open to design researchers since there are presently few resources in design research that provide much guidance through this territory, nor are there many comparative discussions of method in our field.

Epistemology and foundationalism

To begin, it is worth identifying how methods and philosophy are linked. Epistemology is the branch of philosophy concerning human knowledge and understanding. Epistemology considers what knowledge is, what counts as knowledge, how it is acquired and the possible extent to which something can be known. In deciding a method for investigating a research question we are naturally drawn into considering philosophical, epistemological issues such as these. Nevertheless, our argument will be that design research can circumvent many of the thornier ones.

The source of many of the concerns such as those mentioned above can be traced to assumptions about the nature of epistemology. Much of modern epistemology has developed in response to scepticism. Sceptical arguments originate from a persistent concern with the possibility of delusion. You may think you know something obvious, such as that you are currently sitting on a chair, but it may yet be the case that you are mistaken. Perhaps you are hallucinating or dreaming the thing you think you know. The classical response to scepticism has been to try to find an Archimedean point about which doubt cannot be raised, and to use that as a basis from which to (re)construct the rest of our knowledge of the world. The most celebrated such attempt was Descartes' '*Cogito*', "I think therefore I am". Descartes' ingenious response to scepticism was to identify one thing about which there could not be scepticism: scepticism itself. He accepted that he was able to doubt almost everything, but even so, the one thing he could not doubt was that he was just now doubting. Therefore he could be certain he existed (at least mentally). The details of his argument and the generations of philosophical responses to it are not important for our purposes, but the form of his response is important. Descartes produced a *foundationalist* response to scepticism, treating knowledge as though it is a kind of edifice built up piece by piece from axioms that cannot be undermined, through to conclusions about other things – in his case, the existence of God, of an external world, of other minds like his, etc. The charter of much of the field of epistemology has been to defend knowledge from scepticism in such a way, starting from initial axiomatic positions on what is real, what reality consists of, what cannot be doubted and on through to less obvious (but derivable) entailments of those foundational matters. (G.E. Moore's (2002) proof of an external world is another well-known attempt in this general epistemological tradition.) Method, conceived as a formal procedure for the production of knowledge, becomes one of the things that is implicated by, and arrived at through, a stepwise progression from foundations. On a foundationalist view, it can seem that we must first agree on fundamental issues such as of what reality truly consists, how we can know what is real, and what is to count as knowledge before we could possibly debate anything as derivative as, e.g. what design research ought to be.

Many of the methodological concerns identified in the previous section arise from an implicit view of our knowledge of the world as a kind of foundational edifice that is built up from fundamental ontological assumptions about the nature of reality and epistemological assumptions about how we can discover what reality is like. As long as this is our view of knowledge and method, those concerns are not easily dissolved. However, we suggest that foundationalism should be put to one side (at least temporarily) in order to see other ways through the mire.

Practical epistemology

In the ordinary course of our lives, our 'knowledge of reality' is largely unproblematic. We can manage to find our way from home to the local shops without problem and we know where in the store to find rice to buy. It is only in particular circumstances (that are also very ordinary) that the status or certainty of this knowledge may become a matter of concern; for instance, when we have to explain to a guest how to get to the store, or describe in which aisle to find the rice. It is only while doing philosophy that we might ever need to apply a systematic and thoroughgoing method of doubt: we do not actually doubt that we have two hands while picking up a pack of rice from the shelf at the store. Indeed, systematic doubt would be detrimental to any course of practical action – any attempt to actually get something done. It is worth noting that in ordinary circumstances, doubt only takes place amidst a field of much else that is, and must be, taken for granted (cf. Hughes & Sharrock, 1997). A chemist doing lab research may doubt the rate of reaction of two chemicals that is measured by her equipment, but she cannot do so while also doubting the very existence of the chemicals in the beakers in front of her.

Consider that in order to have a disagreement with someone about things such as the nature of reality, of knowledge, and of how we know what we think we know, we must tacitly agree with each other on an indefinitely large number of other things, including agreement on what it makes sense to say. The possibility of disagreement is predicated on intelligibility, among other things.

This perspective paves a couple of new paths out of the mire. We do not need to think of differences between methodological traditions as running 'all the way down' to foundations upon which contrasting epistemological edifices are anchored. We can instead notice that outside of doing philosophy, the world (even the 'hard' scientists' world) is one that is largely and necessarily taken for granted in order to conduct any business at hand, including rigorous research. This brings into focus specific aspects of the research act that tend not to be foregrounded in foundationalism.[2]

Path 1: the purpose of the research

In any research endeavour the researcher limits her attention to the investigation of specific aspects of the world. She has particular purposes in conducting research. These purposes are realised in a set of concrete decisions about what aspects of the world will be collected as data and presented as evidence of the phenomenon under investigation. Ordinarily, this is the job of a method. Method is not, in this view, a formulaic or automatic knowledge-production engine; its task is to offer the researcher a means of collecting, organising and presenting aspects of the world that are relevant to the purposes of the investigation. Furthermore, we need not scrutinise the philosophical foundations of the researcher's methodological tradition in order to make sense of, or evaluate, the research. Indeed such a philosophical foundation may not be explicitly formed.

In design research, epistemology becomes plainly visible in the actual decisions researchers have taken in order to show us slices of the world that illuminate a phenomenon of interest. We do not need to attend to foundational philosophical assumptions, but only to those assumptions that are relevant to the problem at hand. And the relevant assumptions are manifest in the evidence that researchers collect, assemble and display in producing research.

How does this offer a way out of the mire? It makes methodological choice subservient to the researchers' own purposes in investigating a phenomenon, rather than to an a priori philosophical position that (in the case of classical epistemology) rarely comes into contact with the kinds of practical decisions that need to be made in order to conduct research. It matters much less to which epistemological or methodological school is pledged allegiance; rather, researchers' epistemological stances are revealed in and through their concrete decisions with respect to how they have used data as evidence of a particular phenomenon. Rigour in research does not stem from belonging to a particular philosophical tradition, and neither does meticulous adherence to the tenets of a method such as grounded theory. In this sense, rigour consists only of being able to show your peers that the material you have gathered is reasonable as a response to the purposes of the investigation, and of sufficient quality and volume to make a contribution to your particular scholarly audience. The playing field has been levelled here – every practising researcher is a (kind of) practising philosopher; every piece of research, philosophical or not, can be read for the epistemological positions it embodies in its choices of data as evidence of its phenomena. In view are the research questions, aims and foci, and how they relate to the data that has been marshalled in the research account.

Understanding how products affect people

An example from industrial design research may help make this point. A prominent line of research in industrial design investigates the relationships between the forms of artefacts and people's emotional responses to them. Perhaps the most ingenious attempt to create a language-independent cross-cultural comparative catalogue of the emotional responses generated by products belongs to Pieter Desmet. In a series of studies (Desmet et al. 2000, Desmet 2003) he developed and refined an experimental tool, called PrEmo, to gauge people's emotional responses to the design of objects.

Desmet's work is a good candidate for demonstrating this particular path out of the mire, for several reasons. This research represents a particular tradition of design research informed by experimental psychology, with respect to both the theories and methods it employs. Desmet is particularly well read in the history of emotion research in psychology. So if we are curious to know the extent to which one must be within that disciplinary perspective in order to make sense of these research results, or in order to compare it to other research, this makes a good test case, as experimental psychology is just one among many disciplines (physiology, anthropology, sociology, philosophy) that investigate emotion. Desmet is also a particularly clear writer and a very careful scholar, making his work a pleasure to review. Our procedure is roughly: identify the research purpose and the phenomenon under study; examine the data we are shown as evidence of the phenomenon; consider the reasonableness of the evidence in relation to the purpose of the study (see Figure 12.1).

Identify the purpose. In order to work through this path out of the mire, we must set aside the researcher's disciplinary or methodological allegiance, and instead identify his or her purpose in conducting the research. In this case, Desmet's aim in developing and deploying the tool has been to find answers to questions such as "What does this car make people feel?" as a means of investigating people's emotional responses to a product's (industrial) design.

Examine the data. We are shown the results of studies in which respondents were presented a series of tasks. The task consisted of a picture of (in this case) an automobile. The vehicle was presented alongside cartoon animations of 14 different facial and bodily emotional responses: seven 'positive' (satisfaction, desire, fascination, admiration, pleasant surprise, inspiration, amusement) and seven 'negative' (unpleasant surprise, disgust, contempt, indignation, dissatisfaction, disappointment, boredom). Participants could score each emotion on a three-point scale, e.g. "I do feel this emotion", "To some extent I feel the emotion", and "I do not feel the emotion". For each model of a car in the test, the task they were given was to "Rate the puppets [cartoon animations of the specific emotions] to express what you feel towards this car model". Different makes of vehicle were comparatively assessed in this way.

Consider evidence in relation to purpose. The purpose, to gauge peoples' emotional responses to the design of products, is pursued by asking respondents to report on their feelings when shown a picture of a product. The reasonableness of this data with respect to this purpose depends on several premises that become apparent when one juxtaposes data with purpose like this. For example, for the data to be adequate evidence of the phenomenon of interest, a two-dimensional picture of a product must be considered a sufficient stimulus to generate an emotional response. Other properties of a product such as its scale, finish, texture and depth dimension (or other aspects like its 'new car smell', the design of its instrumentation, dashboard or sound system) are excluded from consideration by virtue of the data that was collected and the details of the task that was set the participants. Other practical methodological decisions also become noticeable. An emotional response must be considered something respondents can accurately introspect, identify and report. The fact that respondents do not have the option to give a 'no emotional reaction' answer to the task implies that emotional responses are omnipresent, i.e. that in seeing a car respondents *always feel something*, and what they feel is a result of them seeing the picture of the car.[3]

These observations are not raised as criticisms or shortcomings of the work. Our point is only to show that in any research, irrespective of its philosophical orientation, the evidence it presents has effectively operationalised the purpose of the study in a very specific way that can enable its readers to see many of the philosophical and methodological assumptions that are embodied by the study.

Taking this kind of practical perspective on methodology has an advantageous consequence in comparison to foundationalism. Once we see epistemology as an element of research visible in concrete methodological decisions (such as in what data to collect, and how it operationalises the purposes of the study), we can have very specific conversations about the appropriateness of those decisions. Some researchers may not be convinced that our emotional responses to visual stimuli are always accurately introspectable.[4] Some may not be certain that viewing a two-dimensional image and reporting on what you feel effectively captures the kinds of phenomena that they would like to see included in a study of 'emotional responses to products'. The important thing is that such disagreements, should they arise, are not objections to entire disciplines (experimental psychology) or particular philosophical positions (e.g. cognitivism) or to general approaches to research (e.g. experimental reductionism). This conversation can be practical – about data, evidence, purposes and phenomena – rather than foundational.

We will now look at a second way out of the mire.

Path 2: the claims of the research

There is another closely allied path on offer, which begins from the claims (rather than the purposes) of a particular piece of research. In this respect, it is worth noting with Jacobs (1988), that:

> the rationality of any research enterprise is guaranteed not by some set of established procedures, but by a sensitivity to the nature of the claims being made, the burden of proof those claims impose, and the kind of evidence that can support those claims.
>
> *p. 442*

This is a valuable observation for the clarity it offers regarding the role of method. However, it is also important to realise that in design research, there are many different kinds of claims. This is where the diversity of design research becomes starkly apparent. And different claims carry very different 'burdens of proof' – standards for what kinds, and how much, evidence must be met in order to justify the claim.

When we think in terms of burdens of proof, and when we look at the many types of research that are conducted in our field, further limitations of the foundational view of knowledge in offering much guidance for design research can be seen. It is not just that there are many different kinds of claims made in design research (e.g. empirical claims are different to methodological or conceptual claims), but that many design research claims are 'soft'. There are few proofs in design research; most contributions are better seen as tentative, argumentative, persuasive, sensible or workable (cf. Gaver 2012).

This is perhaps a situation that strict epistemologists might decry, as it would appear there are a great many things claimed by research as research that are genuinely not yet known. But this is the nature of (or at least the state of) design research as a field. This being the case, it is worth looking at the kinds of things that do count as design research, i.e. the nature of the claims advanced by researchers as contributions to the field. These are not anchored in an epistemological certainty that stands up to every conceivable doubt, but rather in the cogent presentation of argument and evidence that is, again, *reasonable*.[5]

Thus, our second path out of the mire is to look carefully at what researchers claim as the contribution of their research (or the contribution that they ideally hope to make). As readers, we hold that contribution up against the evidence and argument presented, and assess it as to its reasonableness. But additionally, we must also consider its value in terms of its novelty, its innovation, the new perspectives and directions it opens to the field, its potential for constructive application, its topicality and its interest. This gives a complex twist to the idea of a burden of proof of a research contribution, and dovetails with the observation that many design research claims are 'soft', i.e. unproven or underdetermined by the evidence presented in their support. The point is that the demonstration of a research contribution depends on more than just evidence and argument, but also on things like the potential usefulness of the contribution to the field or the novelty of the perspective on offer in relation to the field's prevailing programmes of research. A 'soft' claim may yet be an important claim, not because it is unassailably true, but because it is fertile, generative or insightful within the field's current zeitgeist.[6]

Furthermore, there are different types of design research claims. To substantiate some claims, a conceptual argument may suffice without the aid of a formal research method or any new empirical data. For others, the contribution is entirely bound up with the patterns that emerge from an analysis of empirical data. For nearly all forms of research, however, the contribution is accomplished through sensitively balancing the strength of the claims made against the weight of evidence the authors have for that particular conclusion. Compare the work done by phrases such as "*it was found* that X", "*this strongly indicates* that X", "*these results show* that X", "*this suggests* that X", "*we observed* that X", "given situation W, X is *often likely*". In each case, a claim is made in a manner sensitive to the relevance and volume of material presented. The burden of proof is relaxed by adverbs such as 'often', or in choosing a verb like 'suggests' instead of 'demonstrates'. "We observed X" is the kind of claim that is very nearly indisputable (as it carries a very small burden of proof). This is not an oversimplification, nor is it merely semantic hair-splitting. Research papers present themselves as offering a contribution to the field of research to which they are addressed, and authors take pains to formulate their claims in ways that are sensitive to the strength of their evidence and argument. Some claims can be stated baldly because the volume or quality of evidence presented grants an author license to do so. Other claims can be stated just as unequivocally, but only because they impose a very light burden of proof on the claimant. However, many design research claims are expressed with some reservation.

Understanding why students get stuck in the design studio

Working through an example reveals this path to be something akin to 'reverse engineering' a research contribution. Our procedure is roughly: identify the paper's claim as to its contribution; consider the burden of proof of that claim; evaluate the extent to which the evidence we have been shown meets that burden of proof (see Figure 12.2).

The example we will take is drawn from design research in architecture. Sachs (1999) studied the phenomenon of design students getting 'stuck' in their studio projects. It works well as an example here because it comes from a different design discipline (architecture) than Pieter Desmet's work, it employs different methods (open-ended interviews) and is informed by a different tradition of research (qualitative sociology).

Identify a claim. When Sachs formulates part of her conclusion she does so in this schematic format: phenomenon X is *usually manifested* in behaviour Y, with consequences Z, *possibly caused* by A, B or C. In her own words (with our own schematic tags inserted), Sachs (1999, p.209) writes:

> The breakdown [X] is usually manifested in the student's behaviour [Y], often affecting the design process so that it falters or even stops [Z]. Possible causes of 'stuckness' were examined . . . such as the design project requirements [A], confusion over the design process [B] and misunderstanding the studio instructor's intentions [C].

Consider the burden of proof. What is the burden of proof of a claim like this? Adverbs such as 'usually', 'often' and 'possibly' moderate the burden. The task is to consider what one might need to be shown in order to accept (or be convinced) the claim is true. So we might expect to be shown several instances (since 'often' and 'usually' implicitly demand multiple cases) where

Figure 12.1 Beginning from the purpose of the research, one can judge the appropriateness, quantity and relevance of the data gathered for how reasonably it functions as evidence of the phenomena of interest

Figure 12.2 Beginning instead from what the research has claimed, one can work backwards to determine the ideal burden of proof of the claim. This enables readers to generate local study-specific criteria to assess the appropriateness, volume and weight of the evidence that has been presented to support the claim

students were identifiably stuck, where 'stuckness' is evidenced by the halt of progress in the design process. What about the 'possible causes'? Since they are only presented as 'possible' causes, we do not require more than a reasonable case that occurrences such as 'confusion over the design process' are prior to, and seem relevant to, a breakdown.

Weigh the evidence in relation to the burden of proof. In Sachs' account, we find two detailed descriptions of students stuck in their process: Miguel and Dalia. We focus on Sachs' account of Dalia, which is presented in an ethnographic style punctuated with direct quotes taken from interviews in which Dalia explained the origins of her 'stuckness'.[7] It emerges from the account that Dalia identifies a number of possible different sources of the design stagnation she experienced. For example, Dalia acknowledged that she had neglected structural aspects of her solution that were important. She became stuck trying to reconcile those structural requirements with the overall design concept she was committed to developing. This is the basis presented for identifying the design project itself as a possible cause of stuckness – students encounter such dilemmas as constituents of trying to resolve the design problems they are given. Miguel's and Dalia's examples are introduced as elements of a larger data set that Sachs references in passing (e.g. "Two students who participated in the study reported that they were stuck because they did not have an image of the next step of the process" (Sachs 1999, p.207) or "A student reported that she had abandoned her scheme because she felt it was 'boring'" (ibid., p.208)). Although we are not shown very many instances of the phenomenon under study, the material we are shown arguably meets the moderate standard of evidence entailed by the strength of the claim as it has been formulated.

Sachs' formulation of this claim reveals it to be 'soft' (i.e. tentative, inconclusive or provisional). But soft claims do not equate to unimportant ones, nor are they necessarily any less a contribution to design research. On the contrary, Sachs' claim is responsible, nuanced and methodologically sensitive, given the weight of evidence afforded by her data and analysis. Ultimately, the validity of such a claim rests on how *reasonable* the relationships between her identified phenomena and explanations are, in relation to what we have been shown in the data. Specifically, we must accept it is a reasonable task to ask students to identify and explain their own experiences of being stuck, to take those explanations as possible causes of 'stuckness' and to treat their descriptions of stuckness as accounts of the phenomenon of being stuck in a design process. Again, as before, validity does not rest a priori on her philosophical commitments or her research methods. Whatever her commitments might be, they are manifest in her methodological decisions – i.e. it is through her interview data that she has found examples of (and therefore ostensively defined) what she will count as 'stuckness', 'breakdown', 'confusion over the design process', etc. within the study. The possible causes of stuckness identified in the study are ordered types generated from students' own reflections on why they got stuck and how they eventually got past it in their process. Those methodological decisions are there for readers to consider as to their appropriateness, sensibility and reasonableness. As before, this observation is not raised in order to criticise the research, but to show how basic methodological issues are revealed in researchers' practical decisions regarding, in this case, what data will suffice as a 'cause of "stuckness"', how one might know it when one sees it, and what strength of a claim one can make on the evidence that has been collected. Naturally, readers may make an assessment based on their own knowledge and experience of 'stuckness' if indeed they have encountered this phenomenon themselves. And using their own experience as a reference they will judge whether the scope and scale of the inquiry has been sufficient and the methodological decisions adequate.

Practical epistemology in design research

The benefits of seeing epistemology as a practical affair that is handled in concrete decisions with respect to purpose, phenomena, data, evidence, claim formulations and burdens of proof relate to the methodological concerns identified earlier in this chapter. It is possible to approach design research in ways that do not get bogged down at the outset in deep philosophical positions (see Figure 12.3).

Hopefully we have made a reasonable case that the use of different research methods in design does not prevent us from being able to compare or discuss the results of research conducted under different methodological auspices. However, it does highlight the degree of care that must be taken with such comparisons. Researchers may cite many of the same sources approvingly and share a topic of investigation, but that offers no guarantees that they are studying the same thing, or that their results are comparable or cumulative. Research that measures emotions through self-assessment Likert scales are not investigating the same phenomena as research that measures emotions through people's physiological responses (e.g. heart rate or skin conductivity). Concepts such as 'emotional response' or 'stuckness' are not phenomena that are just 'out there' waiting to be examined. Our concepts are transformed into phenomena by researchers who decide, for their present purposes, what slices of the world will be taken to

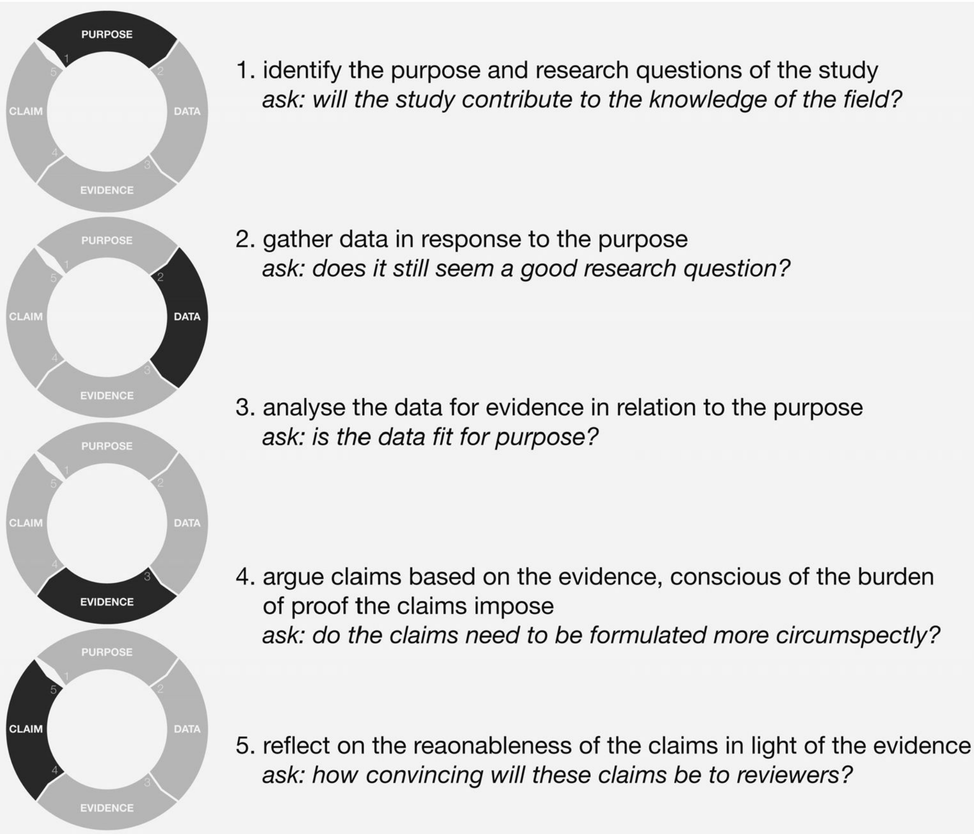

Figure 12.3 An approach to pursuing considered design research that avoids the methodological mire, drawing on the two paths outlined above

count as an instance of 'emotional response' or 'stuckness'. And those decisions are methodological and epistemological. No claim to be allied with a certain philosophical stance or methodological position can serve as shorthand justification for taking a particular approach to study a phenomenon. We are all (researchers and citizens alike) epistemologically accountable, and nothing can spare the readers of research from the task of looking, seeing, thoughtfully considering and critically assessing the reasonableness of the decisions researchers have chosen to make. In this way, all design research is comparable, and the important comparisons can be made on the basis of surface features of a study: what kind of data, for what purpose, in support of what strength of claim. Important methodological differences do not need to descend 'all the way down' to figureheads such as Karl Popper and Paul Feyerabend.

We are also hopeful that such an approach can lead to an abandonment of paradigm wars that result in dismissive treatments of other forms of research solely on the basis of allegiance. Instead such an approach might open dialogue about different methodological possibilities, lead to greater methodological transparency and more comparative discussions of the often contentious issues that relate to philosophical paradigm and method. Design research is diverse, and there are no signs it is growing less divergent. In this chapter we have tried to outline two strategies to aid practising researchers in making sense of, and navigating, our collective methodological plurality.

Notes

1 Technically, 'methodology' refers to the study or analysis of methods and their underlying principles. However, the term suffers from frequent (mis)use as roughly synonymous with 'method'. This is exacerbated by the fact that in English, 'methodological' is an adjective used for both nouns 'method' and 'methodology' (Merriam-Webster 2014). Phrases such as "methodological error" commonly refer to, e.g. an error pertaining to the *application* of methods, rather than to the *study* of methods. Clearly, this adds to the confusion. In this chapter we use 'methodology' to mean the analysis of methods, but there is not an acceptable alternative to 'methodological', which we predominantly use in its 'pertaining to methods' sense. The 'methodological mire' is the bog concerning methods, their choice, and their foundations, not a mire concerning their study per se.

2 Note that at least three of the major philosophical movements in twentieth century Western philosophy have opposed foundationalism in different ways, specifically strands within pragmatism, phenomenology and analytic philosophy following Wittgenstein.

3 It does not appear that respondents were prevented from choosing *not* to perform the task (i.e. they may have been able to elect to rate *none* of the puppets), but this is not an option visibly provided by PrEmo or encouraged by the visual design of the task.

4 And indeed, this is one of several objections that Desmet has anticipated and discussed, and he has justified his methodological decisions in light of such concerns. We are unable to do justice to the depth of the methodological alternatives he has surveyed and thoughtfully considered in his development of PrEmo. Readers are directed to his original work, which stands as a model for the rigorous development of an experimental tool.

5 For example, Schön (1983) does not provide a knockdown proof that 'technical rationality', the idea that problem solving is made rigorous by applying scientific theory and techniques, is patently false. He marshals a set of examples from the professions, philosophy, education and elsewhere as a device for building a *reasonable case* that formalisms are not adequate to the task of addressing the problems that beset the professions.

6 Thus, when acting as reviewers for conferences and journals, we don't only need to assess the merit of a research contribution against the evidence we have been shown, but also against the state of the art of the field and sometimes related fields.

7 As we have done earlier with Desmet, we must similarly acknowledge that we are underselling the value of Sachs' paper by rendering it in this fashion. Indeed, the claim of hers we are scrutinising is not (in our own estimation) even the most important contribution of the paper, it is merely the most visible claim. Perhaps the most important contribution of Sachs' study is in the way it qualitatively

dimensionalises different phenomena of 'stuckness' and their causes, as those phenomena have been experienced and understood by the students themselves.

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13

THE ROLE OF PROTOTYPES AND FRAMEWORKS FOR STRUCTURING EXPLORATIONS BY RESEARCH THROUGH DESIGN

Pieter Jan Stappers, Froukje Sleeswijk Visser and Ianus Keller

Introduction

The relation between design and research is rapidly maturing. For one, research methods have become an accepted, even standard, part of design practice and (academic) design education. But equally important, there is a growing number of researchers who have a background in design, and who make active use of their design skills in research projects. This chapter is based on a series of design research PhD projects, carried out over the past decade at ID-StudioLab in Delft University of Technology in which designing played a prominent part in the research.

The goal of this chapter is to describe how, in each project, a series of studies achieved a coherent unity, as is needed for a PhD thesis. Within established disciplines, this unity is often achieved by working within a theory. In design research, the unity can also be achieved by a commitment to achieving an improvement in the phenomenon under study, where either a designed prototype or a flexibly defined framework provided the central focus of the work. The principles of this may hold for other disciplines as well, especially exploratory engineering research, but we have not found guidance for it in the – admittedly limited – overview that we have of that research literature. We indicate how the prototype and framework served as a conduit to guide the project, and provided a base for later projects.

Research and design – a tension

Research and design share similarities, yet are at odds with each other (Cross, 1982; Archer, 1995). On the one hand, both show an iterative development leading to an increase, either in understandings or the number of solutions. On the other hand, much research is aimed at understanding the past or present (with the hope of putting that knowledge to good use later), whereas design is aimed at constructing a possible future (that may not exist yet). This difference is reflected in the results of the projects, with research typically yielding knowledge about the present (and possibly speculation about possible applications in the future) and design typically leads to concrete solutions for specific situations (and possibly an indication of broader applications). And similarly, it is reflected in the type of questions that are asked. In our experience, designers are eager to ask 'how (to)', whereas scientific handbooks direct the researcher to ask 'what is'.

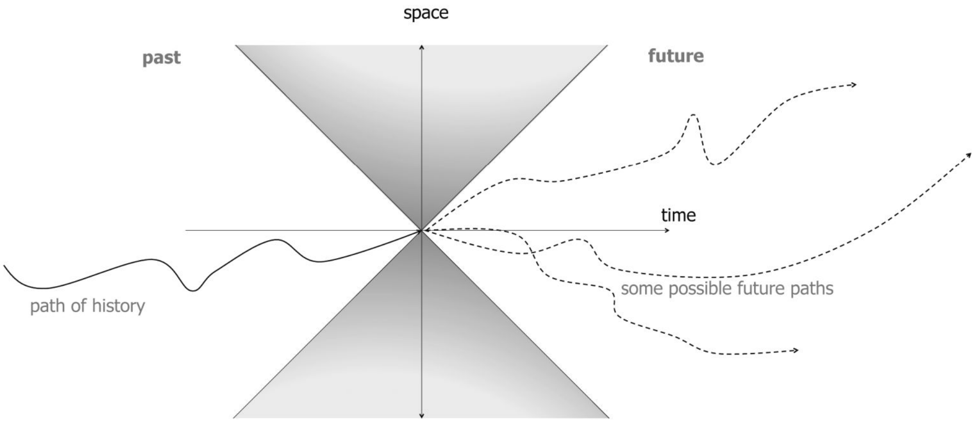

Figure 13.1 A space-time diagram depicting past (a single path) and future (a set of possible futures). Designers, more than classically trained researchers, aim to find or create possible (desirable) futures, rather than precisely understand past or present for its own sake

With the advent of a new generation of researchers, namely researchers with a basic training in design methods, and a mindset that is future- and solution-oriented, we see new types of research being done.

This contrast between research and design is similar to the apparent contrast between basic and applied research. Stokes (1997) pointed out that the accepted paradigm of viewing research distinguished fundamental (a.k.a. 'generalisable', 'basic') and applied (or rather 'application-oriented') research are opposites on a single dimension. The idea was that on one extreme, basic science (exemplified by Niels Bohr, the father of Quantum Mechanics) sought generic knowledge and truth, and on the other extreme, applied research (exemplified by inventor-entrepreneur Thomas Edison) sought only direct, practical application and use. There was a variety of types of research in-between these extremes, but attention to generalisability always went at the expense of attention to application, and vice versa. Over the past half century this view has dominated popular thinking about research, and that of policy-makers and many scientists themselves.

Against this, Stokes argued that generalisability and application can actually go together very well, and exemplified this with the example of Louis Pasteur, whose work both brought applied results in the form of vaccines, and who founded the field of microbiology. In this type of research, which Stokes labels 'Pasteur's Quadrant', both generalisability and applicability are valued. This double attention – to generalisation and application, to past and future, to understanding and solution – seems to fit very well the promise of designers doing research projects.[1]

Design as a part of research – a historical reflection

The role that design skills, and design actions, can have in research has recently received growing attention. In this the prototype, and instantiation of the designed idea, has taken central stage. Zimmerman et al. (2007, p. 493) emphasised that designers are able to make "a product that transforms the world from its current state to a preferred state", and open up that new state for empirical investigation; Stappers (2007) indicated that 'the act of designing' itself is the locus where new ideas get constructed by confronting technology, theory, and phenomenon (that what happens in the world), and many of these confrontations take place before the prototype has matured into a testable thing (see also Koskinen et al.'s (2011) review of recent developments in designers doing research, especially in Northern Europe and the USA).

To clarify the position of research through design, it is helpful to briefly sketch the historical development of design research at the Faculty of Industrial Design Engineering (IDE) of Delft University of Technology from the viewpoint of the first author. This development can be viewed from the survey that Horváth (2007) made of types of research at the Faculty, on the basis of 100 PhD theses. Horváth noted that, regarding the methods used, design research was wedged in-between basic research conducted in established disciplines such as physics or psychology, and design practice in industry (see Figure 13.2). At IDE, he found he could classify the PhD projects in three types: research in design context (using methods of basic research, but applying these to design content); practice-based design (reflecting on design projects, and drawing generalisations from that experience); and between these two design-inclusive research, in which design actions form a necessary ingredient of research. It is in this middle field that research through design fits in, but not necessarily filling that whole field.

This middle field took shape around the late 1990s, early 2000s. Before that, most (PhD) researchers at IDE had received their research training from other disciplines (physics, engineering, psychology). They published in their 'home journals' and tried to make their research relevant for designers by using design activities or designed products as objects of study. The first author distinctly remembers how satisfied he and his colleagues were that 'design students are so useful for making good stimuli for psychological experiments'. Not only could they produce stimulus material of high aesthetic quality, but often the stimulus material thus produced required the researchers to reconsider their experiment, as it brought out new perspectives on the research question.

As this development continued, the design step evolved in importance and complexity, but most often as a modular step within classic experimental method. In this approach, designing is seen as the art of making a stimulus (prototype) that instantiates the hypothesis that was generated from theory. This move, labelled the 'theory driven inflow' from basic research to design-inclusive research involved a change of object of study, and heightened designerly attention to operationalising a hypothesis into stimulus materials, but the scientific-thinking and design-doing can be maintained as separate activities. And often, these are carried out by different people.

At the same time, a second development happened, driven from the opposite side, labelled 'phenomenon-driven inflow' in Figure 13.2. This featured designers exploring a new phenomenon by primarily going in and doing it, observing and reflecting as they went along, and in the interaction surveying which literature from which disciplines helps to understand, frame, and improve the prototype. It is this latter type we label 'research through design'. The difference between research through design and practice-based research lies in the goal of the work that is carried out: in the latter, the goal of a project is a product, and insight is a spin-off, while in the former, the goal of the work is to gain knowledge by exploring a phenomenon, even if a product might result as a side effect (Horváth, 2007).

The difference in the middle column of Figure 13.2, between top and bottom, lies in the role of designing, and the place of theory and phenomenon. In design-inclusive research, the design action is a necessary step between hypothesis and stimulus, but one which is separate from knowledge generation: one person (the researcher) might generate the hypothesis and test it with the stimulus using the regular methods of experimental research, whereas another person (the designer) might design the stimulus, given the hypothesis as a given set of constraints. In research through design, the design action is essential to the knowledge generation, and carried out by the designer-researcher him- or herself. Where the former can be seen as theory-driven

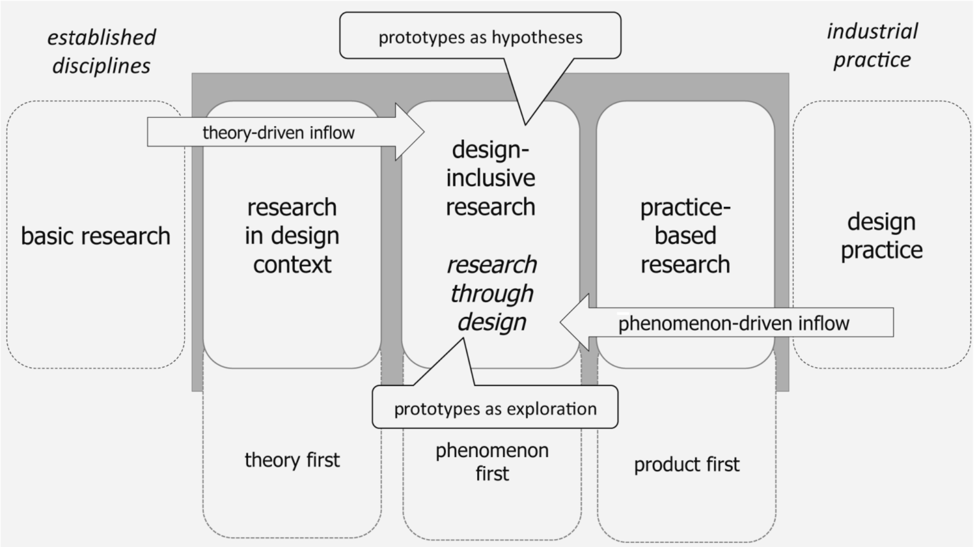

Figure 13.2 Types of research

Source: Based on Horváth (2007)

and hypothesis-testing, the latter is phenomenon-driven, and most often explorative in nature.

In this paper we focus on explorative research using research through design, because in these we have seen the strength of doing design as a part of doing research (Stappers, 2007).

Research through design: the role of prototype

As mentioned above, we use the term research through design to indicate studies in which knowledge is generated on a phenomenon by conducting a design action, drawing in support knowledge from different disciplines, and reflecting on both the design action and an evaluation of the design result in practice. Moreover, we look at PhD research projects, which consist of a coherent series of such studies, exploring a phenomenon, and simultaneously yielding both generalisable knowledge and practical application.

To avoid losing our readers (and ourselves) in abstraction, we look at two examples of such PhD research projects. In this section we look at one guided by a research prototype, in the next section we look at one guided by a framework.

Ianus Keller's PhD project identified the phenomenon of study as "the way designers use informal collections of visual material that they keep as part of their professional practice" (Keller, 2005). Our research group at the time was working on interaction design and creativity, and moving from "creating cool visions of design tools for 2050" to developing tools and techniques to help design practice in the short term (Stappers et al., 2007). Ianus' work started with a review of theory, one of technology, and a contextual study of how designers use visual materials in their current practice, which at that time was undergoing vehement changes as computers were becoming the basic design tools for manipulating images, but not yet useful enough for managing them. From this threefold exploration, the phenomenon was bounded more sharply to how designers keep their collection of visual materials they use for inspiration and information in design processes, and how can this be improved (Keller, 2005). Next step was to get our hands dirty and our feet in the mud by developing a prototype of a tool that would bring this improvement. The tool was called *Cabinet*, short for 'Cabinet of curiosities', after the nineteenth Century's collections that wealthy amateur scientists kept for information and inspiration.

In this project, the technological possibilities and the design practitioners' immediate needs were important in demarcating the boundaries of the prototype that could be realised, and thereby constrained the questions posed in the research. The initial literature review (see Figure 13.3, middle) had indicated a number of areas of knowledge that might be valuable to frame the phenomenon under study, among them library science and database theory (understanding collections), media theory (visual materials), design processes, and creativity (the purposes for which the collections were kept). On the basis of the feasibility for prototyping, some of these areas were placed outside the frame. For instance, database theory was discarded, as we estimated that a realistic prototype would have to be made from the users' own collections in intense visual interactions, and most database theory dealt with typically large collections of a symbolic nature. What you can study helps to frame the phenomenon.

The research progressed through a number of stages: after exploration, the prototype was developed and during its development it was continuously tested with members of the ID-StudioLab research community as test subjects and critical participants. After several iterations and improvements, the prototype was deemed 'fit for duty' and set out at design offices in practice for four-week practice trials. Also in this last phase, there were expectations ('they use it for storing and organizing', 'they use it in presentations and for random inspiration'), but not in the form of hypotheses to be tested. The 'how' was more important than the 'what'. The results of the studies were formalised and published in journals and conferences, but we noticed another factor in forming our growing insight: the importance of repeatedly presenting the prototype to different audiences. Throughout the project, versions of the prototype were shown to people who visited the lab (see Figure 13.3, left). Some of these were researchers in our field, some had different research backgrounds, some were design practitioners, students, other colleagues or family. Having to explain the prototype, its goals, technical principles, and examples of how it worked each time for a different audience played an important role in gaining insight, and gave interesting feedback and connections from different perspectives. Not only on the level of the study ('could I also animate the pictures for use in a presentation?') but also at the level of research method: many people asked when the product would be available, mistaking the research prototype for a product under development rather than a tool for generating insight. This illustrates the boundary between practice-based research and research through design as described in the previous section.

The series of prototypes anchored the focus of the research, and determined the scope. What was or was not possible to 'bring to life' with the prototype was a de facto framing of the phenomenon under study. Elsewhere, the roles of prototypes were summarised as (Stappers, 2013):

> Prototypes are unfinished, and open for experimentation; they are
>
> - a way to experience a future situation,
> - a way to connect abstract theories to experience,
> - a carrier for (interdisciplinary) discussions,
> - a prop to carry activities and tell stories,
> - a landmark for reference in the process of a project.
>
> Prototypes force the researcher to confront theory, confront the world, they evoke discussion and reflection, change the world, and can be used to test a theory.

Note that the last item 'to test a theory' fits the design-inclusive research type of hypothesis-testing evaluative research (see previous section), whereas the others are more generative, explorative, and descriptive in nature.

Lessons drawn from this project were:

- your prototyping ability constrains the phenomenon that you can study;
- not only the phenomenon, but also the qualities of the prototype constrain the areas of theory that can be brought in;
- along the development (see Figure 13.3, right) many insights and decisions are made that never get reported; some of these can be picked up by others, as the prototype embodies them; but many evaporate as we do not have the means to capture them sufficiently, or cannot reach an audience that can work with this, often partial, knowledge; and
- knowledge can come on different levels simultaneously, e.g. how the technology works (e.g. making images interactive), how the prototype is used (the phenomenon under study), how the research is conducted (by placing the prototype in everyday work conditions). On each of those levels, knowledge was generated.

Research through design: the role of frameworks

In the case described above, the phenomenon, operationalised and bounded by the envisaged prototype, served to guide the different steps in the research. In this second case, a conceptual framework, built on both an initial hands-on exploration of the phenomenon, and a broad search for promising theoretical constructs, which might have provided that guidance.

Before starting her PhD project, Froukje Sleeswijk Visser had worked on the contextmapping method of user research (Sleeswijk Visser et al., 2005). In her experience with using the method in industrial practice, she noted that a bottleneck of applying user research in industrial practice lay in communicating the research findings in a way that the design teams could use. For that reason, she chose to aim her PhD research activities towards improving that communication, and conduct the research through a series of case studies in industrial practice. Doing the research in industrial practice was done primarily to increase relevance: it served to get realistic data, but also to guide the research questions towards knowledge that would be applicable in practice in the short term. As with Keller's cabinet prototype, we expected that our ability to handle the

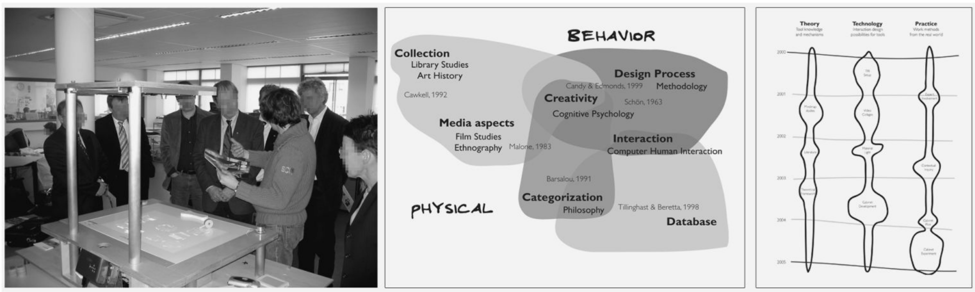

Figure 13.3 Images from Ianus Keller's Cabinet study. From left to right: a demonstration of the prototype; a map of domains of theory affecting his topic; and the co-development timelines of theory, technology (prototype), and interactions with practice during the project

Source: all pictures from the thesis (Keller, 2005) technology (graphic design, formats for interactive workshops, and company-wide websites) would form an important part of the knowledge that we could generate. But in this case, a research framework was chosen to guide the work, as shown in Figure 13.4.

The framework contained three levels, as shown in Figure 13.4, which connect the means (technologies mentioned above) and ends (communication goals) by exploring the mechanisms that connect these.

At the top of the framework are communication goals, derived from experience with the contextmapping method (top level), then psychological factors which were expected to play a part (middle level), and concrete communication content, forms, and process plans (bottom level). Figure 13.5 presents the fieldwork through eight case studies, sandwiched between an initial framing which showed the three levels, and a filled-in frame in which the levels were filled in, and in which a number of relations between the levels were discussed.

Whereas with Keller the physical prototype served to guide the research by determining what phenomena it could ‘bring to life’, with Sleeswijk Visser there were several smaller prototypes, and filling the framework guided the approach in the separate studies. In most of the studies, user research was done with the contextmapping method and new methods were explored to share the findings with the product development team. Some studies addressed working formats for presentations of findings, collaborative ways of using findings to generate

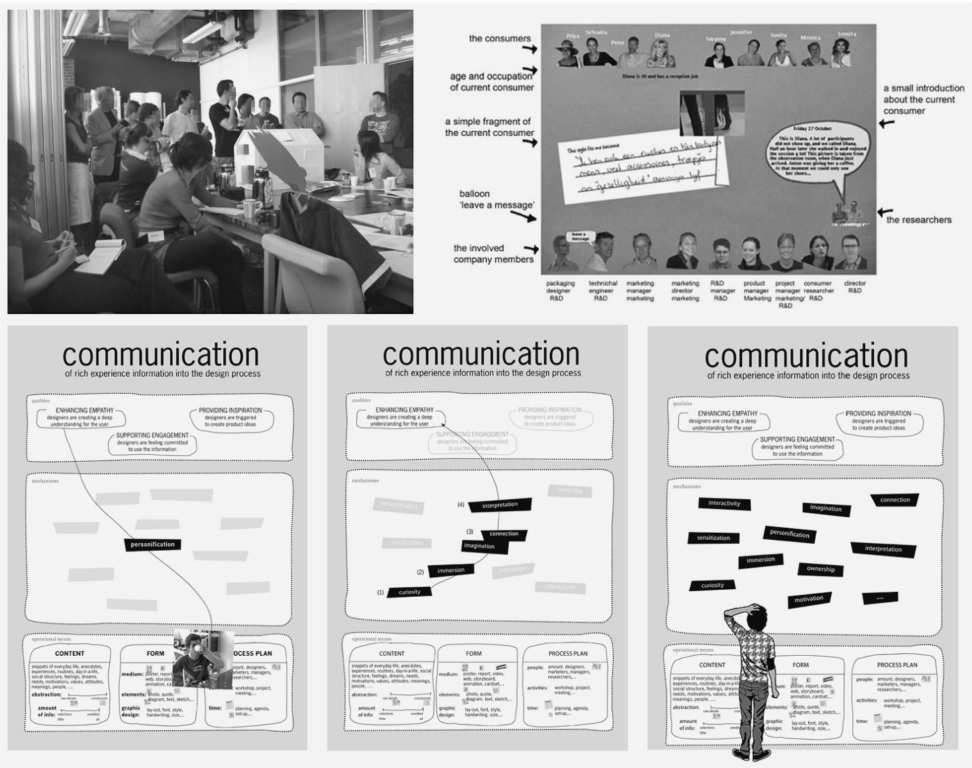

Figure 13.4 Top: communication formats used in Sleeswijk Visser’s studies; left, a workshop format; right, a web-based format. Bottom: three stages of the communication framework, from left to right: research plan, identified connected factors, and factor map

Source: images from the thesis (Sleeswijk Visser, 2009a)

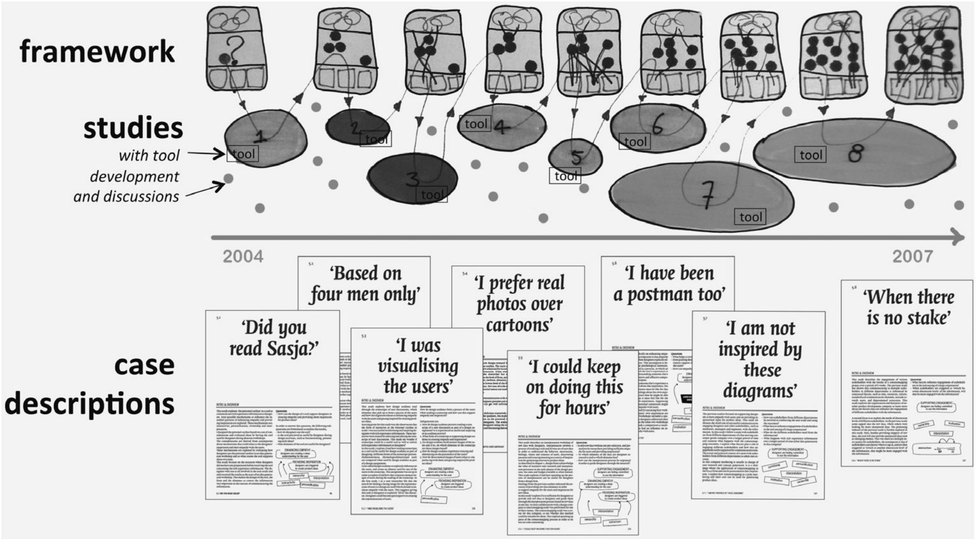

Figure 13.5 How the sequence of case studies filled the framework – the eight pages shown in the lower half from left to right are the title pages of the chapters describing case studies one to eight in the upper half; the sprinkling of dots in the upper half represent numerous small interactions, discussions, and informal observations that contributed to the framework

Source: Sleeswijk Visser, 2009a

and develop ideas, and ways to use internet technology to involve different parts of a company in the data analysis, findings generation, and concept development stages (for more details, see Sleeswijk Visser, 2009a).

The framework helped to 'fill the holes' set out at the beginning. It helped distinguish which design actions were part of the core of the research (aspects of communication), and which were spin-offs (specific findings about user groups, ways of analysing user research data to produce insights for communication), and pay attention to the three levels of abstraction (communication goals, psychological mechanisms, and design parameters) and their relations.

And again, the methods under development were intensively demonstrated and explained to audiences in courses, masterclasses, and workshops, especially to design students and design practitioners keen on learning contextmapping and its application. Having to explain the communication methods to these audiences helped to strengthen the framework and the connections within it. And again, there was a difficult hurdle in communicating what 'the research' was about, because the term 'research' appeared on two levels: (1) 'research about user experiences' and (2) 'research about how to best communicate findings from (1)'.[2]

Sleeswijk Visser (2009b) compared her research approach to existing approaches in art and design and in the social sciences, notably practice-led research (Nimkulrat, 2007), action research (Avison et al., 1999), and grounded theory (Glaser & Strauss, 1967). Each of these approaches has similarities to research through design as described here, but none of them fits exactly. For instance, practice-led research stresses the communicative value of the designed object as a carrier of knowledge (in this project communication tools and techniques were the designed objects). Action research provides methodological support in the way it accommodates end-user involvement, but whereas action research focuses on iteratively improving a concrete situated practice in one organisation, the research through design studies do not focus on a single organisation, but each study serves to explore a part of the frame. Finally, grounded theory provides support in developing insights bottom-up from the phenomenon, rather than having to commit beforehand to one specific theoretical perspective. It embraces the openness of the researcher in relation to the phenomenon and provides room for the research's interpretation as part of the data collection.

Sleeswijk Visser concludes that the framework guided the research journey as a process of discovery, rather than evaluation. The structure of the thesis, as shown in Figure 13.5, shows how the framework supported this. On the one hand it provided a set of 'holes to be filled through exploration', on the other it allowed the author to separate the rich description of the case studies from the description of the general findings in the framework. The framework, as it were, served as a meta-level leading the reasoning through the sequence of individual grounded case studies. The framework also allowed her to position the tools that were developed for the cases into a coherent whole. Because many of these tools were copied and modified in practice, the framework could serve for practitioners as a way to find the rationale and evidence behind the tools.

Discussion: connections and spin-offs

In the two sections above we outlined how both prototypes and frameworks can help guide explorative research: prototypes through giving a physical instantiation of a phenomenon, frameworks by placing a phenomenon in a conceptual perspective. In the examples, both these means were present, albeit with an emphasis on the prototype (Keller) and framework (Sleeswijk Visser). Both give direction to the research, help to focus attention, and demarcate the boundaries of interest. Both give rise to concrete experiences, connect to possible applications, and fit well into the practices, cognitive repertoire of design skills.

One important thing of the framing, both through prototype and framework, is that the phenomenon under study is clearly marked, and spin-offs can be given a place. As Keller (2005) stressed in evaluating the Cabinet project, serendipity plays a large role in engaging with the world in a designerly manner: regularly there are findings which are clearly valuable, but do not fit the question in a particular study. What should be done with these? If the findings are sufficiently interesting and complete, the framework may be adjusted, or a spin-off publication may be produced, e.g. on research methods, or promising side-effects. But most of the spin-off insights that come about while doing design as a part of doing research get lost, they 'evaporate' again as the project continues. Here, both prototypes and framework can help by giving a place where these insights can be anchored, either in concrete experiences (with prototypes) or future promising conceptual areas for exploration (frameworks). At ID-StudioLab itself we noted such follow-ups, where sparks generated from one project were kindled into fires for another. Daniel Saakes (2010) further developed projecting material qualities over physical objects, building on playful explorations during the development of Cabinet; Carolien Postma (2012) and Helma van Rijn (2012) further developed methods of designing with user research extending the contextmapping method; and several others are currently further extending these findings, even though the above-mentioned projects were not part of, say, one larger planned project.

This shows how progress in design research is not just furthered by published theories, but that prototypes and frameworks help to channel the view on phenomena, and serve as 'an institutional memory' as communication between researchers as well. On the other hand, it can also show that the field of design research is as yet not mature, and progresses still more through series of cross-pollenating single explorations, rather than through an academic research agenda with grand theories and questions. Other scientific fields, such as biology and physics, have also gone through such phases some centuries ago, as the cabinets of curiosities illustrated.

Conclusion

More than other types of research, research through design is in need of structuring its approaches. Where most other types of research can fall back on theory-driven paradigms and the basic scientific method, research through design has the promise of using the design action as a knowledge-generating step. As long as design is a modular step between precisely formulated hypotheses and material stimulus, research is 'business as usual'. But if the design action is to bring its value as a knowledge-generating step in itself, i.e. not the result alone, but also the reflection on the design decisions in the process bring value, then the act of designing is not an outsourceable job, and we need ways of sharing insights gained from design action. The field is only recently beginning to find ways to do this (e.g. Brandt & Binder, 2007; Höök & Löwgren, 2012).

Doing so is not easy. Not for nothing are the early phases referred to as 'the fuzzy front end', as it depends on ideation, creativity, reflection, making, trying, and association rather than linear logical argumentation.

But doing so is not without precedent. Many of the breakthroughs in the history of science have been made by people who were dealing with practical, applied issues: both Newton and Huygens were working on clocks for navigation at the time that they developed their theories; the Wright Brothers developed methods and principles of measuring, and ways of reframing the problem of flight, as well as constructing a flying machine. Their scientific worth was not just that they developed a theory that had design applications, but that they conducted design-relevant explorations from which they drew lessons that went far beyond the single clock or airplane.

The traditional methods of science have not been without criticism from philosophers and historians of science. Feyerabend (1993[1975]) argued that no single method could suffice to explain scientific development in the past, and Harré (2002) showed the huge variety of ways in which the great breakthroughs in our understanding have taken place. This is not to downplay the value of thorough validated experimental studies based on theory, but to point at the fact that our academic publishing culture has often emphasised the testing and proof of new ideas and regarded the generation of those ideas as unexplainable, magical, or non-interesting. But this is the area in which design research can probably be strongest: showing that something is *possible* (rather than necessary), where that was not obvious before (e.g. putting a man on the moon), constitutes knowledge that is already of value, i.e. an existence proof. The state of that prior belief (whether we could put a man on the moon) determines if that existence proof is sufficiently useful, or whether we must prove that we can put every man on the moon. As always, it depends on the purpose for which we need the knowledge.

Within explorative research, finding such possibilities that were not obvious before is key. There, having a framework for one's efforts, e.g. a PhD research project, helps connect the phenomenon to what we know about it, where we see connections to other pieces of knowledge, and where we see holes in that knowledge that we can fill. The framework is formulated at a larger scale than an individual study. It helps to direct development of interventions and prototypes, to separate and distinguish findings and spin-offs, and it provides a perspective for fitting findings to relevant disciplinary areas of literature. We believe that this has at least pragmatic uses in conducting a (larger) exploratory research project, whether in design research or elsewhere, but especially projects invoking design skills as part of the research method.

Acknowledgement

We thank the colleagues of ID-StudioLab for their constant engagement and willingness to discuss and try out prototypes and methods.

Notes

1 The discussion here is simplified to make a point. Several authors have discussed how scientific work is complex and does not fit a single mould. An inspiring introduction on the variety of methods of discovery, proof, and exploration, is Harré's *Great scientific experiments* (2002), describing 20 important and very different experiments in the history of science, challenging a simple explanation that science is done according to one single approach.

2 The difficulty of separating levels of research, design, and use is discussed in Stappers & Hoffmann (2009).

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14

THE ROLE OF EXPERIMENTAL STUDIES IN DESIGN RESEARCH

Philip Cash and Steve Culley

Introduction

In the context of design research, experimental studies play a key role, accounting for a significant number of research publications in journals such as *Design Studies*, *Research in Engineering Design* and the *Journal of Engineering Design*. Further, design experimentation has been used extensively over the last 40 years (Cross, 2007). Recent examples include Bar-Eli's (2013) work on sketching, Corremans' (2009) work on design methods and Cai et al.'s (2010) work on sources of inspiration. Experimental studies form a fundamental part of design research by supporting both theory building and theory testing whilst also providing a flexible and readily accessible research approach (Stempfle and Badke-Schaub, 2002). However, with this increased popularity and more extensive scope of use comes the ongoing issue of ensuring research quality and effective implementation in, what frequently are, ever more complex situations (Blessing and Chakrabarti, 2009).

In this context there seems to be both a perceived and an actual lack of scientific rigour, particularly with regard to the use of experimental methods from other fields and the application and development of effective, field specific, experimental research methodology. This has been highlighted by a number of authors over the course of design research history, including Dorst (2008), Blessing and Chakrabarti (2009) and others (Finger and Dixon, 1989a, 1989b, Reich, 1994, 1995). As the field has developed, so too has the complexity of the studies being undertaken and so developing and using effective experimental methods has become critical to the future of rigorous design research. It would seem that the improvement of experimental methods has been hampered by a lack of field specific discussion and development (i.e. methods developed within the context of, and specific to, a distinct field of research). Throughout this chapter the following definitions have been used to delineate the scope of the discussion (Oxford, 2010):

- *Experimental studies* – the action of putting anything to proof, often arbitrating between competing hypotheses.
- *Experimental methods* – the characteristic set of procedures employed (more or less systematically) as the primary mode of investigation in experimental studies.

This lack of field specific discussion has been consistently highlighted as a key issue (Ball and Ormerod, 2000, Reich, 1995, Antonsson, 1987, Dixon, 1987), with these authors stressing the need for field specific development of methods, methodology and theory. With this increasing scope and lack of field specific development comes a number of methodological issues (Cash et al., 2012). Specific to experimental study are three key issues:

1 The complexity of the dynamic effects on human behaviour in the research context. This is manifested in the form of detrimental *experimental effects* (see following main section), which affect all aspects of human behaviour in a research setting. This issue is further confused by the Hawthorne effect – a term used extensively in related fields to describe the general result of experimental effects but not a specific effect itself.
2 The difficulty in controlling for subjectivity and other experimental effects. This issue has led to the development of *placebo controls* (see second section below) in many of the fields closely related to design research.
3 The problem of linking experimental study to reality (Cash, 2012). This issue is underpinned by the difficulty in establishing the external validity of discreet experimental studies when examining complex multifaceted phenomena. This can be characterised as *linking laboratory and practice* (see third section below).

This chapter presents a discussion of the three issues with respect to current design research practice. As such, the three main sections reflect on each of the issues above with the aim of examining the following questions:

Experimental effects

- What are experimental effects in the context of experimental design research?
- What is the Hawthorne effect and how does it apply to the design research field?
- What are the main experimental effects that the design researcher needs to consider when planning a study?

The placebo control

- What is the placebo control and why is it important in the context of design research?
- What are the placebo control's key characteristics and how can it be applied?

Linking laboratory and practice

- How is experimental study related to the wider research process?
- What are the main approaches for linking experimental study and practice?
- How can these approaches be characterised in the context of design research?

Experimental effects

The study of designers plays a key role in design research. However, the act of studying human subjects has a range of effects on their behaviour, whether the study is observational or experimental (Kazdin, 1998). Further to this, there can be confusion when deciding which elements from other fields should be adopted when designing a study (Ball and Ormerod, 2000, Reich, 1995). In addition, effects on participant behaviour due to study design are often not considered in design research. This tends to have the effect of limiting the understanding of underlying variables in complex systems (Goldschmidt and Tatsa, 2005, Cross, 2004) and may lead to the inappropriate selection of control conditions (Cash et al., 2012).

In this context, these are termed experimental effects and a key area of study in many of the fields where human subjects are a primary source of information (Patton, 2001, Glasgow and Emmons, 2007, Winter, 2008). As such, this section undertakes a brief exploration of these experimental effects and what researchers need to know when coming across them for the first time.

Within the range of experimental effects the Hawthorne effect is one of the most commonly referenced and also one of the most difficult to deal with. This difficulty arises from the fact that the Hawthorne effect is a term that, although proven to be defunct (Taris, 2006, Adair, 1984), is extremely prevalent throughout social (Leonard and Masatu, 2006), educational (Adair et al., 1989) and clinical (Verstappen et al., 2004) research. In these contexts the meaning of the Hawthorne effect has evolved to cover a whole range of more specific experimental effects, as described below (Holden, 2001, Falk and Heckman, 2009). However, this subtlety can be lost in translation and, as such, it is important for design researchers to understand what the Hawthorne effect is, and what it is not, in a modern experimental context.

The original Hawthorne effect emerged from a number of studies carried out and interpreted by Mayo (1933). Mayo's analysis found that, seemingly, a subject's knowledge that they were in an experiment generated a change in behaviour irrespective of any active intervention on the part of the experimenter. This interpretation gained widespread acceptance in a number of fields and became a fundamental aspect of experimental design (Macefield, 2007, Adair, 1984). However, nearly 40 years after the work of Mayo, the original findings supporting the Hawthorne effect were overturned, being reinterpreted by Parsons (1974) and others (Franke and Kaul, 1978, Holden, 2001). Despite this, the Hawthorne effect has remained a key term for two main reasons – the depth and breadth of its original adoption (with some researchers still using outdated definitions (De Amici et al., 2000)) and the acknowledgement that such effects do exist, if not in the form originally described by Mayo.

This chequered history of adoption and rebuttal has lead to the current situation within the social, psychological, educational and clinical fields where there is a widespread recognition that significant non-treatment experimental effects exist (Adair et al., 1989, Diaper, 1990, Barnes, 2010) while the specific term 'Hawthorne effect' has become increasingly ambiguous with repeated re-analysis and redefinition (Taris, 2006, Chiesa and Hobbs, 2008). Thus, although the term is common, it is typically used to describe the more general effect of an experiment on the behaviour of the participant without referring to any specific effect type. In this context the design researcher can consider the Hawthorne effect as a 'catchall' type term referring to the multiple interlinked experimental effects which, depending on the study, have varying degrees of impact (Cook, 1967, Diaper, 1990) (although some degree of caution should be exercised as the term is still sometimes erroneously used in its original definition). In this general sense Adair gives a good working definition that can be used by design researchers, stating that the Hawthorne effect can be generally defined as "the problem in field experiments that, subjects' knowledge that they are in an experiment, modifies their behaviour from what it would have been without the knowledge [of being in an experiment]" (Adair, 1984, p. 334).

Although the term is heavily used in other fields it is not yet embedded in the design research literature. Further, even in these fields it is accepted that due to the ambiguity of meaning and imprecise definition of the Hawthorne effect it can no longer be accepted as a definitive description of an experimental effect and should not be reported as such (Barnes, 2010).

Therefore, the authors strongly urge design researchers to make an informed judgement of the term 'Hawthorne effect' given its historical significance and role in other fields but to avoid its use in the context of modern design research experiments. Instead there are a number of more specific terms that have risen up to replace the Hawthorne effect in describing specific experimental effects. These various effects are listed and described in Table 14.1, which brings together reviews from several fields as well as identifying other commonly used terms. Examples of the effects described here can be found in texts such as Rosenthal (1976), Cook et al. (1979), Leonard and Masatu (2006) and others (McCarney et al., 2007, Chiesa and Hobbs, 2008). The placebo effect is included in this table as although it is distinct from experimental effects (being a deliberate effect used for control) it is still sometimes reported or interpreted as a Hawthorne-type effect.

Table 14.1 Experimental effects

Specific effect name	*Description of effect*
Experimenter bias effect or Pygmalion effect	Researchers expect certain participants to improve and reinforce these expectations (Gephart and Antonoplos, 1969, Barnes, 2010).
Novelty	Participants are affected by the novelty of research procedures and modify their behaviour (Gephart and Antonoplos, 1969).
Awareness of participation	Participants are affected by awareness of the research process and modify their behaviour (Gephart and Antonoplos, 1969).
Altered social structure	Participants interact amongst themselves and the researcher and modify their behaviour (Gephart and Antonoplos, 1969).
Hypothesis awareness	Participants become aware of the hypothesis and modify their behaviour (Adair, 1984).
Knowledge of results	Participants become aware of the reporting of their performance and modify their behaviour as a result (Gephart and Antonoplos, 1969).
Demand characteristics	Participants' perception of their role in a study lead them to attempt to modify their role in the study (Gephart and Antonoplos, 1969).
Halo effect or social desirability	Participants feel the need to disguise negative behaviour or emphasise positive behaviour (Green, 1977, Podsakoff et al., 2003).
Learning effect	Participants give more thought to the subject based on the research questions and attempt to give 'correct' answers (Barnes, 2010).
Contamination	Participants improve performance not only for topics under study but also for related ones (Verstappen et al., 2004).
Message contamination or leaking effect	Participants learn of the intervention and are indirectly exposed to the intervention (Verstappen et al., 2004, Barnes, 2010).
John Henry effect or compensatory rivalry	Participants indirectly learn they are not receiving the intervention and compensate for this lack by improving their behaviours (Barnes, 2010, Adair, 1984).
Placebo effect	Control participants' interactions with specific procedures affects their behaviour altering the performance of control subjects (Gephart and Antonoplos, 1969).

These effects have a significant impact on studies involving people and must be accounted for either in the design of the study or through the use of control and normalisation (Diaper, 1990, Cook, 1962). This leads to the question – how can such a wide range of effects be controlled and taken into account? In this context one of the most effective and well-proven ways to mitigate these experimental effects is the use of a placebo control condition (Kirk, 2009), which will be explored in the next section.

The placebo control

The use of placebo control techniques forms an integral part of many studies involving human subjects and is regarded as a methodological 'gold standard' in fields including: social, clinical and psychological research (Neuman, 1997, Kazdin, 1998, Tashakkori and Teddlie, 2008). The placebo has achieved this status by being one of the most effective means for mitigating the experimental effects, outlined in the previous section (Kirk, 2009, Leber, 2000, Adair et al., 1990), as well as other effects such as expectancy and classical conditioning (Stewart-Williams, 2004, Kirsch, 2004, Price et al., 2008). Further, placebos can be used effectively in both large-scale studies and complex, small sample-size studies similar to those encountered in empirical design research (Torgerson et al., 2005, Wampold et al., 2007). A good working definition of a placebo is given by Colman: "placebo n. An assumedly inactive substance **or dummy intervention** administered to a control group to serve as a baseline for comparison of the effects of an active drug or intervention" (2009, p. 580, emphasis added by the authors).

Placebos have been present in some form in medicine since the eighteenth century, when the term was used to describe an ineffective intervention (Oxford, 2010). However, by the late 1950s this had evolved into the placebo concept used today in clinical research (Wampold et al., 2007, Stewart-Williams, 2004). Other fields, such as psychology and education, rapidly adopted and adapted the placebo control, leading to its use as a powerful control method since the 1950s (Leber, 2000, Adair et al., 1990).

Two key concepts underpin the placebo control: the inert intervention itself (the placebo) and the subsequent effect on the participants (the placebo effect). In this context inert means an intervention that has no active element – as defined by the study hypothesis – but is otherwise identical to the actual treatment intervention. This simulation of the treatment intervention, whilst removing the active element, allows for the isolation of the effect of the active element from any other experimental effects – see the example below.

Placebo example

The recent work of Cash et al. (2012) aimed to test the impact of giving information on the energy consumption habits of users to designers. This was communicated to the participating designers via an ethnographic video administered by the researcher. As such, the treatment intervention was the ethnographic video while the active element was the specific information on energy consumption habits. In this case the placebo condition could be characterised as an edited version of the video with the specific energy consumption information removed and all other variables (e.g. length and tone) kept the same.

The second fundamental concept is that of the placebo effect, describing the change in behaviour displayed by recipients of the placebo intervention. These effects can range from specific physical reactions (Ross and Olson, 1981) to improved classroom behaviour (Eastman and Rasbury, 1981) and are considered to derive from incidental factors associated with the intervention (Ernst and Resch, 1995). These can be characterised as the combined result of the experimental effects described in the section above (*Experimental effects*) and the incidental effects of the experimental procedure itself, e.g. the disruption of watching the video in the example above, or simply the additional interaction with the researchers (Paterson and Dieppe, 2005, Geers et al., 2005). Thus despite being described as inert, the placebo has a clear and demonstrable effect on participants. As such, a placebo can only be considered to be inert with respect to the active element, with the remaining effects of its implementation making up the placebo effect (Moerman and Jonas, 2002, Miller and Kaptchuk, 2008). This isolation of experimental variables is illustrated in Figure 14.1, where a normal no-treatment control, a placebo control and an active treatment are compared. Here contextual variables refer to the overall processes of the study, e.g. setup and general procedure. As shown in Figure 14.1, typical no-treatment controls only cover the incidental contextual variables while the placebo control covers all of the incidental variables, both contextual and related to the intervention. Thus the active variables can only be fully isolated by subtracting the placebo from the treatment condition.

In terms of implementing a placebo control in the context of design research there are several key points to be considered when designing an inert (with respect to the study hypothesis) intervention. Some more examples are given below to illustrate some of the points in actual studies.

1 Establishing what is being tested and therefore defining the active element in the experiment. This is highly dependent on a clear and well-defined hypothesis.

Active element example

Two studies sharing similar characteristics, each used a short film to give information to study participants as their treatment intervention. However, despite this similarity the active element can be significantly different. The active element in study one was the information content of the video (Douglas et al., 1999). Here, an analogues example in design could be the affect different types of inspiration cards (biological, technical, random, etc.) have on a designer's creativity. In study two the active element was the format of the information – video, paper, etc. (Fichten and Wright, 1983). A design example in this case might be the influence the format

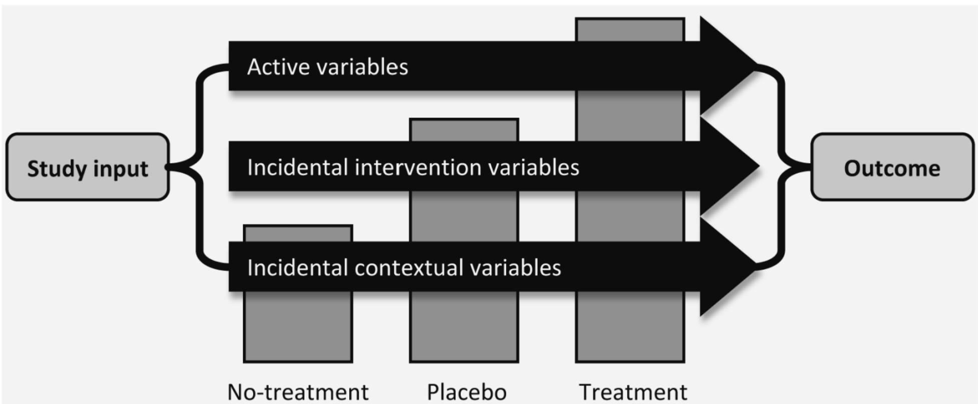

Figure 14.1 A breakdown of the variables assessed by each experimental condition

of a boundary object has on its role in facilitating the communication of engineering knowledge (Carlile, 2002). Thus, despite the similarities between the studies a placebo for study one would be significantly different from a placebo for study two.

2 Establish the context of this active element with respect to the overall experimental setup and the treatment intervention. Identify what the placebo will simulate by describing the treatment intervention in detail and isolating the active elements where possible.
3 Define the inert placebo intervention by mimicking the treatment intervention whilst eliminating the active elements that are under investigation. This can be achieved by replacing the active elements with ones of a similar theme and type (Schinke and Gilchrist, 1985, Fulda et al., 2007, Eastman and Rasbury, 1981).

Inert example

Douglas et al. (1999) identify specific mental health information as their active element, for their inert intervention they use general health information delivered in the same format and with the same level of researcher contact. A similar example in the design domain might be the substitution of specific user-needs information with generic information about the target population during a design exercise (Cash et al., 2012). Further, Smith et al. (2006) identify their active element as specific learning exercises delivered during health visits by nurses. In this case the inert intervention was the introduction of generic healthy eating advice during the periods of the health visit previously used for the specific learning exercises. Here, an analogues example in the design domain might be the testing of a specific design method, e.g. the TRIZ contradiction matrix (Altsuller et al., 1997), verses giving information detailing a generic design process, e.g. the double diamond (Design-Council, 2006).

Due to the difficulty in defining and effectively replacing active elements in the complex situations referred to above, it is important to develop the placebo control through iterative testing. A common issue encountered at this stage is that although the inert intervention successfully mimics the treatment intervention in terms of style, it does not mimic it in terms of participant attention. This can happen when the participants identify the placebo as not relevant and dismiss it. As such, prototype studies and other elements of good experimental design – particularly double blind design – are essential to the effective refinement and implementation of placebo controls. Building on this point it is important to note that no single technique is capable of mitigating all the challenges associated with complex human-focused design research studies and thus the placebo must be considered in conjunction with overall experimental good practice (Erceg-Hurn and Mirosevich, 2008, Song et al., 2009, Mattocks and Horwitz, 2000). Further, there are several factors that must be considered when implementing a placebo as discussed at length by Hrobjartsson (2002). Key points with respect to design research can be synthesised from the literature and are highlighted below:

1 Ethical issues: In particular the administration of inert treatments when working treatments exist – this can be problematic in certain contexts (Puzynski, 2004).
2 Specificity: Placebo conditions must be developed for each study and hypothesis under test (Ernst and Resch, 1995, Louhiala and Puustinen, 2008) limiting the scope of a placebo's applicability (Bracey, 2004, Torgerson and Torgerson, 2003).
3 Complexity: It can be difficult to isolate the active elements if suitable theory (or explanatory framework) is not available or the hypothesis is not clearly defined (Moerman and Jonas, 2002, Miller and Kaptchuk, 2008).

Despite these issues the randomised, placebo controlled trial has become a critical tool for establishing effective experimental control and fundamentally necessary for making causal claims when human subjects are involved (Price et al., 2008, Quitkin, 1999, Riehl, 2006, Adair et al., 1990) – even in extremely complex situations such as those encountered by design researchers (Kazdin, 1998, Cash et al., 2012). However, even where the placebo is effectively deployed there can still be a significant gap between results generated in a laboratory and the ultimate impact in practice. As such, the final area discussed in this chapter will examine how these two disparate contexts – experimental study and practice – can be linked and examined cohesively.

Linking laboratory and practice

The link between laboratory study and actual practice is often complex and multifaceted, leading to difficulty in assessing external validity and applying findings (Eifert et al., 1999, Friedman, 2000). However, this does not diminish the importance of high quality experimentation in the wider research context, as emphasised by Brown (1992). As such, this section will explore the context of the experimental study, with respect to the research process, discuss how external validity can be developed and present a number of approaches for integrating experimental work into a more cohesive understanding of practice.

In terms of the process of developing understanding there are two main elements that can be described: theory building and theory testing (Eisenhardt, 1989). Eisenhardt has developed this work to describe it as a cyclical research process based on replication: data allows inductive theory building, which is then examined by deductive theory testing, resulting in new data and so on (Eisenhardt and Graebner, 2007). Figure 14.2 depicts this process with theory being continually derived, tested and then modified or replaced.

This dynamic process of theory building/testing supported by empirical study is critical to generating meaningful understanding (Carroll and Swatman, 2000) but also in defining and

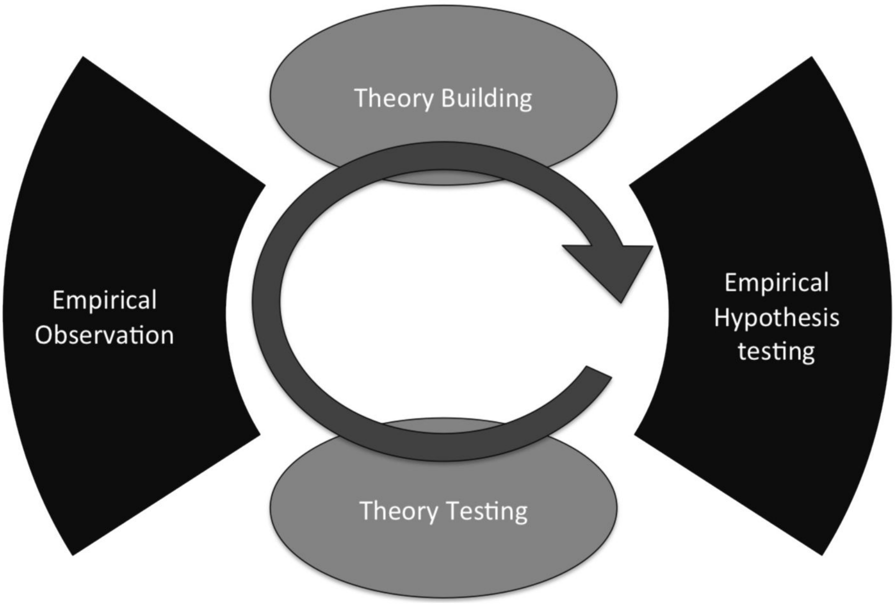

Figure 14.2 The cyclical theory building process

deploying appropriate research methods (Flynn et al., 1990). A clue as to how experimentation fits into this cycle is offered by Snow and Thomas (2007) who distil the process into three key steps for theory building/testing: description, explanation and prediction. These three steps give a process of describing variables/metrics; developing relationships/testing subsequent hypotheses; and predicting future events/testing competing theories, as discussed in detail by Wacker (1998).

In this context experimentation plays a fundamental role in theory testing – particularly in the testing of specific hypotheses related to theoretically identified variables. Similarly, descriptive or grounded studies (Simon et al., 1995) play an important role in theory building. However, it quickly becomes apparent that isolated experimental/observational studies alone are not sufficient when considering complex multi-variable systems, such as those encountered in design research. This is particularly important where individual variables cannot be isolated or tested effectively.

In this sense there is the need for a final bridge between experimental testing of individual variables and application in the multi-variable context of practice (Flynn et al., 1990, Levin and O'Donnell, 1999, Cash, 2012). This is exceptionally relevant in applied research areas, such as design research, where findings must be applicable in real situations where the starting conditions and wider context are often poorly understood and difficult to meaningfully qualify, if at all.

Based on these considerations it quickly becomes apparent that a key driver for research in the applied sciences is building on and integrating fundamental experimentation and the reality of practice (Messick, 1994, Levin and O'Donnell, 1999, Sandoval and Bell, 2004). Both Messick (1994) and Levin and O'Donnell (1999) highlight the importance of extending experimental study into integrated studies in order to fulfil the need for rich, cohesive evidence and to close the loop with practice. This leads to *three main requirements* when aiming to bridge laboratory and practice:

1. Understanding and mitigating subjectivity. In particular Levin and O'Donnell (1999) highlight the problem of research becoming: 'examine, select, prescribe' based on researcher bias rather than evidence.
2. Integrating context into the research process. This is critical for developing generalisability and allowing for re-examination (Jonas, 2006).
3. The need to underpin practical impact with fundamental understanding through rich multifaceted study (Eisenhardt, 1989, Eisenhardt and Graebner, 2007) and explanatory models or frameworks (Dorst, 2008).

In order to fulfil these requirements there are a number of approaches for combining and extending experimental studies. Most significant and well-established of these is the randomised, controlled trial, referred to as the 'gold standard' and considered the strongest form of evidence (Grimes and Schulz, 2002) in clinical research (Kazdin, 1998, Hulley et al., 2007). This type of study builds on a proposed explanatory model to take a representative population and randomly assign participants to either a treatment or a placebo control. These conditions are then administered using a double blind design with results being recorded over significant periods of time – sometimes over decades. It is important to note that these trials do not occur in a vacuum, building on significant laboratory testing of individual elements before being considered ready for trial. This integrated approach has evolved from a research philosophy, which emphasises the link between research and reality (Hulley et al., 2007). Further, experimental effects are important and well-acknowledged in clinical research and have played a key role in shaping methods, such as the placebo control discussed in the section above (*The placebo control*) (McCarney et al., 2007, Taris, 2006).

Taking a lead from this well-established approach in clinical research Levin and O'Donnell (1999) propose randomised trials for education research. In their proposed approach Levin and O'Donnell attempt to synthesise the best qualities of both applied and fundamental techniques by building on extensive descriptive studies of practice and experimental studies of specific variables in the laboratory. They then use these to define cohesive longitudinal trials, which can be effectively deployed in practice. Levin and O'Donnell (1999) developed this into 'CAREful': evidence is based on appropriate **C**omparison, outcomes can be produced **A**gain and again, direct **R**elationships can be established between intervention and outcome, and all other competing explanations can be **E**liminated.

Alternatively, an approach can be generated that aims to explicitly characterise the differences between behaviour in the laboratory and practice in order to directly apply laboratory results. This has been attempted in a number of fields with varying degrees of success. For example, Nordgren and Morris McDonnell (2010) examine how people judge the severity of others' crimes, Bolton and Ockenfels (2008) look at trading behaviour in online auctions and Levitt and List (2007) measure social preferences in the laboratory compared to the real world. Most recently in the design research context Cash et al. (2013) undertook a similar approach when assessing designer activity in a range of commonly studied design situations, including information seeking, ideation and design review. In this study Cash et al. also used an intermediary study between practice and laboratory in order to further link the two contexts.

The use of intermediary studies has been highlighted by a number of authors as a key means of investigating complex situations. Both Bonetti et al. (2010) in behavioural research and Marsden (2007) in education research have adopted the approach of developing intermediary studies – taking an experimental approach into a practice context, while Bolton and Ockenfels (2008) describe this as losing control in a controlled way. Although this approach can be important it is most effective when based on substantive theory, and rigorous explanative models (Dorst, 2008), allowing key factors to be controlled as well as offering predictions to be examined (Levitt and List, 2007), and also used in combination with the other main approaches.

In summary the two main means for bridging the gap between laboratory and practice can be characterised as:

- Extensive longitudinal, randomised, controlled trials deployed in the context of practice.
- Direct comparison of specific events, situations or behaviours in the context of laboratory and practice. These are often underpinned by the use of intermediary studies or combined with the longitudinal trials outlined above.

Although the examples presented are significantly different in their approach, they are by no means mutually exclusive. For example, it has been argued that strong evidence can be generated by running a longitudinal trial with a shallow level of data capture which is supplemented by in-depth experimental studies of specific events or variables (Bolton and Ockenfels, 2008). As such, this would constitute some combination of the two approaches described above, being both longitudinal and directly comparative. Further, as the work of Cash (2012) highlights, there are significant gains to be made in the application of experimental work by integrating multiple methods of study and streams of evidence (building on the ideal of triangulation as described by Denzin and Lincoln (1994)) in order to give a richer understanding of a phenomena in practice without losing the deeper insight available through the study of specific variables in the laboratory.

Conclusions

As highlighted in the introduction to this chapter, experimental studies play a key role in design research, however, there is a critical lack of field specific discussion of experimental methods and methodology. This 'field specific' research issue has been decomposed into three main areas – *experimental effects*, *the placebo control* and *linking laboratory and practice*. In each area, key points have been distilled in order to set the stage for further discussion and development by the design researcher. However, it is important to note that each subject discussed here is deserving of a specific chapter or even a dedicated book. As has been highlighted in this chapter, there are many weighty and significant works (noted again here for clarity) on these topics in fields such as psychology (Kirk, 2009, Tashakkori and Teddlie, 2008), social science (Robson, 2002, Neuman, 1997) and clinical research (Kazdin, 1998, Denzin and Lincoln, 1994). However, this is beyond the scope of the discussion developed in this chapter. It is simply worth noting that any design researcher aspiring to take their experimental methods to the next level of rigour can no longer afford to ignore the significant work in other fields.

In this context the authors suggest some summary answers to the questions posed in the introduction:

Experimental effects

- The importance and extent of experimental effects in design research experimentation cannot be overstated as they affect every aspect of studying human participants.
- The importance of the Hawthorne effect as a general descriptor for experimental effects must be acknowledged when reviewing other fields but it is important to realise the term is effectively defunct and should not be used when describing specific effects in the context of design research.
- There are a large number of important effects that need to be considered when designing a study. These have been distilled and are summarised in Table 14.1, which can be used as a useful checklist.

The placebo control

- The placebo is fundamentally underpinned by the idea of an inert intervention, which is based on the active elements defined in a study's hypothesis.
- The placebo control is key to mitigating the experimental effects described in the section above (*Experimental effects*) and forms a fundamental technique in many fields and in particular in many of the fields closely related to design research.

Linking laboratory and practice

- The role of experimentation serves to support both theory building and theory testing – both of which must be considered in order to develop meaningful understanding.
- There seem to be two key approaches for linking experimental study to practice: *Extensive, longitudinal trials* drawing on and integrating elements from both experimental and observational methods; and *Direct comparison* of specific situations or variables. Further, these approaches can be combined cohesively to give significant insight into practice without sacrificing the detailed examination possible through laboratory study.

The purpose of this chapter has been to bring inputs from other disciplines into the design research community to help in the development of greater scientific rigour and the improvement of experimental methods and methodology. In particular, this supports the cyclical theory building process (Figure 14.2), which is the critical outcome of individuals and teams' research.

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15

RESEARCHING THE FUTURE BY DESIGN

Martyn Evans

Introduction

Predicting the future is important to design. Designers are often charged with synthesising information from the past and present to create visions of the future that are not only required but desired by consumers. This means that researching the future is increasingly important to designers as socio-cultural change, often driven by technological advance, requires an intelligent understanding of what possibilities the future may offer. To ensure products are developed that meet the needs of consumers in the future, there is a need for a useful understanding of what the future holds if we are going to meaningfully prepare for it. Placing designers unprepared into this context of rapid change and increasing possibilities without appropriate research tools is likely to be problematic. What design is lacking is a structured method for conducting research that informs future-oriented design projects.

The creation of next-next generation products requires the application of a particular set of research methods (Margolin, 2007) that extend beyond traditional design research domains and benefit from engagement with the theoretical base of future studies. Future studies is the field of social inquiry whose purpose is the systematic study of the future (Bell, 1996).

This chapter considers the role of design and the designer in researching the future. It is structured around four main strands: 1) design and the future, 2) futures thinking and the study of the future, 3) approaches design can utilise to research the future, and 4) a design future's research framework which supports designers when researching the future. The chapter concludes with a discussion of the challenges design faces when developing next-next generation products and, increasingly, services.

Design and the future

> They [designers] are concerned less with what has happened, what already exists, or what can be predicted by extrapolations from the past than what can be done. Designers' most outstanding ability is not being afraid to explore new ideas, to challenge theories that claim that something cannot be done, or to question what is commonly taken for granted.
>
> *Krippendorff, 2006: 26*

Designers create visions of the future that suggest how the future might be (Marzano, 1999). The underpinning theoretical base by which these visions of the future are created can too heavily rely on the intuition of the designer (Evans, 2011). This process lacks a rigourous and replicable method and is often mentioned in the same breath as fortune telling and crystal ball gazing (Ward, 2002). Cross et al. (1975: 2) assert that:

> visions of the future are particularly important for designers, because designers have to imagine both the future conditions that will exist when their designs actually come into use and how those conditions will be changed by the creation of their new design.

To do this successfully, designers need to understand future consumer needs and communicate effectively their visions for new products.

Designers need to be mindful when communicating their visions for future products to ensure that they do not scare consumers off by presenting something that is too alien for them to connect with. Products that are so new that people are scared of them, or what Seymour (2010) terms the 'violence of the new', can result in costly and unsuccessful products.

Tomorrow's technology-driven products and services are hard to market research as although asking potential users if they consider a certain approach to be a good idea is potentially useful, their answers are unlikely to be too revealing (Ireland & Johnson, 1995; Johnson & Masten, 1998). People have very little experience of what they may encounter in the next few years and their answers are usually based upon what they understand today (Hollins & Hollins, 1999).

To address the issue of stakeholders being constrained by such limited understanding, design has a history of creating visions of the future that captivate and occasionally bemuse onlookers (Kinsley, 2012). The responses of these onlookers can be used to inform subsequent development activities and bring what Raymond Loewy termed the most advanced yet acceptable (MAYA) products and services into being (Loewy, 1951). Loewy's MAYA concept has unknowingly become the vanguard of many designers as they attempt to create the most innovative and advanced proposals that will be acceptable in the marketplace. Yet how they go about researching, hypothesising, synthesising, and manifesting these futures is still very much an art not a science.

Within design practice, one of the most well-known examples of designers creating visions of the future is the concept car – a prototype made to showcase a concept, new styling, technological development and more. They are often shown at motor shows to gauge customer reaction to new and radical designs which may or may not have a chance of being produced. General Motors' designer Harley Earl is generally credited with inventing the concept car during the early 1950s. Concept cars can inspire both organisations and their customers to head towards a future that they can influence. Concept cars stand out as great examples of experiments used to inspire the market and prepare it for new ideas in styling (Brown, 2005).

In another design context – the fashion industry – awareness of trends is a key driver for the creation of visions of the future in the form of fashion collections. Understanding and anticipating changes in style and taste are crucial for fashion designers and they often look to trend setters for clues to the future. Vejlgaard (2007: 39) notes that the "fashion industry is very conscious of trends and the existence of trend setters, and designers use this knowledge to stay in touch with the market and try to stay ahead of it".

The above examples only scratch the surface with regard to how designers use visions of the future to underpin how they think about, and conceptualise, the future. A key challenge in these activities is the use of a replaceable research process that segments the use of designers' intuition. Before addressing this challenge, this chapter will summarise the potential guidance and support available to design from the field of futures thinking and how the future can be conceptualised (or to be more precise the discipline of future studies).

Futures thinking and the study of the future

For millennia the future has intrigued the human race. From crystal ball gazing and fortune telling to soothsayers and Old Farmer's Almanac, there have been immeasurable ways that humans have tried to predict the future. History tells us that humans consider the future as a core aspect of their existence (Cornish, 2004; Ogilvy, 2002). The human mind, imagination, and spirit are free to roam at will among a stunning array of different worlds and world-views, past, present, and future (Slaughter, 1996) and predicting the future to a greater or lesser extent is an inescapable part of human destiny. Rescher (1997) contends that the three most salient facts about the future are: that it does not exist, that it unavoidably will, and that we can only gain incomplete information about its nature, let alone achieve control of it.

The desire to understand the future and be able to anticipate what it may bring is ever present in today's society as it always has been. Whereas all experiences are of the past, all decisions are about the future (Boulding, 1973). There are many ways of conceptualising and thinking about the future, some more valuable to design than others. A seminal approach for categorising the future was developed by Henchey (1978) suggesting we can think of the future in terms of what is possible, plausible, probable, and preferable.

- **Possible futures**: Possible futures are all the things we can possibly imagine, no matter how unlikely. Thus possible futures may include science fiction futures that transgress the currently accepted 'laws' of science.
- **Plausible futures**: Plausible futures comprise only the possible futures that seem to make sense given what we know today. Plausible futures can be forecasts of individual trends or a set of scenarios that combine various trends to describe a range of alternative futures.
- **Probable futures**: Probable future is the one that is most likely to happen, based on examination of the current situation and appraisal of likely trends and future developments. Probable futures reflect the fact that most people see the future as an extension of the present with little significant change.
- **Preferable futures**: Preferable futures are the ones we would like to have happen and are sometimes called a prescriptive future or normative forecast. This is where vision becomes important as it moves reality beyond the present towards the best that can be.

Hancock and Bezold's (1994) Futures Cone is a valuable way to represent Henchey's (1978) classification of the future as it visualises their relationships. The Futures Cone illustrates that all futures start from where we are today, but diverge. The closer to today, the harder it is to tell them apart, but clearly choices made now can have dramatic effects over time. The outer area is the zone of possibilities, which includes a number of wildcard events – typically events with low probability but high impact. Although most planning efforts deal with the zone defined by the plausible, having a sense of what kinds of wildcards might arise is useful (Petersen, 1997). Wildcards are surprises, discontinuities or shocks (Voros, 2006) and although unlikely to occur they would have great consequences if they did (Cornish, 2004; Barber, 2006). A wildcard event could be a natural disaster, such as an earthquake, or a war or a famine.

Design is often concerned with preferable futures, i.e. to imagine better futures and to attempt to make them happen through the introduction of new products and services. Preferable futures stretch thinking beyond what is both probable and plausible into what is possible. Marzano

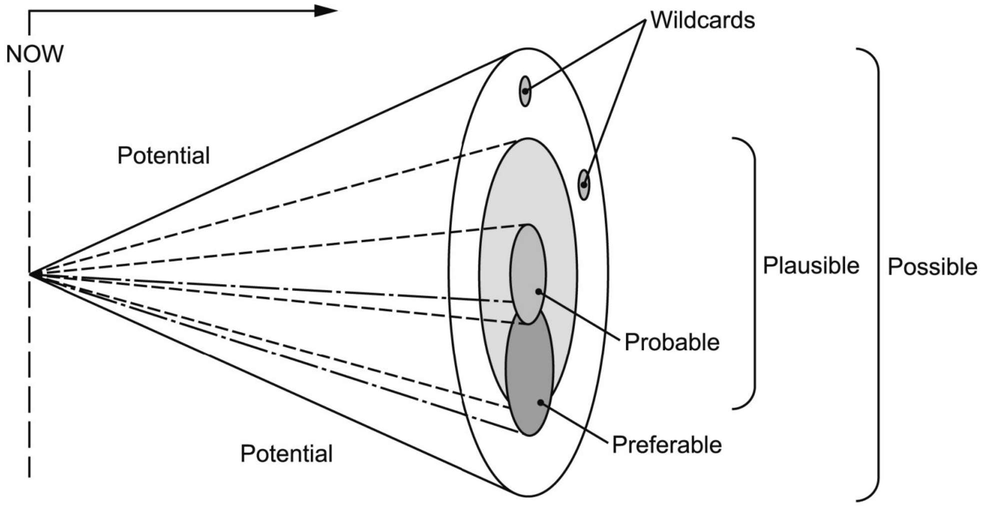

Figure 15.1 The Futures Cone

Source: adapted from Hancock & Bezold, 1994

(2005: 26) has augmented this concept and used it to describe how design can attempt to plant memories of the future in people's minds:

> Thinking about potential future developments opens your mind so that you are ready to see the signs relevant to those developments if and when they occur. The brain uses plans and ideas just like real memories and experiences to filter information and guide decisions. These memories of the future potentially lead to new aspirations and desires.
>
> *Marzano, 2005*

One of the ways that futures thinking consider preferable futures is through visioning. This is of particular relevance to design as the visioning process is analogous to the design process. A vision is a vivid picture of a desired future, and to be effective it must be well anchored in the hearts of those who are to make it come true (Lindgren & Bandhold, 2003). Bezold (1994) defines a vision as a compelling statement of the preferred future that an organisation or community wants to create, adding that "vision development is the most powerful way to clarify where you would like change to go". Visioning projects values and aspirations into the future, then describing that future succinctly in a powerful phrase or sentence, or as a scenario (Canadian Medical Association, 2000).

> Visions spring from the capacity to recognise the seeds of change that lie in the past and the present; moreover, visions make it possible to create a future that is different from the present although its seeds are in the present. In a sense, visions capture the changes that are already latent in the present and posit these as the future reality.
>
> *Masini, 2006: 1163*

Visioning preferred futures is valuable in that it can take us beyond the limitations of prediction based on existing trends and act as an inspiration to innovation and a better future

(May, 2006). Visioning is motivational and emotive and contains a high level of desire. In fact, the driving force of visioning is wishful thinking. It has to be emotional to arouse people's visceral commitment to succeed. Although participants in a visioning exercise are free to imagine any possible future, they often struggle to go beyond the bounded thinking of what they understand and know and may require creative techniques to assist in free visioning. Again, we can see how when asked about what they'd like in the future, participants struggle to move beyond what they know.

Understanding how we may think about the future, both from an individual and collective point of view, enables the future to become more tangible. As is often the case with intangible or somewhat nebulous ideas, without an understanding of what this is or could be (the future, in this instance), people tend to be unwilling to engage in a meaningful way with it. A model of the various futures that are possible can bound and inform designers' creative process. By considering the various futures outlined in Hancock and Bezold's Futures Cone, designers can focus their creative efforts to create next-next generation products and services that are intentionally positioned within the landscape of futures.

Approaches design can utilise to research the future

A number of research approaches are available to designers when developing next-next generation products and services. The challenge designers face is twofold: 1) understanding what research approaches are appropriate to augment the design and development process, and 2) how to best organise future-oriented research approaches such that they provide effective guidance to the design and development process. What is clear is that traditional design and development approaches need to be augmented to provide future-oriented intelligence and insights. As time horizons extend beyond accepted norms, designers need to prepare, what Seymour (2010) refers to as, a runway for new ideas such that the receiver – be it a potential consumer – is able to accept the idea. Without creating this momentum, the idea will bounce right off. Listed below is a selection of research approaches useful to designers when developing next-next generation products and services.

- **Trends and trend forecasting**: A trend is a social process in which style or taste changes. While a trend is an ongoing fundamental change over a period of time, trend forecasting uses past data to define a pattern of change and extends that pattern to project future developments. There are three stages required when harnessing the power of trends for commercial ends: 1) identification – the process of observing change utilising both primary and secondary research; 2) interpretation – which involves analysis and judging of trends in order to predict how they will develop; and 3) implementation – dealing with impact analysis and exploring what effects the trend might have upon an individual sector or business. (Cornish, 2004; Higham, 2009; Raymond, 2010; Schwartz, 2005; Vanston, 2003; Vejlgaard, 2007.)
- **Technology roadmapping**: A technology roadmap is a high-level, visually oriented, overall communication and coordination aid. It displays the interaction between products and technology over time. Utilising the metaphor of a roadmap with a start point and end destination, a technology roadmap is a plan that matches short-term and long-term goals with specific technology solutions to help meet those goals. It provides different routes that can be taken (from the present into the future), and outlines where there are choices and where there are not. It helps to understand where there are roadblocks ahead and where construction is needed to achieve the technology destination. (Garcia & Bray, 1997; Smith, 2005; Vanston & Hodges, 2004.)

- **Scenarios**: A scenario is a descriptive vision of the future communicated by a narrative structure outlining how certain dynamics of change occur over time – a description of a sequence of events that might possibly occur in the future. It is an extremely useful approach for design as it allows a simple or complex consideration of the future which can help to communicate the essence of a design idea within its probable context of use. Scenarios may take the form of a written description but is also regularly supported by visuals that assist in the communication of a point of a particular view. (Fahey & Randall, 1998; Jensen, 2005; Rescher, 1997; Schwartz, 1991; Lindgren & Bandhold, 2003.)
- **Horizon scanning**: Horizon scanning is the systematic search, usually through detailed review of selected formal and informal publications, of current developments and trend shifts that suggest that future changes may be brewing. Horizon scanning describes a process in which the environment of an organisation is systematically scanned for relevant information. It provides early warning about important changes in the environment and detects weak signals that indicate if plans should be amended. Strictly speaking, horizon scanning is a monitoring of the present, not a system for imagining the future. (Gordon & Glenn, 2003; Millennium Project, 2007; Schwartz, 2005.)
- **Expert group analysis**: Expert group analysis is a Delphi-esque opinion technique that allows participants to use their skills in originating new ideas, evaluating the ideas of others, intelligently addressing differences in opinion, and rating a series of ideas according to agreed-upon criteria. Its intended purpose is to make the best use of a group of experts in obtaining answers to questions requiring reliance, at least in part, on the informed intuitive options of specialists in the area of inquiry. Experts offer opinions that are aggregated to form a view of possible futures, which can be used to guide decision making. Expert groups may include lead-users as participants and is particularly useful in areas where the design and development teams cannot experience things first hand. (Cornish, 2004; DFFN, 2003; Gordon, 2003; Helmer & Dalkey, 1983; Schwartz, 1991.)
- **Mood boards (and evidence walls)**: Mood boards are typically "a collection of images compiled with the intention of communicating or provoking a mood or ambience during the product design process" (McDonagh & Denton, 2005: 35). The term 'mood board' is often used to cover a range of visual board types that have specific uses. Baxter (1995) identifies three types of boards: 1) a lifestyle board, which is a collection of images representing target customers' personal and social values; 2) a mood board, which tries to identify a single expression of values for the product; and 3) a visual theme board, which is a collection of images of products, which convey the target mood. Mood boards are used by designers to bring together visual data, usually in the form of images, with the aim of focusing the attention of the development team by attempting to make intangible concepts more concrete. In future-oriented work, mood boards can also act in a problem-solving and/or problem-defining role. (Baxter, 1995; Cassidy, 2011; Garner & McDonagh-Philip, 2001; Julier, 2000; McDonagh & Denton, 2005; Raymond, 2010.)

As can be seen from the above list of research approaches, there are a range of opportunities for designers to formalise how they develop next-next generation products and services. Depending upon the nature of the project being undertaken, the type of design problem being considered (and obviously the associated design disciplines involved), the characteristics of the target sector, the outlook and aspirations of the client, and the experience of the designers involved vary greatly (Evans, 2011). What is lacking is a structured method for conducting research that informs future-oriented design projects.

Design futures research framework

The design futures research framework articulates the key research considerations and approaches available to contemporary design in the exploration, development, and communication of future-oriented design projects. Drawing upon the field of future studies, it formalises the tacit and intuitive approaches designers employ to consider extended project time horizons.

This framework comprises five critical research factors: 1) understanding the socio-cultural context, 2) tracking of trends and movements in behaviour, 3) utilisation of non-design research techniques, 4) designers use of intuition and insight, and 5) gathering expert opinion. Underpinned by insights from leading design professionals, the design futures research process provides designers with a route map when developing next-next generation products and services.

Understanding socio-cultural context

An understanding of the socio-cultural context in which products and services are used is essential for next-next generation products as this forms a basis for projecting visions into the future. The socio-cultural context in which future consumers utilise products and services must be considered as, when time horizons extend, it becomes increasingly problematic if projecting existing technological or business based considerations.

Understanding the socio-cultural context draws upon a number of research tools and techniques. Standard environmental analysis tools such as PESTLE (Political, Economic, Social,

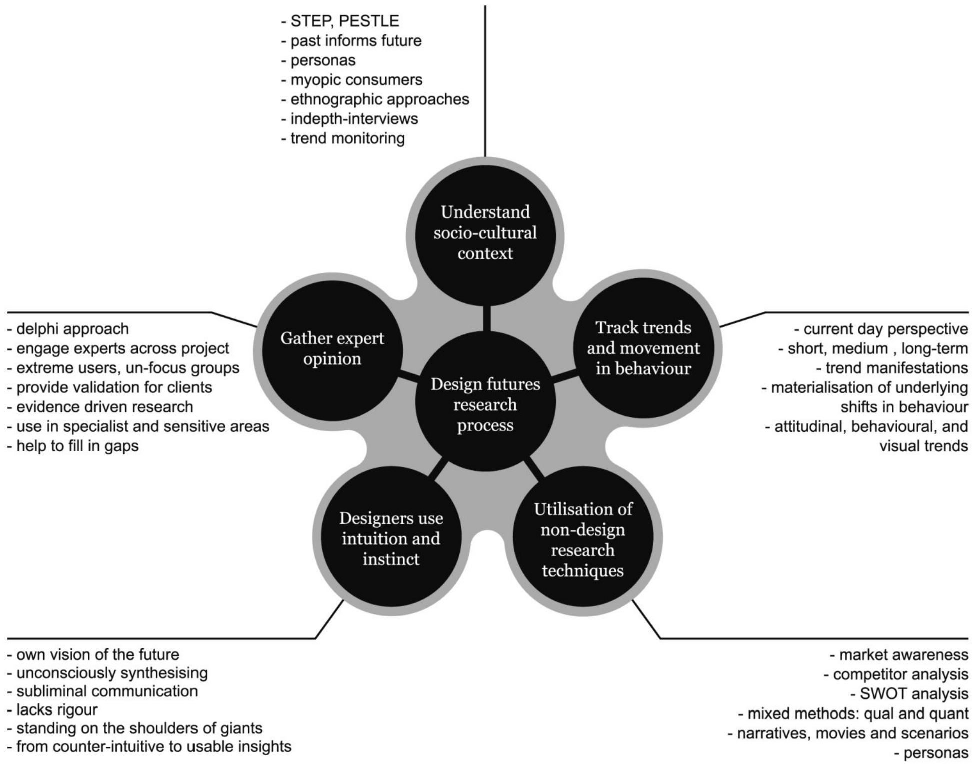

Figure 15.2 Design futures research framework

Technological, Legal, and Environmental) or DEGEST (Demographic, Economic, Government, Environmental, Social, and Technological) frameworks provide an accessible approach to structuring research data. Data sources vary between projects as context specificity shapes particular approaches. Primary data may be in the form of ethno-methodological observations or indepth interviews. Participants may be target consumers or drawn from a broader stakeholder line-up that may include extreme or counter-culture viewpoints. This can provide an insight into early adopter views that lie outside those of the general public and can point to early warning signs that may become mainstream trends in the future.

Increasingly, the democratisation of research in design, combined with developments in, and access to, digital technologies, has greatly broadened the potential research base. For example, the use of online forums is growing in popularity in research phases of design projects. Often these approaches are employed to gather a broader data set but importantly the analysis of such data is still undertaken by professionals from within and beyond design.

Insight into socio-cultural contexts is communicated in a variety of ways, with no specific single approach prevalent. The use of visual mapping techniques, combined with an underlying framework, permeates the majority of communication approaches. Textual data is often kept to a minimum in presentations but is used to underpin and validate insights. Textual data, in the form of a social-cultural report, normally accompanies such presentations. This more traditional approach is deemed necessary by clients as it provides validation to the research process.

Tracking of trends and movements in behaviour

Tracking trends and mapping out potential future trajectories helps to explore, monitor, and assess movements in behaviour. Trend tracking broadly falls into short-term (between one and three years), medium-term (between three and seven years), and long-term (between seven and ten years) time horizons. Techniques are employed to identify the early warning signs or weak signals of the trend. The use of cool hunters – researchers who are culturally sensitive to these weak signals – permeates design forecasting. As the materialisation of underlying shifts in behaviour, trends can be used to capture new and emerging thinking. Combined with observational processes, intuition is often used to propose new and emerging tastes and modes of thinking based upon identified trends.

Trends can be grouped into three trend aspects: 1) attitudinal, 2) behavioural, and 3) visual. Attitudinal trends are concerned with our attitudes and ways of thinking; behavioural trends are concerned with our behaviour and what we do; and visual trends represent the visual changes to our material world. All three trend aspects contribute to an understanding of future consumer behaviour.

Utilisation of non-design research techniques

Design increasingly utilises a range of research techniques from other disciplines. Examples may include market research techniques from marketing, a range of ethnographic methods from the social sciences, and usability testing from computer science. Within the context of future-oriented projects, designers have embraced many research techniques from the marketing profession. Environmental scanning approaches that provide market and competitor awareness are regularly employed to provide a clear and rigorous understanding of relative product or organisational positioning. Such an approach has been adopted by design to validate insights for clients.

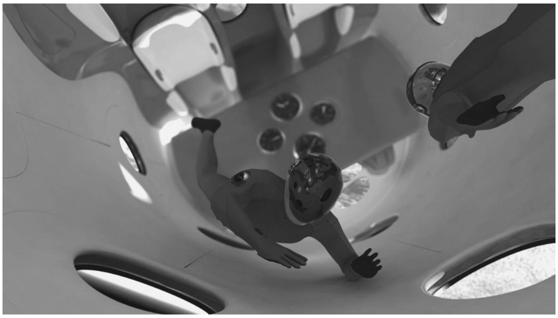

Figure 15.3 Virgin Galactic
Photo credit: Seymourpowell

Well-established business based research techniques such as SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) can be employed as a counter for more experiential creative research techniques such as the use of narratives of experience movies. In such examples, design draws upon cinematography and associated disciplines to create immersive movies, often drawing upon *Wizard-of-Oz* techniques, to convey experiential proposals for new products or services. UK-based design agency Seymour Powell provided an experiential film to communicate the potential of the Virgin Galactic project – which plans to provide suborbital spaceflights to space tourists – to potential stakeholders. This approach was critical to communicating a potentially alien concept to investors thus providing confidence in the project.

The use of such techniques can be employed as a research and communication tool; drawing in new data and insight in response to new concepts, or conveying proposals for new products and services to stakeholders. Combined with design's creative leanings, this approach provides a powerful medium for communicating visions of the future.

Designers use of intuition and insight

A key aspect of the development of next-next generation products and services is the use of designers' intuition. In many situations, intuition or gut instinct may be in direct opposition to research findings. It is in such instances that design brings something that is not easily quantified. The use of intuition may be an antithesis to current day thinking, but to mediate against myopic consumers it may be required to break out of existing paradigms. The concern with the use of designers' intuition is often that it lacks rigour as it is not necessarily a replicable process. Confidence can develop between designer and client throughout a project such that when a gut instinct is put forward, which may be counter to research findings, a creative leap is taken and accepted. Many instances exist where designers have put forward proposals based on their gut instincts that may contradict many other viewpoints. As future-oriented projects often require a leap of faith (as it may be impossible to rigorously research a particular future context) a combination of intuition and research activities is often employed.

As with previous attempts to explicitly understand all aspects of the design process, conclusions suggest that some aspects of designing are tacit and may not be fully rationalised. Designers draw upon many tools and techniques, years of experience, and the views of other stakeholders to inform their design process. Serendipity can shape a design project in a way that no one predicted. What can be stated, therefore, is that although a generic design process can be presented, designers also use an internal guidance system to navigate each project. Some of this activity can be externalised, some cannot.

Gather expert opinion

The use of expert opinion is a key research resource in future-oriented projects. Experts can be drawn from many backgrounds – from those closely aligned with a particular project or from a seemingly unconnected field. Expert input may be used to fill in gaps in knowledge within the development team as well as providing provocative viewpoints or counter arguments. As the future may not be the same as today, extreme, controversial, and challenging viewpoints are often included to create a breadth of insights and spark debate.

One area that expert opinion is valued is in the use of extreme users. Such users represent an atypical worldview yet can provide highly relevant insights that may be useful in mainstream new products and services. The outlier concept – people operating on or outside the edged of expected reason – is one that has been popularised in design in recent times (Kelley & Littman, 2006; Brown, 2009). Such approaches are termed by some as 'unfocus groups' as they are the antithesis of mainstream focus groups.

Expert opinion is also used in specialist and sensitive areas where knowledge is particularly context specific. This may be an instance where the development team may not have access (e.g. in a nuclear plant), may not have the required skill level (e.g. a brain surgeon), or are not from the appropriate demographic (e.g. when designing for children). In all instances, the use of expert opinion is used to increase the knowledge and understanding required within the project.

In 1995–6, Philips conducted the Vision of the Future project which aimed to explore what people will perceive as useful, desirable, and beneficial in the future, based on socio-cultural analysis and design. The project team included designers from a range of disciplines supported by a multi-disciplinary research team including ergonomists, technologists, scientists, anthropologists, and sociologists. This project is perceived to be an exemplar in design-led future-oriented projects and helped to reposition Philips from being perceived as a technology-led organisation to one that is human centred.

Figure 15.4 Philips Vision of the Future – Emotion Containers

Photo credit: Phillips

Discussion

The above design futures research process demonstrates that no single research method is prevalent but rather a set of interrelated activities that assist in the consideration of research within the development of next-next generation products and services is outlined. Organisational context and project specificity impact upon how design-led futures projects are conducted. The requirements of specific projects may result in certain aspects of the process being focused upon or omitted. As presented, the design futures research process may be interpreted as being self-contained, but it feeds, and is fed by, the other elements of the design and development process.

Socio-cultural contexts draws upon a range of research techniques and within the overall design futures research process overlaps with, and draws upon, many research tools and techniques. As previously noted, there is no single research approach that dominates, but rather an amalgamation of a range of associated research approaches perpetuates.

Trends are often likened to an iceberg metaphor: although a small portion is visible, there is much more underneath. Designers seek to identify the small portion visible above the waterline and understand and harness what lies beneath. As the trend is the manifestation of more deep-rooted changes in society, early identification of such elements can assist in developing a plan that accommodates such changes.

Non-design research techniques are normally combined with designerly approaches and as such augment, rather than replace, design-based approaches. It is noted that where clients seek validation and verification of proposals for what are essentially visions of the future, techniques that they are more familiar with are often employed.

The use of intuition and gut instinct within the design futures research process may contradict research findings and can be seen as designers following a whim without any rational reason. Clients need to develop a level of trust with designers to feel comfortable supporting this approach. The use of gut instinct has been studied within the design process but much of this approach cannot be rationalised. Without gut instinct there is a danger that projects follow previous approaches and do not result in radical approaches.

The use of experts once again provides clients seemingly with validation of proposals and support for decisions. Although in some instances this may be the case, expert opinion provides immensely valuable insight for the development team. It can assist in developing an understanding of complex issues that hitherto may not be accessed without their input. The use of expert opinion can provide access to a vast amount of data and can provide excellent value for money if employed in the correct manner.

The design futures research process synthesises the key research stages within the design process, which specifically look at projects beyond the normal three-year time-horizon for design and development projects in industrial design. The design futures research process is not presented as a single integrated process as this is not how design organisations engage with such activities. Rather, it details the key nodes of activity which occur across a temporal landscape – often taking place concurrently. As with all models, there is a level of abstraction to provide a generalisation rather than bespoke model appropriate to specific organisations.

As this chapter notes, traditional market research techniques are inherently unreliable in future contexts as consumers have very little experience of what they may encounter in the next few years. The process detailed in this chapter aims to provide designers with a mechanism to research the future to address this challenge.

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16

A PHOTOGRAPH IS EVIDENCE OF NOTHING BUT ITSELF

Craig Bremner and Mark Roxburgh

Introduction

Design, and more specifically design research, in taking what we call the ethnographic turn, has adopted many research techniques from the allied disciplines of anthropology and sociology. In this chapter we present the case that this turn, while attractive to the discovery of the user and their experience, has occurred with little consideration for the fundamentally different enterprises that are ethnography and design. We look specifically at the use of photo-observation and note that its use is generally premised on the notion that the photograph is evidence. We argue that by viewing the photograph as ethnographic evidence we accept it on its own conditions and consequently it conditions us to see the world-as-is. However, design is concerned with what-might-become, and this conditioning is problematic for it results in the endless reproduction of the here-and-now. With specific reference to one of the author's research projects we will demonstrate that if we regard the photograph as a form of question we recondition it to be a frame through which we can re-engage in the project of what-might-become.

Without generalising, design research has become preoccupied by the pursuit of methods to answer one of the two fundamental questions of any field (Groys, 2012: 1) – how can I explain to myself what I am already doing? To add authority to any answer to this question, Donald Schon (1983) is now cited profusely and as a result so much 'reflecting' is now happening that any observer of the current of design research could be 'dazzled'. For it now resembles a mirrored room, or even worse the distorted reflections produced by the hall of mirrors in the sideshows of carnivals. Knowing what I am doing has completely overshadowed the other key question – what needs to be done? The ethnographic turn in design research appears to be attempting to answer a similar question – how do I reveal to myself what I can already see? But just as we don't seem to be able to let go of the celebration of reflection, we now cannot get over the spectacle of documenting the here-and-now. All this produces two questions – how can I imagine what-might-become and if I could represent what-might-become, how do I illustrate what needs to be done? This chapter looks closely at the distorting effect the photograph has had on these questions and design research.

The use of ethnographic research methods in design has taken off in the past two decades and is most prevalent in the area of user-based, participatory, or co-design. There are nuanced differences between these areas yet they are all concerned with the observation and/or participation of key stakeholders in the development of the design outcome. More often than not this involves either real or imagined end users. Much of the research effort goes into observing and understanding the contexts of usage that a product, built environment, or service will play out in. This implies a need to engage with the experience users have of the designed world, the world-as-is. Observation has long been used in the field of anthropology, and to a lesser extent sociology, to gain insight into the experiences people have, and the meanings they make of the worlds they create and inhabit. It is therefore not surprising that design research has taken what we call the ethnographic turn**.** This turn is another in design's evolving journey of self-discovery, having already taken similar turns through art and science (Roxburgh and Bremner, 1999). Although we regard the ethnographic turn, and the programme of observation derived from it, as an apparently logical shift required to discover the user and their experience, we contend that like these other turns it has occurred with little consideration given to the differences between the intents of ethnography and design. The history of design is typified by the importation of methods and theoretical frameworks from other disciplines (see Dilnot, 1998; Glanville, 1999; Downton, 2003: 35–53). Glanville argues that theory imported into a field without a test of its appropriateness is polemic and that the field becomes confined to what is already understood, making growth beyond these confines unlikely. Furthermore, he contends "in fields such as design, where emphasis on creativity and the novel is central, such constraints are especially limiting and undesirable" (Glanville, 2005: 8). In this chapter we will argue that the fundamental difference between ethnography and design is that the former is primarily descriptive whereas the latter is largely transformative, and the photograph does not describe the transformation. Given this we will then examine and critique the available literature on design's use of the ethnographic method of photo-observation and argue that it is circumscribed by an often-unarticulated descriptive logic that is at odds with design's transformative dimension. We will then proceed to outline a project using photo-observation in design research with specific reference to a project produced for the festival *Glasgow 1999: UK City of Architecture and Design*.

Seeing the evidence

The histories of photography and ethnography are inextricably linked and have conditioned one another in very particular ways. Unless this is understood it becomes difficult to see that a programme of design research based upon ethnographic photo-observation is not unproblematic. The discipline of anthropology and the medium of photography both emerged during the mid-nineteenth century and were either the product of, or influenced by, scientific thought. Early anthropological fieldwork, using the ethnographic method of direct observation, was heavily informed by theories of biological evolution and the categorisation of species prevalent at the time (Edwards, 1992: 5–6; Harper, 1998: 25). This played out in anthropology in the guise of theories of social evolution that involved the hierarchical categorisation of the human race from civilized to primitive. The first significant pieces of ethnographic fieldwork undertaken – Spencer and Gillen in 1894, Albert Cort Hadden in 1898 and Malinowski in 1922 – established the world as an object of study that could be held at a distance, and observed and analysed in an objective manner. Photography was understood and used at the outset then as something that could record objective facts about the world (Kelsey and Stimson, 2008: xii). Because the camera is mechanical, and because of the direct indexical link between the photograph it produces and the scene it photographs, photography was regarded as an objective way of recording the seen world. More than this, Flusser argues that because the photograph "is an image produced by apparatuses" (cameras) that are "the products of applied scientific texts", they are inscribed by the programmatic agenda of conceptual thought (Flusser 2007[1983]: 14). In other words it is not just that photographs appear to present the seen world as is, that we regard them as objective; the very apparatus that produces the photograph conditions us to see them, and the world through photographs, in a very particular way. That is, the photograph and the reality it purports to depict are conflated as one and the same.

Rather than seeing the photograph as a purely objective device to document aspects of the world-as-is, in 1942 Bateson and Mead believed that photo-observation was integral to the generation of new knowledge (Harper, 1998: 25–26). Their work signalled an epistemological move within anthropology, from an objective view of the world to a subjective view of it. Photography used as a subjective, interpretive tool of observation came in to its own during the 1960s and owes as much to the emergence of critical sociology as it does to early twentieth-century American social documentary photography (Harper, 1998: 28). It was understood that the photo-observer's subjectivity framed any such observation and that the photograph was an intervention into the world to be interpreted. Understanding is arrived at through subjective interpretation.

Geertz (1988) deals with the interpretive dimension of ethnographic social inquiry in detail in articulating what he calls the author function. In an interpretive view of the world we participate actively in constituting reality rather than passively receiving it. This point is significant in relation to design, for design actively constitutes aspects of the reality of the world by transforming its material dimensions. It is little wonder then that ethnographic methods appear to be a natural fit for design. However, this fit has occurred with little interrogation of the differences that exist between social inquiry, from which the ethnographic method comes, and design. The utility of ethnography in design has been overwhelmingly premised on the perceived similarities between the two with scant attention paid to those differences.

We will come to the goodness of fit between ethnography and design shortly for it has a bearing upon how we might use photo-observation within design in a way that leverages those similarities yet recognises and manipulates those differences. The key point that needs to be made here is that despite the shift in social inquiry from an objective science to a form of inquiry that was subjective, both anthropology and sociology have interrogated the relationship between the photograph, reality, the world, and knowledge. By contrast, design has not – it has simply talked about the utility of the ethnographic method in the design process.

A more radical approach to ethnographic photo-observation is the work of Grimshaw and Ravetz that draws upon artistic visual practices and "involves quite different assumptions about the making and presenting of knowledge" (2005: 15). Grimshaw is less interested in the discursive production of knowledge through language (the interpretation of meaning of what is observed) and more interested in an exploration of the haptic knowledge generated through the "re-embodiment of the self as the foundation for renewed engagement with everyday life" (Grimshaw, 2005: 23). In doing so she recognises that her ethnographic approach is not concerned with the documentation and interpretation of reality but is involved in the transformation of knowledge and subsequently reality, and is centrally concerned with understanding what she calls social realities (ibid.: 21). However, she does not regard her observations of these social realities as a kind of "simple minded realism, a reflection of life", rather it is a transformational "interrogation of it" (ibid.: 24). This suggests a conceptual equivalence to Merleau-Ponty's notion of the transformational nature of artistic practice as a form of embodied perception that transforms our understanding of the world and hence our conception of its reality (Merleau-Ponty, 1964: 165).

Like Grimshaw, Ravetz explores the relationship between art methods and ethnography and recognises and conceives social research as being concerned with the "process of making social objects" that are "shaped in the creative tension between social experience (participation) and reflexive communication (observation)" (Ravetz, 2005: 70). However, she is aware that anthropology elevates the social world, the here-and-now, while art privileges the visual imagination and the unreal, or in design terms what-might-be.

The significant point here is that Grimshaw and Ravetz's model of observation is not concerned with the realist photo-documentation of the seen world readily substituted by the photograph. It is premised on the transformational dimension of observational interrogation, and the gap that this creates between what is observed and how it is observed. This is the gap of imagination that plays between what is seen, what is experienced, and what is communicated about that seeing and experience. In anthropology that gap is most often described in words. For design that gap is the space in which we can imagine what-might-become, but only if we recognise it and not simply substitute the photograph for reality. The Glasgow project, which we will turn to shortly, demonstrates the importance of recognising and manipulating this space.

In suggesting equivalence between arts practice and a radical approach to anthropology, the work of Grimshaw and Ravetz offers some conceptually rich pickings for design researchers. While there are apparent similarities there are also subtle and significant differences and these are the differences between the making of meaning (the ethnographic interest in understanding experience and its relationship to knowing) and the meaning of making (the design interest in the experience of making). And while current anthropological understanding generally accepts the premise that in transforming knowledge it transforms our sense of reality – that may or may not have material consequences beyond the transformation of social realities – design is fundamentally concerned with transforming our material reality that may or may not have social consequences.

Designing the seeing

Plowman (2003: 36–37) notes that it is generally believed that the pioneering work of Xerox PARC in the 1980s was the first instance of ethnographic methods used in the design process, but before that the HfG Ulm School had "courses in sociology, and in other humanities and social science subjects" (Margolin, 1991). The interest the Ulm school showed in the social sciences was paralleled by Henry Dreyfuss in the USA who published *Designing for People* (2003[1955]) in which he advocated that "experience, observation and research" are crucial attributes for industrial designers to succeed in what he calls "the science of appearance" (Dreyfuss, 2003[1955]: 65). Dreyfuss provides no theoretical framework for the research outlined, although market research logic prevails, but it is clear that participant observation drawn from the social sciences is regarded as crucial for successful design outcomes. Where photography is discussed it is used as a research method to accurately and realistically depict existing, competing models of products to enable visual analysis (ibid.: 280). Dreyfuss's approach to both observation and photography sees them as providing visual evidence that can be readily and unproblematically substituted for the actual object or experience observed. The photograph and reality are one and the same.

The first attempt to systematically describe a programme of design research, Design Methods, also recognised the importance of observation for design. John Chris Jones, a leading figure in Design Methods, argued that once "efforts are made to observe what is going on, vast quantities of design-relevant information are quickly generated" (1992[1970]: 236). Jones outlines a number of his design methods that use observation in one form or another. These methods are ethnographic in the sense that they involve direct observation in the field but are often used without concern for the ethnographic focus upon the meaning people give things. Photo-observation itself first gets mentioned as a tool for documenting objects to enable the analysis of the images to search for 'visual inconsistencies' in the object in order for design improvements to be envisaged (ibid.: 209). In this method the photograph is once again taking on the attributes of evidence. Jones also talks about using filmic observation "to make visible, patterns of behaviour upon which critical design decisions depend" (ibid.: 259). In all of this work the emphasis is on realistic photographic and filmic documentation. The images generated are a form of evidence that are analysed to identify and codify patterns of behaviour that are subsequently transformed into tabulated and more scientific data (ibid.: 266–267). And we demonstrate later in this chapter how the Glasgow project used photographs to illuminate very different tabulations of experiences.

In an apparent departure from a scientific approach to design, Henry Sanoff is interested in understanding the subjective meanings and experiences users have of their designed environment arguing that designers "have overlooked the application of social science techniques for acquiring visual information" for design (1991: ix). He presents a series of design case studies that use a range of different visual methods of inquiry, drawn from the social science field of environment-behaviour (E-B) research. These case studies have a strong user-based or participatory design focus and Sanoff argues that the methods facilitate both a deeper understanding of people's perception of their environment and provide an opportunity for a dialogue with the people who use it (ibid.: xi–xii). Despite Sanoff's interest in extending the E-B agenda to encompass meaning and experience, there is a strong quantitative slant to how many of the techniques are implemented and analysed (ibid.: 1). Not surprisingly his use of photo-based research methods is premised on the photograph as evidence.

Sanoff's techniques include, for example: multiple sorting – where users sort images based upon their own criteria (ibid.: 5–7); categorising visual cues – where users sort photos based upon pre-determined descriptive attributes (ibid.: 15–20); photo-elicited interviews – in which users are interviewed about their perceptions of environments, using photographs of them as prompts (ibid.: 34–36); visual questionnaires – which require users to describe supplied photographs and answer questions related to them (ibid.: 53–56); and visual appraisal – which involves users numerically ranking photographs of buildings to pre-set statements or questions (ibid.: 56–61). These are by no means all the techniques outlined but are indicative of Sanoff's concern for removing researcher bias from the research process. They also point to the analytical framework that Sanoff privileges in constructing his research and this has some parallels with the work of Jones. Although Jones' and Sanoff's aims may be different, ergonomics versus experience, both use the photograph as evidence from which non-visual data can be extracted and analysed. Sanoff himself believes that "the information locked in visual content must then be transformed by the observer into a useful, analysable form" (ibid.: 75).

Zeisel (2005[1984]), like Sanoff, is also concerned with environment behaviour research for design of the built environment. In outlining his conception of design, Zeisel is well aware that the problem/solution paradigm is an oversimplification of the design process. Like Sanoff, Zeisel presents a compelling rationale, supported by substantial case study work, for the E-B design agenda and there is much of value for design practice and theory contained within it. Zeisel argues that researchers need to carefully devise research programmes "to increase their control over the consequences of their actions" and that when such an approach is applied to design it is to improve the quality of design (Zeisel, 2005[1984]: 119). He then proceeds to outline a series of criteria to establish and maintain research quality. This approach suggests that the researcher can simply separate themselves from, or minimise their presence within, the systems they are observing and designing in, and is typical of a kind of positivist logic prevalent in early anthropological research. This in turn has implications for the manner in which photo-based research methods are used and suggests once again a view of the photograph as objective evidence.

Photo-based methods are a common tool used in Zeisel's research. In his framework photography is used to document phenomena and behaviour so that there is a high degree of congruence between what is observed and what the photograph looks like. The resultant photographs are evidence of what is observed and are used for analytical purposes. The photograph's powerful claims to evidence of an observed reality are essential requisites when used in such a way. Zeisel's approach is largely about finding proof of emerging hypotheses, yet there is recognition that they can also be generative of insights through recording relationships or patterns of behaviour. However, the significance of any such insight is only established through subsequent objective analysis of the evidence.

The work of Zeisel and Sanoff suggests a largely unproblematic reading of the photographic depiction of the real as evidence and many of their techniques are developed to eliminate misunderstanding and variations of interpretation across different viewers of the image to sure up the reliability of that evidence. However, Glanville argues that we "must take responsibility for our observing, our knowing, our acting, our being: for we cannot pass on our observing: it is ours, integrally ours" (Glanville *in* Anderson, 2004: 91).

The relationship between the photographic image as evidence and the contrived nature of its codes of representation is something that Strickland explores, albeit in the context of observational cinema (2003: 118–128). Strickland argues that the realist framing of the realist documentary image is an ideological construct and that entertainment cinema, which is total artifice in that it does not document 'real' phenomena, is constructed upon models of realist fictions (ibid.: 124–125). In effect she is arguing that although documentary and entertainment cinema purport to have different intentions, one exploring reality the other creating fictions, they share common realist codes. The point Strickland is making is that the distinction between factual and fictional filmic representations and its bearing on our sense of reality is not as great as one might imagine for "postmodern theory overturned the old idea of a world whose existence is independent of our representations of it" (ibid.: 125). It is evident that Strickland recognises, within her own observational practice, that the artificial nature and the aesthetic dimensions of her media, and its modes of representation, are central to how knowledge is developed and design concepts generated. Further underlining this more synthetic or interpretive approach to her research is her belief that observational cinema is "essentially a manner of revealing rather than a language of telling" (ibid.: 126). Strickland's work in design demonstrates an interest in exploring the space and slippage between the analytic aspects of looking at evidence and the synthetic aspects of making interpretations through asking questions; in ethnographic terms the making of knowledge of things and in design terms the making of things of knowledge.

Questioning the image

What we have been discussing above is that the ethnographic turn to observational research illustrates that gathering information about the everyday is very easy to do because it is everywhere around us. However, once observed and captured (mostly by photographs in design research), the process of transforming that information into a form that can be communicated or put into effect to make 'design' projections presents numerous problems. As we have explained, in the critical discussion above, the observational image of the everyday is not a record of the everyday but a record of the observation.

But perhaps a more immediate problem for observational research has become the over-whelming banality of what is found. In its raw form this information tends to merely depict that which we know. Once classified as 'known' it is therefore considered ordinary and humdrum, less attractive than the seductive flows of information sweeping around us, and unless something is done with this imagery it is easy to classify it as not very interesting. And the everyday is diminishing in interest because it competes against massive, global flows of information that is the ideal context for selling things, but not necessarily for creating them. Observational imagery then runs into the problem of transforming what is observed into forms that could be considered useful for design, partly because of an unacknowledged – and unchallenged – conflation of the photograph with reality and partly because of this competition. The imagery itself is often difficult to classify using any technique other than polar groupings of similarity versus difference. Without reference points even the differences can begin to look the same. These reference points, we would argue, are best located by regarding the photograph as a record of someone's observation and not the observation itself; considering the photograph as a form of question rather than a statement of apparent fact; and acknowledging the space between what is seen, what is experienced, and what is communicated about that seeing and experience is the gap of imagination that design must explore. This exploration is impossible when we conflate that space by regarding the photograph as evidence of the reality we observe.

Having dispensed with the evidence what is the question?

The project described here took place in Glasgow as part of the Glasgow 1999 festival year and set out to test whether images and descriptions of people's experience of the world-as-found could be communicated to designers, and if so, how designers could work with a depiction/description of this imaginary mental space.

The initial stage of the project was an attempt to picture the everyday experience of people living in Glasgow by asking them to document their observations of this experience. The resulting survey presented the broadest possible picture of what it means and how it feels to live in Glasgow. The systematic documentation of the context of house and home in Glasgow was intended to allow us to not only look in and see, through an active process of observation, but also to then transform the state-of-affairs we found.

After respondents photographed what they felt made their house into a home and wrote what they had photographed and why they made their choice, they were asked to photograph (if possible) what would make this experience better, and again to write what they had photographed and why. The two-part structure of the research method was designed to produce an identifiable differential between what produces the best experience, and what changes would produce a better experience. This differential about how it feels to live with the world-as-found produced comparative indices for the description of what is called the experience, or mental space, or public imaginary. The tabulated results of what they wrote can be assembled to read as per Table 16.1.

Next, designers were sent a random selection of the photographs with the tabulated responses. With all the documentation, designers were asked to sift through the photographs using whatever organisational method suited them in order to transform the documentation into information that was either personally, commercially, industrially, or socially useful; adapt the information to appropriate design frameworks; and evaluate the information to project possible future products, services, and living scenarios. In this way they were taking responsibility for their own observations of the images supplied rather than trying to develop an objective overview of them. Their resulting design projections were installed in ten apartments in the Homes for the Future development in Glasgow in 1999. From the ten designs we present four responses to research that is observational but whose ethnography was photographed and written by the observed.

Table 16.1 The experience of home

These things	*Transform*	*My house*	*Into my home*
ornaments 17%	to feel more spacious 20%	fixtures/fittings 34%	for relaxation 23%
rooms 21%	to modernise 18%	rooms 21%	for the feeling of space 14%
furnishings 11%	to make more attractive 12%	technology 10%	for pleasure 13%
to give more light 7%	garden 5%	for socialising 8%	
warmth 5%			

Konstantin Grcic's idea was to assume the role of the observed by selecting ten typical items one would find in any young person's flat in a city like Glasgow, and then incorporate them into the structure of this person's single room (a bed-sit). The objects could be new or second-hand, they had to be affordable for someone with an average income, no designer furniture, average looking, well considered, but not too cynical. Given that 37 per cent of people wanted their home to feel bigger, his design showed how someone fitting the profile he outlined might really live; how the need for storage, display, and a sense of livable space could be designed to make a space feel bigger (Figure 16.1).

A more empirical approach came from the architects McKeown Alexander who used the photo survey as a datum for their approach. They felt they were not qualified to attempt to make a physiological reading of the photo records, however they did mark similarities or repeated preoccupation's. For example, in their analysis at least 30 per cent of the images pictured lounges and living rooms with TVs; approximately 20 per cent provided exterior images, either of houses, extensions to houses and gardens; very few dining areas were shown; and kitchens, bathrooms, and bedrooms were shown in equal weight. Their basic summary of the above observations suggested that generally people were aware of their holistic domestic environments, but present a bias on a particular aspect or space within that environment, which makes the issue of emphasis subjective and dangerous for the designer to assess. They then said that the

Figure 16.1 'Glasgow Flat', designed by Konstantin Grcic, 1999

Figure 16.2 'Untitled installation', designed by McKeown Alexander, 1999

conclusions from the returned surveys provided them with enough evidence that informed their proposal, i.e. the need to express individuality through objects and furniture; the need to project/recreate interior ambience; and the desire to create an illusory sense of light and space (Figure 16.2).

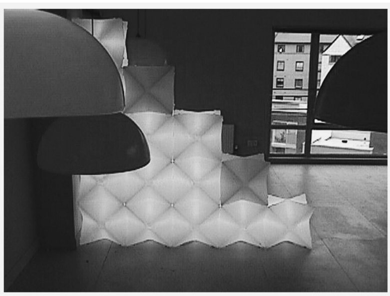
The partnership One Foot Taller thought that even a cursory look at catalogues of living room furniture showed an abundance of very large lounge chairs and sofas, and the photographic survey of Glasgow homes showed the same. They were interested in the paradox of how the living room still dominates people's 'imagery' and 'imaginary' (mental image) of their home, how the furniture was still so large, and yet how everyone appeared to want more space. Respecting all these demands, they designed a chair that was more or less the same size as the typical chair depicted in the photos, but all the non-essential structure was removed to leave the 'essence' of comfort (Figure 16.3). They hoped this would allow the apparent attachment to big armchairs to be more compatible with the pressure of small living spaces.

The British designer Tom Dixon appeared to be intrigued by how people described their desire for a sense of spaciousness in the research (a light/space correlation), so he decided to take some products he had already manufactured (domestic lights) and use them to demonstrate how they could be arranged according to the need to balance space and light (Figure 16.4). And they were assembled in this way so they did not prescribe how they should be used, but rather how they might be lived with.

Enlarging the question

Having asked what experiences make a house into a home we then sought to illustrate the public experience of a city. Using the same method of photograph and questionnaire we asked the people of Glasgow to describe what they liked and what would make that experience better in an expanding radius from house to street to neighbourhood, to suburb, to city centre. This time the results of what they wrote could be read as per Table 16.2.

No design response to this information was pursued because the information was sufficiently descriptive of the 'mental space' of the city to be assembled into an exhibition. A detailed analysis was given to the city for its planning department to guide future design decisions, but in brief the findings showed people preferred increased social and community facilities to comfort and security combined (the law and order invasion of public space is clearly more about fear than livability); the city's architecture was three times more important than the architecture of their houses (a note to the Council to care for the city); they perceived the most unattractive aspects of the city to always be closer to their home (pride has a radius); parks and gardens were seen as a dimension of the street (inside and outside overlap); they felt it was twice as important to promote the sense of belonging than to improve the city (more desire to blur the boundaries);



Far left: *Figure 16.3*
'Untitled installation', designed by One Foot Taller, 1999

Left: *Figure 16.4*
'Untitled installation', designed by Tom Dixon, 1999

Table 16.2 The experience of Glasgow

How it feels	*In Glasgow*	*Could*	*Do with a change*
pleasing 29%	is pleasing 15%	change the architecture 12%	to be more pleasing 30%
reassuring 11%	its architecture 11%	facilitate community 12%	because it is unattractive 21%
somewhere I belong 9%	its history/heritage 11%	tackle transport/traffic 12%	to enhance sense of belonging 16%
comforting/relaxing 7%	has good places to go 7%	consider tourists 9%	to improve the city 9%
a source of pride 6%	is familiar/reassuring 6%	add parks and gardens 8%	to negate the sense of loss 7%
a vital/changing place 6%		be left as it is 7%	
a sense of loss 5%			

and they felt twice as sentimental about their houses as they did about the city (change gets harder as you radiate from the centre). Despite a very dynamic set of possibilities for modifying the experience of the city, the sum of all changes (like compared to better) equated in a not surprising conclusion that they would change very little about their city.

The observational research detailed in these two related projects represents the attempt to find a method to illustrate experience rather than document the here-and-now. This research questioned the description of experiences (the search for meaning), and the photographic illustration of these experiences (the meaning of the image). Having captured evidence of experiences, the manner in which these experiences were described for the purpose of design needed to be indicative of how people felt, but not prescriptive of how matters might be changed to enhance those feelings. The research did not purport to design peoples' experiences for them; rather it illustrated experiences of the world-as-already-designed to add to the flows of information design uses in its relentless re-design of everything around us.

That the observer carried out the photo-observation of their own world illustrated not only what people saw, but the questionnaire gave us insights into why they saw it as significant in their experience of their home and city. What these projects present is the case that for design the most viable observational goal is not patterns of use, but the 'mental space' of living. By asking people to use a camera to complete a questionnaire, the pictures they take describe the actuality of their experience of the designed-world. Asking them to do this again, to use a camera to complete a questionnaire to depict how this might become a better experience, renders design possibilities. What this tells us is that photo-observation is better used to abstract experience rather than visualise the construction of the world-as-found.

Conclusion

Where the art of design has led to the myth of creativity and the science of design has led to the myth of technical rationality, the sociology of design (of which the ethnographic turn is a part of) has led to what we now call the myth of proximity. In an effort to overcome the limitations of both the artistic and scientific framing of design, design has turned to ethnography to understand the users of design and the experiences they have of the designed world so that we might better give them what they want. In getting so close, through ethnography, to the reality that users inhabit we have lost perspective of the abstract and transformative dimensions of design, as well as the abstract and transformative dimensions of experience. The perspective we have lost is critical distance, which is not the same as an objective stance. In other words, because the epistemology and methods of photo-inquiry used in design's ethnographic turn have an unchallenged realist framing we are more likely to replicate the seen world as it exists as yet more banality. That is, the project of photographing the conditions of the world-as-found in the name of research turns the project of design into a conditional image. The myth of proximity is the promise that the closer we get to the user's reality the more likely we can give them the reality they want, when in fact what we produce are images of the world that increasingly look the same. In this chapter we have presented the case that the habitual way we 'see' photographically conditions the evidence. And the ethnographic turn in design research, dependent on the photograph as evidence, is undermined because the image is now nothing but evidence of itself.

In the Glasgow projects the photograph assisted in framing the questions – what is this image and why is the object of this experience meaningful to you? The photograph in this way is a prompt to observation, not evidence itself. It is about framing, perspective, and distance – not about evidence. If regarded as evidence the photograph must be accepted on its own conditions. If regarded as evidence we are conditioned to accept as evidence of the as-found. If regarded as a way of asking questions it re-conditions observer and observed – the as-found becomes as-if.

Through careful use, observational research can be a very different study of relationships between people and the artificial world. This focus might link it with the study of social ecology, but in this relationship we are concerned with the role of design ideas in the production of this artificiality. Observing abstractions of experience creates pictures of the pathways and messages that convey individual experiences of past design decisions. Incorporating descriptions of this can enrich relationships in the future.

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PART III

How do we conduct design research?

Asking questions; data collection methods; analysing information; ethical issues

The chapters in Part III are concerned with how design research is conducted and offer examples of a wide range of approaches, tools and methods used for various disciplinary, academic and commercial contexts. The methods presented here are not an exhaustive list but they offer a patina of relevant, contemporary and often very different approaches appropriate for design research. The variety of ways in which design research is conducted illustrates the plurality, depth and richness in it. We also see a blurring of design practice and design research as we begin to see many different ways that practice might feature centrally in the production of knowledge in design. A recurrent theme in Part III is the use of mixed-methods and hybrid approaches, where the formula seems to be combining or appropriating established techniques from other domains with design abilities such as visualising information (Shumack, Sadokierski and Sweetapple) and making through prototyping (Wensveen and Matthews). Another observation in the chapters of Part III is the focus on enacting change, which aligns to conventional methods such as 'Action Research' (Villari) and explicitly applied in von Busch's 'hactivism' approach that calls for direct intervention into the artefacts of society.

Part III opens with Koskinen's identification of four main analytic cultures in design research: statistical, inductive, explication-based and art- and design-based. He argues that several cultures co-exist in contemporary design research and that this pluralism should be present in a healthy and mature field of research. A new approach, firmly situated in Koskinen's art and design analytic culture, is 'hacktivism' (hacking + activism) introduced by von Busch. Hacktivism is an emergent research approach that is used to deal with socio-cultural issues in participatory ways, offering design researchers a way of 'cultural counterintelligence', a stance currently explored in design research under the guise of 'critical design' or 'adversarial design' as it intervenes in order to challenge established orders. Similarly, Shumack's description of a hybrid approach enables us to explore in detail how existing methods borrowed from different fields can be appropriated with more design specific approaches. Shumack introduces a hybrid research approach termed 'creative designerly mapping' that offers a useful and practical means by which to explore complexity across individual and collective understandings. Shumack provides three case studies that each reflect a different emphasis and approach as forms of 'creative designerly mapping'. We continue this theme of 'designerly' research methods with Sadokierski and Sweetapple's three examples of visual analytic methods which are used to help designers draw out ideas, understanding and inspiration from written texts. All three methods rely on turning text into visual abstractions and representations in order to find hidden patterns of themes and ideas in either a focused or an exploratory way.

One of the many unique characteristics of design research is the role of and focus on designed things in the research process. This is highlighted in Wensveen and Matthew's chapter that discusses the use of prototypes as vehicles for research 'about', 'for' and 'through' design. They present a rough typology of the various ways that designed things appear in design research methods in order to identify and differentiate the range of possibilities open to design researchers for whom design practice is an essential component of their modes of investigation. Continuing with research tools and methods that have affordances for visual thinkers, Bolton introduces his 'Visual Thinking Method' as a set of reflective and critical thinking tools devised specifically for designers. The purpose of the 'Visual Thinking Method' is to help reduce uncertainty in front-end design-driven innovation and is seen predominately as a way to help design teams improve their ability to rapidly and clearly see radical innovation opportunities. Like many visualisation techniques used in research, the ability to externalise data and work with visually based information are crucial factors of the 'Visual Thinking Method'. Like the methods introduced by Sadokierski and Sweetapple, the 'Visual Thinking Method' has been developed and honed through a mixture of professional practice and design research.

The remaining three chapters in Part III offer examples of specific methods and approaches used in various design research contexts. Woodward, in an emerging interdisciplinary field of Interpretation Design, illustrates the use of Christopher Alexander's pattern language as a strategy to facilitate sharing of knowledge and professional expertise between different teams. Villari offers a detailed explanation and rationale on the suitability of the 'Action Research' method in instances where a collaborative and participatory design approach is used to facilitate shared decision-making, knowledge exchange and creative problem solving. Part III concludes with Christensen and Ball's chapter on the 'in vivo' method: a 'live' research technique aimed at investigating design cognition in naturalistic settings. Christensen and Ball's chapter offers a fitting end to Part III as it highlights recurring themes of appropriation and mixed-methods observed throughout the chapters.

17

FOUR CULTURES OF ANALYSIS IN DESIGN RESEARCH

Ilpo Koskinen

Analytic practices in design research

Design research has gone through several phases over the last 60 years. The first serious attempts to lay design on scientific foundations took place in HfG Ulm, and slightly later in architectural programmes in the United States and at the Royal College of Art in London. Most key figures involved in these efforts had, however, given up hope of turning design into a science by the early 1970s. Tomas Maldonado called them immature; J. C. Jones told designers to turn to art; Christopher Alexander famously told designers to "*forget the whole thing*" (Maldonado 1984; Alexander 1971; Jones 1984). The disappointment to post-war optimistic dreams of building a rational society was part of the Zeitgeist of the late 1960s, and design could not escape it.

What we were left with were a few research departments in design schools, lukewarm enthusiasm among practitioners, and few significant academic contributions. With the exceptions of ergonomics and foundational work in how designers solve problems, design research was dominated by art history and with the wake of postmodernism, cultural studies (for example, Dreyfuss 1967; Lawson 1980; Cross 2007). Useful as they were in teaching, they tended to widen the gap between design and research.

Fresh interest in design research came from several corners in the 1980s and the 1990s. The 1980s saw the first steps of design management, but a broader renewed interest in research had to wait until the 1990s, when design first turned digital, and slightly later, when communications technologies began to change the technological base of design. These technologies, however, had no obvious form – what is the 'shape' of software? As the problem designers faced was what to design, not how to design, designers turned to user research. In slightly over ten years, design had got several new research communities, like usability and user experience researchers, ethnographers, sociologists, even some natural scientists, management scholars, computer scientists and engineers of many persuasions, and 'practice-based' research communities that bring art into design research. Much of this development took place under the wings of semiotics, philosophy, management, usability engineering, psychology, and sociology.

As a result, design as a set of disciplines has at its disposal an immensely richer set of methods and techniques than 20 years ago. The picture of design research today is hard to compile because of the proliferation of research communities. As new research communities have developed, they have usually learned their research practices and worldviews from disciplines with longer historical roots. By implication, keywords like 'analysis', the topic of this chapter, have become difficult to understand.

One source in understanding how the design profession understands analysis is the research class design schools organise for MA and PhD students. They tend to tell a picture of an occupation borrowing its methods from other fields of learning, be these sciences or social sciences. For instance, at The Hong Kong Polytechnic University doctoral classes divide methods into qualitative, quantitative methods, and historical methods. Many design research disciplines do fine with this palette – for example, in design management research tends to be statistical or it builds on case studies that build on linear models (Heskett 1989; Kicherer 1990).

If we turn from education to design research, the picture gets more nuances. For example, critical design builds on design tradition, architecture, and contemporary art in search of methods. Art provides references and models also to 'practice-based' research (Mäkelä and Routarinne 2007). As the case of cultural probes, some of these initiatives speak the language of design, and are more attractive to design students than, say, statistics or case study analysis (Presence Project 2001). Also, some recent work has started to unravel empirically how designers and architects of the calibre of Santiago Calatrava analyse problems and turn them into design programmes (Dorst 2012).

As this brief account suggests, design research has several cultures of analysis, not just one or two. There is no such thing as 'the analysis'; rather, there are several ways to analyse. The variation is not endless, though, and can be broken into a few main categories. The unit of analysis of this chapter is analytic culture – those deeply ingrained habits and techniques through which design researchers examine the structure of their data before proceeding to conclusions. Terminology used to describe this step varies, and practice adds to confusion: design firms like eLab and IDEO have talked about storytelling, concept design, or predesign rather than analysis.

Designers as statisticians

Interaction designers in leading engineering schools like Delft, Eindhoven, and KAIST usually take their research methods from the sciences and theories from psychology (see discussion on statistics below). In practice this means that research becomes a theory-driven, experimental enterprise in which analysis is statistical. A researcher interested in, say, a new form of interaction, reads existing literature and formulates a hypothesis, an explanation based on theory. After creating a design, he conducts experiments. These experiments produce measurements that he analyses with statistical methods. The final phase of research is discussion, in which the researcher evaluates the merits of his hypothesis against competing explanations, assesses possible threats to validity, and describes his vision of the implications of the study for the future (see Stappers 2007 for a good account).

Usually statistical methods are used in conjunction with experiments and surveys. They are also routinely used in non-experimental sciences, however, like geology and bird migration studies, as well as in some mathematical fields of the social sciences, most notably econometrics. Statistical methods are typically divided first in descriptive and decision-making statistics, and second in linear models and multi-variate methods. A specialised field is statistical inference and sampling. There are numerous statistical software packages, most notably SAS and SPSS.

Typically, a study that uses statistical methods has its beginnings in some theoretical issue. For example, when working in Delft, Stephan Wensveen built an alarm clock that was supposed to read emotions in the evening, and adjust its wake-up call accordingly (Wensveen 2004). His design was a large spherical disc with slide buttons around the disc. The idea behind the design was that when tired or angry in the evening, people almost hit the clock; when in a good mood, they carefully adjust and almost caress it. Sensors in the clock read these patterns, and then the clock decides how to wake the user up. For instance, if the user went to bed angry, he got a gentle alarm; if in a good mood, the alarm could be more abrupt. His study used sophisticated trigonometric models to model the positions of the switches, and subjects in his study came from the technical university community at Delft (for pictures of the clock, see for example www.acm.org/uist/archive/adjunct/2002/pdf/demos/p55-wensveen.pdf).

In very broad terms, statistical methods are the first choice in engineering schools, in engineering research communities, in ergonomics, in psychologically oriented fields of design research, and among the more senior factions of human-computer interaction. The anomalies are significant as well. Most researchers in art schools and traditional design occupations (including industrial design) avoid statistical methods, as do most researchers in Europe and North America. Also, in design firms and in design units in major corporations, ethnographic methods tend to find a more receptive audience than statistics.

It is important to keep in mind that a good deal of research that at the outset has little to do with statistics or experiments shares a basis with them. The most important design research area in which researchers often – not always – share background assumptions with the sciences is design management, with many researchers trained either in economics or engineering. The methods of choice in design management are questionnaires and case studies, and a good deal of case study research follows Robert Yin's well-known book with the same name (Yin 2003). The best case studies are typically about firms like Philips and Olivetti (Heskett 1989; Kicherer 1990), and though qualitative and historical, they are usually treated by other researchers as observations in statistics. The practice is similar to case studies in business schools and the Human Relations Area File in anthropology.

The problem of meaning: design and qualitative social science

User-centred design became popular in design in the 1990s. User-centred methods of analysis usually come from interpretive social sciences, most notably from sociology and anthropology, but there are philosophical reasons too. People think and talk, and can always change their ways, however habitual and mechanical they may look. As the philosopher Peter Winch noted in the 1950s, the apple that fell on Newton's head could not choose not to do what it did. When the President declares the state of war, he is not only making a choice, but also is deeply aware of the consequences of his words. As Winch notes, this means that in studying humans as if they were bacteria or atoms misses the crucial point that move humans: meanings (Winch 2008: 119). A related problem is 'context': those times, places, and practices in which people make sense of design and put it to use. This context is practically always socially shaped and heavy with meaning: cities are shaped by someone's visions, and elaborated by others'; interiors are designed by someone, decorated by others; our fellows listen to us and build on what we say, and come to shape the way in which we can act. People make some things relevant from this environment, edit others into the background, and that way make some definitions real.

To make sense of meanings and context, design researchers have sought useful techniques from anthropology and sociology. While literature has centred on contextual design and, in human-computer interaction (HCI) on participatory design, several recent books have begun to expand the picture (Squires and Byrne, 2002; Cefkin, 2010; Clarke, 2011). The first pushes to ethnography took place in Chicago and slightly later in Silicon Valley (Beyer and Holtzblatt 1998). Ethnographic research has many proponents in industry and in many university departments design research has come to mean short ethnographic studies akin to site visits in architecture.

When researchers build on this background, analytic practices are usually loans from the social sciences. For instance, post-it clustering exercises known as 'affinity walls' have much in common with analytic induction as the sociologists William Thomas and Florian Znaniecki described in their research technique in the 1930s (Thomas and Znaniecki 1974). Analytic induction has a few steps:

> 1 Analyse a small number of cases (typically, people) closely. Push hunches and inspiration too far: at this stage, it is important to be creative. Unworthy ideas are dismissed later.
> 2 Create a set of hypotheses from this analysis.
> 3 Test these hypotheses with the same data.
> 4 When a hypothesis stands this preliminary test, analyse negative cases that fit to the emerging hypothesis only with difficulty. If the case does not fit the hypothesis, discard or revise the hypothesis, or add a new dimension to the analysis. Typically, negative cases come from secondary and deviant user groups.
> 5 Proceed until all cases have been analysed, and you have a description that describes all data. Typically, this is a conceptual framework that is ordered from the most important concepts to less important ones. This conceptual framework can simply be called 'an interpretation'.
>
> *Koskinen et al. 2003: 62–63*

Sometimes researchers also want to generalise the interpretation with comparative data from other studies. Occasionally, this interpretation is shared with people in the study, who can check whether it makes sense and what needs to be corrected.

A recent example comes from Helsinki, where Heidi Paavilainen (2013) studied the lives of design in homes. The aim was to study what kind of role the notion of design plays in this process. She collected data by repeatedly interviewing people, both design enthusiasts and people who knew next to nothing about design, to see what happens to design objects at their homes after what can be called a honeymoon period – a period in which people explore alternatives, visit shops, buy a product, and explore it at home. She quickly realised that in everyday life, design plays a far less prominent role than many design writers tend to assume. Some people pay a great deal of attention to design, while others could hardly care less. Many design objects enter the home through inheritance and as gifts, and as a consequence break the curated feeling of the home. Design collections disappear in broken marriages, while new relationships create new collections.

One big issue in ethnographic research is the relationship of theory and analysis. Brigitte Jordan, one of the most experienced design anthropologists, has noted that through her years at Palo Alto Research Center there was a constant strain between technique and theory. Teaching data collection to engineers and designers was relatively easy, but teaching the intricacies of analysis was considerably more difficult. She placed the blame on education. Professionally trained anthropologists learn analytic skills through repetitive immersion in fieldwork and years of graduate education in which they are exposed to many kinds of analyses. She asks rhetorically whether it really is possible to teach similar skills to non-anthropologists without all this experience (Jordan and Yamauchi 2008: 35)?

The question Jordan opens up is what kinds of skills designers learn in their graduate studies, and how these skills shape research; after all, they are exposed to *some* kinds of analyses in their education. As IDEO's Jane Fulton Suri has noted, successful designers are sensitive to things around them, even though these observations inspire their work in non-theoretical ways (Fulton

Suri 2011: 1–2). She tells how IDEO was hired to extend the brand of Havaianas, the Brazilian brand known for swimwear. The project leader, Miguel Cabra, first took his team to Brazil. The team came back with hundreds of photos and a wealth of observations. The problem, however, was that everything seemed exotic to European team members. When the team then went to India, it realised that many themes – colours, patterns, ways of carrying things – they had seen as 'typically Brazilian' were in fact common to both countries. They came up with a bag that could carry more than its capacity. Their observations about the meanings of things were based on their design sensitivities, not on anthropological theory.

Explication: design researchers as scholars

When browsing through some of the most prominent design conferences and journals outside industrial and interaction design, we can easily see papers based on yet another culture of analysis. This is the case in the humanities – including design history – aesthetics, and philosophy, but also sometimes in constructive research and in interpretive research in design management. There are exceptions, as historians who work with quantitative methods, but the mainstay is not statistics or fieldwork but what can be called 'explication': a detailed examination of meaning. Explication can be theoretically informed, as is often the case in product semantics, which uses linguistic and semiotic theories in deciphering meanings in design.

Though not codified in the manner of statistics or analytic induction, explication has a structure, however. The structure is fairly similar to analytic induction in that explication is a bottom-up activity. There is first an examination phase in which a piece of design is examined and evaluated in detail before decisions about where to go next are taken.

Usually, these kinds of procedures are described as a circle or spiral. When discussed in philosophical terms, the most common reference is to hermeneutics, and in particular to Hans-Georg Gadamer's seminal *Wahrheit und Methode (Truth and Method)* (1975), which described explication as a hermeneutic circle in which new facts force the researcher to change his interpretation until all the facts can be explained. The roots of Gadamer's work are in text-critical biblical studies that go back to the end of the eighteenth century. Yet, it is important to keep in mind that the title of Gadamer's *magnum* opus is ironic. He does not propose that the way to knowledge is having a method, but the contrary: his book is a warning that no method is failsafe. The only way to truth is relentless, careful questioning.

Processes of explication may be difficult to describe, but they work, as the history of humanities amply shows. In design research, their stronghold is in studies building on the humanities. If a researcher wants to understand Frank Lloyd Wright's, Ettore Sottsass's, or Hans Gugelot's career, she has to go to several archives; talk to their family, friends, and contemporaries; study design culture and its dynamics of their era; and situate their work into a framework more complex than typical heroic narratives of creativity. This is even more evident if she wants to write the history of Swiss graphic design. It is impossible to work through 50 years of history mechanically. The only viable method is to rely on the historian's mind and turn it into a research instrument.

What kind of scholarship does explication lead to? The sociologist Pertti Alasuutari has made a useful distinction between factist and sample perspectives (Alasuutari 1995). In factist perspectives, data are treated as facts about something outside data. For example, letters tell about the writer's emotions. From this assumption follow others: most importantly, the question of whether data is correct or not. In sample perspectives, in contrast, a piece of data is treated as an object of interest in itself. The question of whether it is true or false is meaningless, and research concentrates in explicating its structure.

When explication lies in the heart of analysis, contribution and novelty lies in constructing better explanations, not in discovering new facts or conducting better experiments as stated the doyen of American anthropology Clifford Geertz in 1973:

> Knowledge [in cultural anthropology] . . . grows: in spurts. Rather than following a rising curve of cumulative findings, cultural analysis breaks up into a disconnected yet coherent sequence of bolder and bolder sorts. Studies do build on other studies . . . in the sense that, better informed and better conceptualized, they plunge more deeply into the same things . . . the movement is not from already proven theorems to newly proven ones . . . a study is an advance if it is more incisive – whatever that may mean – than those that preceded it; but it less stands on their shoulders than . . . runs by their side.
>
> *Geertz 1973: 25*

There is something akin to growth of knowledge indeed but it is not like in the sciences in which facts accumulate. In Geertz's vision, a contribution is typically an improved understanding. Earlier explications are contestable and debatable, and treated as arguments in on-going conversation rather than as indisputable facts. Many fields of learning function like this. Goethe does not write anymore; still, Goethe scholarship improves over time. Many design disciplines also function like this. The world is full of chairs, but occasionally, better chairs show up. Contemporary designers build on their knowledge of other chairs, but somehow manage to go deeper than the giants from the past. Making a piece of furniture better than Eames, Ponti, or Kukkapuro is very difficult, but not impossible.

Art and design as analysis: learning from contemporary art

While the three cultures above build on research world practices, the fourth culture builds on contemporary art and design. For practising designers, this may be obvious, but for researchers, the step can be radical. In fact, many who take the step explicitly distance themselves from science. The best-known example is probably *Design Noir*, in which we can read that through research it is "definitely not scientific" (Dunne and Raby 2001: 75).

Perhaps the main difference between this and other cultures is that in other cultures, researchers want to make sure other design researchers can understand the way in which some study has taken shape. Without transparency, others can neither repeat the study nor inspect its reliability and validity. In art and design, there is more tolerance to idiosyncrasies and vague analysis; in fact, ambiguity may even be encouraged, if it leads to interesting designs (see Presence Project 2001).

A good recent example from the borderline of design and research comes from a new catalogue about Alessandro Mendini's work (Mendini, Weiss and Nollert 2012). The catalogue describes how some of his designs saw daylight as games and collages of everyday objects and colours and forms from Czech Cubism. In treating ordinary objects as ready-mades but by colouring them with a completely different palette, he built extensively on several art-world practices. For instance, by contemporising things and values with Cubist aesthetics, he created collages of the banal and the refined and the stylish with the kitsch. In more traditional language of research, he created a multidimensional space by juxtaposing extremes. The results were objects like *Poltrona di Proust*, a collage of an old chair with pointillism.

This kind of work begins with browsing, organising, reading, and getting familiar with materials that have been collected. These materials are placed on moodboards for visual inspection and turned into collages for critique, which identifies themes for design. Sometimes the aim is analysis; sometimes it focuses on seeking discordances and pathways out from conventional design solutions.

As recent literature argues, several well-known design cases have been based on these techniques. For example, when Alessi renewed its thinking about kitchens and went from stainless steel and other metals to plastics, its designers started to redesign spoons, eggcups, and bottle openers as if they were toys (Verganti 2009). It goes without saying that many avant-garde designs of the likes of a Jerszy Seymour owe a lot to performance art, actionism, and installations (see Seymour 2011). How would Jackson Pollock have designed interiors?

Kees Dorst, who has developed a design methodology for unsolvable problems, has made a related observation in a forthcoming study of how people like Santiago Calatrava work (Dorst 2012). The creative step in his methodology consists of identifying themes and framing them in ways that solve several problems simultaneously. One of his examples has been the King's Cross area in Sydney. Having a high concentration of bars and nightclubs, combined with Australian heavy drinking habits, this area is seen as a public problem with nightly fights, petty theft, and occasional alcohol poisonings. The City had tried every traditional method of social work and policing to calm the area. Dorst's group took another tack. Instead of thinking about King's Cross in public policy terms (for instance, community policing), they saw it as a public event, and sought methods from rock festivals and other massive public events that gather tens of thousands of young adults to celebrate, but have very few, if any, of the problems typical to bar streets. With this frame in mind, designers went on to find ways to distribute water on the streets, add knowledge of existing toilets, and design signs that could lead people away from late-night taxi queues to trains.

Seeing some analytic processes in design research though art gives insights into how many designers and design researchers work. It also helps to understand better some of the creative steps they take. The main danger in this kind of thinking is glorifying creative work and neglecting research. As Otl Aicher, one of the leading figures in HfG Ulm, has noted, design schools have had a habit of encouraging designs that build on form rather than functionality, technology, and aesthetics. As he writes, Rietveld's constructivist chairs are Mondrians for sitting rather than serious design in the manner of Charles Eames, for whom materials, technology, and aesthetics came before form (Aicher 2009). Design needs its artistic end, but if this end defines good design, this choice runs against the professional ethic of bodies like ICSID that tell designers to serve ordinary people. The creative step is only one step in a much longer design process, not its essence.

Discussion

Design research has developed fast over the last two decades, and in the process it has learned from many kinds of research and artistic practices. This chapter has been looking at analysis, a crucially important step in any research, but also a step that has not received as much attention in literature as it merits. It has been looking at analytic cultures instead of what the individual studies, and described four main cultures: statistical, inductive, explication-based, and art and design-based.

As this chapter shows, several cultures co-exist in contemporary design research. This is how things should be. This is how things are in many other fields of learning, and design cannot be different. Just like methods for data gathering, analytic methods need to fit the purpose. Designers have learned from the sciences, the social sciences, the humanities, and art, but this does not turn them into scientists, sociologists, philosophers, or artists – after all, using statistics does not turn economists or biologists into statisticians. Refusing to borrow analytic methods from other fields of learning would be preposterous. For design education, however, this chapter poses a challenge: how to bring this diversity into curriculum currently dominated by loans from the sciences and the social sciences.

When design researchers aim to construct something, analysis proceeds in two steps. At first, there is analysis in the sense described in this chapter: it is an effort to make sense of data, be these secondary data of some sort, ethnographic data, probe returns, or some kind of scrapbook or collage. Then researchers decide what kinds of implications this analysis has for design. Though not always, these are usually separate steps. Research and analysis 'inspires' detail design rather than structures it. Analysis is followed by design workshops that take research findings as a starting point for creative solutions.

This chapter has touched upon theory in a few places. The way in which theory works in research depends in part on analytic culture. In statistical research, theory gets a way more pronounced role than in other cultures. Researchers rely on theory in formulating research questions, planning data gathering, analysing data, and, in case they construct something, in prototyping. In interpretive and explication cultures, theory works as a source of precedents but also as a sensitising framework that brings imagination and process to analysis. In addition, it gives tools for following how people understand prototypes in everyday life. In art and design-based work, research builds on referents rather than theory; however, there is often a lot of theoretical and philosophical depth behind the surface. For instance, in recent work in critical design, these references go from Situationism to Marx's theory of commodity fetishism, to mention a few (Presence Project 2001; Debord 2002; Jappe 1999).

The contribution of this chapter is in its way of posing the question of analysis. My belief is that the best way to understand analysis in design research is to look at it from an abstract perspective. In this chapter, the device of abstraction was the concept of analytic culture, which gave the chapter a powerful narrative that covers most analytic practices in design research. Can there be more cultures? Possibly, but unlikely: the cultures explicated in this chapter are dominant in the sciences, the social sciences, many fields of the humanities, and contemporary art. It is difficult to be creative against the full weight of these traditions. The main gaps in knowledge are no doubt in art and design-based analytic methods. Despite recent advances, more research is needed to understand these crucially important practices better.

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18

HACKTIVISM AS DESIGN RESEARCH METHOD

Otto von Busch

When designers do academic research it may sometimes be ambiguous what to do with our own agency. Being trained to make *the next new thing*, it can become troubling to realise that one's profession is mainly making new solutions in order to preserve an unsustainable, and often socially unjust, status quo. However, there are examples of ways to re-activate existing assets and resources, ways to 'hack into' and re-circuit systems and knowledges, and from these interventions build more socially sustainable and just practices.

Activist research methods

While some types of research are based on distanced observation and non-intervention, others claim agency, action and a will to intervene in the world in order to change it. As highlighted by liberation sociologists Joe Feagin and Hernán Vera, the researcher's aim for social change builds on the tradition of Karl Marx, who wrote that "the philosophers have only *interpreted* the world, in various ways; the point, however, is to *change* it" (Feagin & Vera 2001: 1) and they continue:

> Sociologists centrally concerned about human emancipation and liberation take this insight seriously. The point of liberation sociology is not just to research the social world but to change it in the direction of expanded human rights, participatory democracy, and social justice.
>
> *ibid.*

As pointed out by sociologist William Carroll, knowledge is unavoidably implicated in relation of power, and research may challenge some aspects of domination as,

> the critic realizes that our world—including our knowledge of that world—is not simply *given*, or the result of a natural process, but is an historical construction. It has been produced by the past actions of people, and therefore *can be remade* by future actions.
>
> *Carroll 2004: 2*

For critical research, the task of knowledge production is to change the world, and Carroll starkly puts it, "in a socially unjust world, knowledge of the social that does not challenge injustices is likely to play a role in reproducing it" (ibid.: 3). Carroll further distinguishes three overlapping critical edges of inquiry: *oppositional*, challenging status quo and taking the side of the oppressed; *radical*, getting at the root of matters to challenge the deeper, systematic bases of the challenges we face; and finally *subversion*, which disturbs the ordinary, interrogating the common-sense and opens doors to alternatives (ibid.). It makes research a critical movement, which is 'open and experimental' and unlocks new political spaces in which to act (Magnusson & Walker 1988: 60).

Similar to Participatory Action Research (PAR), hacktivism (hacking + activism) deals with public issues and social 'troubles' in participatory ways in order to change unjust social conditionings. In PAR research methodology, the research is only one element besides inclusive participation and action for change, and it is "in effect a form of radical pedagogy" (Carroll 2004: 276). Following the influences of Paulo Freire's *Pedagogy of the Oppressed*, the subjugated or marginalised must be active participants in their own emancipation, "so that through transforming action they can create a new situation, one which makes possible the pursuit of a fuller humanity" (Freire 1970: 32). Freire means this is facilitated by a problem-solving education which talks back, and "strives for the *emergence* of consciousness and *critical intervention* in reality" (ibid.: 81). The aim is to improve practices that produce knowledge relevant to the democratisation of social life, which leads to the conclusion that "In PAR the question 'Is it rigorous?' is complemented by the equally important question 'Is it empowering?'" (Kondrat & Julia 1997: 44).

British philosopher Stephen Toulmin (1996) argues that action research is based on an Aristotelian perspective of publicly enacted knowledge or virtuous practical reasoning, or *praxis*. For Aristotle, various forms of knowledge require different methods, even those that explicitly pose value questions about virtuous performances. "*Praxis* knowledge regulates, or organises, the relationships between equals" (Eikeland 2012: 27). These types of knowledge are locally anchored in emancipatory practices. Hannah Arendt proposes a similar perspective, where *praxis* is a public form of intervention, or producing public debate through virtuous action (Arendt 1958). Similarly, Jürgen Habermas declares that "in a process of enlightenment there can be only participants" (Habermas 1974: 40). This take on practice resonates with the basic constitution of design, as design in itself is an intervention and a course of action towards something intended, which in itself is a value proposition, conscious or not made by the designer and later user. Design not only changes things to the more desired condition, as famously proposed by Herbert Simon (Simon 1996), but in addition it brings forward what does not come naturally, by purposefully proposing the realisable (Krippendorf 2006).

Friedrich Fröbel, the founder of the kindergarten educational model, claimed that "[m]an only understands thoroughly that which he is able to produce" (Larsson 1902: 11) and early action researcher Kurt Lewin meant that "in order to understand something you have to change it" (Eikeland 2012: 16). In resonance with these ideas, PAR aims "to study a system and concurrently to collaborate with members of the system in changing it in what is together regarded as a desirable direction" (Gilmore et al. 1986: 161). However, PAR aims not only to build individual agency in the form of artefacts and individual knowledge but exposes systematic contrast in order to examine alternative social arrangements in a manner similar to what sociologist Gideon Sjoberg has called a 'countersystem' approach (Sjoberg et al. 2003; Feagin & Vera 2001).

If we would call the workings of our daily life the 'operating system' of society, the hacktivist countersystem approach aims to hack into and reorder these workings, making them more socially just through community action, social justice, diffusion of agency and critical curiosity in order to amplify self-determination and build capabilities for action. The critically constructed countersystem built by the hacker slightly shifts the critic's role, in line with the new form of critique called upon by Bruno Latour:

> The critic is not the one who debunks, but the one who assembles. The critic is not the one who lifts the rugs from under the feet of the naïve believers, but the one who offers the participants arenas in which to gather. The critic is [. . .] the one for whom, if something is constructed, then it means it is fragile and thus in great need of care and caution.
>
> *Latour 2004: 246*

This type of assemblage of new worlds is central to hacking, even if its purpose is to call upon emergent systemic change. As we will see further on, hacking requires a tactic of 'cultural counterintelligence' (Becker 2002), and this stance resonates with design research such as 'critical design' (Dunne 1999) or 'adversarial design' (DiSalvo 2012) as it intervenes in order to challenge established orders.

Not only are the outcomes different from non-intervention research, but also the methods of inquiry. Besides participatory observations, a popular and playful way to examine systems and practices is the use of 'probes' – provocative tools for inquiry – engaging users to become co-researchers (Gaver et al. 1999). This type of perspective is also common in 'constructive design research' where designers put entities into the world and discuss their performance both academically and practically, primarily experimenting with ideas rather than aiming to build rigid or valid claims. In this type of research programme, "debate is more important than facts and knowledge" and a "successful constructive program participates in public discourse and interprets society rather than acts as a legislator" (Koskinen et al. 2011: 48).

The core of hacktivist research is the amplification of participant agency and the orchestration of emancipatory processes: it is based on finding, tracing and bending processes of becoming, tuning and re-circuiting energies, flows and power. It is not about revolution or migration to a new system, but like PAR, taking the system at hand and *liberating* unused assets, potentials and passages through it. In this manner, hacktivism is about actualisation of the virtual, re-circuiting processes of becoming – using the 'in-betweens' and hidden resources and potentials by *intensifying* their force through strategically deployed efforts to build new capabilities. That is, not adding more of the same energy, but re-circuiting seemingly disparate energy flows and skills to strengthen one towards social aims, such as Feagin and Vera's directions of expanded human rights, participatory democracy and social justice.

The aim is to affect the processes of becoming/actualisation, and produce new capabilities within the system in the hands of the participants. This is made through the hacking tactics of building on existing codes, comments and interventions of previous researchers, and making sure these efforts point to new possibilities and mobilise new capabilities in efforts of small change. To expose these mechanisms better, we need to explore the concept of hacking.

Hacking and hacktivism as systemic practices

Hacking is a contested concept usually connoting some form of digital-based countercultural rebellion and it is a contested matter if hacking is constructive or destructive. Programming guru Eric Raymond simply makes the distinction: "hackers build things, crackers break them" (Raymond 2001), while media theorist William J. Mitchell paints a more nuanced description where "[t]he best hacks are cleverly engineered, site-specific, guerrilla interventions that make a provocative point but aren't destructive or dangerous" (Mitchell 2005: 118).

Social researcher Anne Galloway draws out some central points of hacking:

- Access to a technology and knowledge about it ('transparency').
- Empowering users.
- Decentralizing control.
- Creating beauty and exceeding limitations.

Galloway 2004

To these points I would also like to add: 'using the intelligence of many for innovation, and sharing it freely', as the hacker ethic is based on sharing, collaboration and building on already existing code and systems. This last point is often provocatively summed up in Stewart Brand's idea that "information wants to be free" (Brand 1985: 49).

As noted by Raymond earlier, the constructive part is the main motivation of the hacker (Raymond 2001). However, when newly constructed elements appear in the world, old relations of power may be altered, or even broken. As anthropologist Christopher Kelty (2008) points out, hacking, or the practice of 'geeks', introduces new entities into the world, based on the worldview of the geeks. Such new entities overturn existing concepts and modes of representation. These types of constructive practices are "involved in the creation of new things that change the meaning of our constituted political categories" (Kelty 2008: 94). A hack mobilises a mix of entities, not just software or hardware, but also law, people and practices, and all are somehow affected by the new entity constructed. What from one producer seems like trespassing can from the perspective of the newly introduced entity seem as a rightful appropriation of everyday culture, as exposed in the motto of the DIY magazine *Make*: "if you can't open it, you don't own it" (Jalopy 2005).

By introducing new entities, often amplified from existing sources and unsettling status quo, a hack draws new borders, displaces power and re-circuits established chains of command. A hack is a countersystem which tweaks the order of the habitual system, sometimes even making the old and new systems incompatible. Hacking may thus produce a situation of 'adversarial design', a dissident contribution to the world, as examined by interaction designer Carl DiSalvo. Adversarial design exposes inconsistencies and disagreements as a form of political design, producing agonism and contestation (DiSalvo 2012: 2). It highlights ruptures and dislocations and is a tool to provide, recognise and express dissensus, but also constructs paths for change. As DiSalvo notes: "adversarial design can identify new terms and themes for contestation and new trajectories for action" (ibid.: 13) Just like hacking, it proposes new paths for a countersystemic and emancipatory movement, and also produces agonistic 'design things' or controversial assemblies that challenge hegemony and views other than the 'legitimate' (Binder et al. 2011: 189).

Ever since it was coined in 1995 by Jason Sack, the neologism 'hacktivism' (of 'hacking' and 'activism') has been connected to the field where autonomous anarchist tradition meets activism and digital subversion. Hacktivism as a concept connotes to squatters, phreakers, scammers, crackers and cultural jammers who mix civil disobedience, online activism and hacking to employ the "nonviolent use of illegal or legally ambiguous digital tools in pursuit of political ends" (Samuel 2004). The hacktivist stance gathers agonist and dissident constructions of countersystems to highlight contested areas of life and are means to the political ends of expanded human rights, participatory democracy and social justice. Hacktivism could be said to be an emancipatory mode of bottom-up (counter)system design.

Traces of this countersystem approach can also be found in the *Jargon File*, the lexicon for hacker slang. The entry of 'hacker' suggests that it is: "A person who enjoys exploring the details of programmable systems and how to stretch their capabilities, as opposed to most users, who prefer to learn the minimum necessary" (Jargon File n.d.).

As already noted, the whole social sphere and knowledge is human-made and can be seen as many overlapping 'programmable systems', technologies, apparatuses or soft systems. Not least the structural arrangement of culture, capital and communication.

However, what sets hacktivism apart from PAR is hacking's emphasis on direct intervention into the *material culture* and *artefacts* of society, tweaking the material, social and cultural systems and operations. Hacking takes on a system that is embodied in a machine or device; it is the conscious "trickery and manipulation of a system" (Cramer 2003). Hacking means to open black boxes, reverse-engineer their circuitry and build a new 'plug-in' to the system, challenging it and releasing new capabilities from it. It is about constructing alternatives, not too unlike Andrea Branzi's imaginative research:

> The architectural or design project today is no longer an act intended to alter reality, pushing it in the direction of order and logic. Instead the program is an act of invention that creates something to be added on to an existing reality, increasing its depth and multiplying the number of choices available.
>
> *Branzi 1988: 17*

Such programmatic inventions require hands-on interventions.

Interventions and provotypes

Hacktivist research is about action, making interventions in the world. A lot of everyday design happens on a simulation level, where the designer makes proposals in the form of sketches and renderings, and very few ever come into existence. This type of design is about the hypothetical preparation for the future. Typical examples of this may be architects, who draw many proposed buildings and may pass through a whole education without ever building a finished house. A similar training is that of the military officer who passes through endless histories, hypothesis, scenarios and simulations, but very seldom experiences a real battle (Abbott 1988).

Another take is an experiment-based approach where the lab is the arena for staged and enacted tests of ideas. In the lab, however, the situation and context is staged in one way or another. The lab is about controlling the parameters of the inquiry, creating isolated scenarios and minimising noise. The lab reproduces reality and lets some of it in through its methodological filters; users may be invited to perform tests, or various forms of more tangible techniques such as 'bodystorming' may be used to bring the experiments closer to real experience (cf. Buchenau & Fulton Suri 2000).

However, hacktivism is *implemented* through interventions and takes on specific social and material effects. As mentioned above, it is based on systemic counterintelligence, reverse engineering, the tracing of pathways and flows through a system, in order to position an intervention at the most effective place in order to change it in some physical way, however modest. Hacktivism is craft-based, breaking open, probing and exploring systems in order to bend or re-systematise them into a more desirable direction.

Hacktivist research follows in the footsteps of the artistic interventionist tactics encouraged by the art and activist group Center for Tactical Magic. Their projects are multilayered yet they follow a framework guiding their creative engagement. Their formula puts emphasis on the physical intervention characterised by:

1) a thorough analysis of existing forces
2) an attachment to one existing force
3) an active engagement within the dominant sphere of activity
4) specific, material effects

Gach & Paglen 2003

This type of intervention resonates with the 'interrogative design' of industrial designer and artist Krzysztof Wodiczko and enacted, perhaps most famously, in his vehicles for homeless people. Parts of his method are similar to those practised in participatory design, but crucial to his method is the addition of a critical questioning to the design practice which disrupts and reveals the underlying inequalities that design usually covers. Without finding real solutions to the problems, the importance is put on the intervention which questions the world and its functions, pointing towards political action.

> Designers must work *in* the world rather than 'about' or 'upon' it. In an unacceptable and contradictory world, responsive and responsible design must appear as an unacceptable or contradictory 'solution'. It must critically explore and reveal often painful life experiences rather than camouflage such experience by administering the painkillers of optimistic design fantasies. The appearance of interrogative design may 'attract while scandalizing' – it must attract attention in order to scandalize the conditions of which it is born. Implicit in this design's temporary character is a demand and hope that its function will become obsolete.
>
> *Wodiczko 1999: 17*

In this sense the hacktivist intervention interrogates the world, materialising a scandalising countersystem. The intervention also serves as a 'provotype', rather than prototype, as sketched out by interaction design researcher Preben Mogensen (Mogensen 1992). Mogensen proposes a method of "provocation through concrete experience" as a way to "devise qualitatively new systems" (Mogensen 1992: 31). This means to prototype the future through concrete experience, while simultaneously raising the perspective of what is possible beyond the habitual reference of the actual, thus stimulating action. The aim of the provotype is to break the everyday operations and taken-for-grantedness of our interactions. The role of the designer is to enact three different roles: expert, facilitator and provocateur, depending on the concrete situation.

The provotype creates a framework to imagine and manifest the radically different. The intervention is thus a type of rehearsal of a possible 'micro-utopia', made in order to render the possible imaginable and discussable (Wood 2007). It is a practical fieldwork in the future, or in the radical imagination of designers and users, rather than in the present. Koskinen and colleagues draw similar parallels where:

> The aim is to turn fieldwork into an exercise of imagination rather than mere data gathering. In the tough time lines of design, it is hard to view 'dreams' by observation alone. If researchers want to about things like dreams, people have to be invited to the dream during fieldwork.
>
> *Koskinen et al. 2011: 76*

The provotype intervention thus questions the world by raising awareness to new possible scenarios, and mobilises action. Technical examples may be the tweaking of gender-stereotyped toys by Barbie Liberation Organization (Harold 2007), or the hacking of sounding toys in order to produce new forms of music, called 'circuit bending' (Ghazala 2005). But it may also be systematic intervention into the system of fashion and collaborative clothes production (von Busch 2008).

Such actions may seem limited in scope, but the modus operandi is similar to the development concept of 'small change', suggested by Nabeel Hamdi (2004) which means improvised and immediate small-scale actions towards empowerment. To Hamdi, this means participation from below in limited issues, for example a bus stop or a compost bin, that later grows into a large-scale and long-term practice, as over time the collaborations become more sophisticated and intelligent. By redrawing the stretch of a bus-line, introducing a new stop, Hamdi shows how the re-circuiting of the bus stop produces other social interactions, leading to new informal social structures emerging, producing new conditions for an informal market, which in turn assembles children doing their homework on the electric light of the vendors (ibid.: 73ff). The importance is put on finding the dynamic forces and points where acupuncture-like interventions may release energies throughout the system, and not try to force the system towards one abstract and distant end, such as 'modernisation'. For Hamdi, the goal is not to create a massive movement but to encourage and 'tip over' those who are close to acting but lack courage or a working example:

> Small Change captures three important principles that recur throughout: 'small' because that's usually how big things start; 'change', because that's what development is essentially about; and 'small change', because this can be done without the millions typically spent on programs and projects.
>
> *ibid.: xxiii*

For Hamdi, small change is a starting point for empowerment, and the output of the process can indeed be small scale, community based, visible and tangible, as the bus stop: "[s]tart small and start where it counts" (ibid.: 139). Understanding of the current operating system is required to find the spots to intervene, but the perspective puts emphasis on doing, and starting small. As Hamdi puts it: "in other words, we didn't think too much before we started doing, and we didn't do too much before we stopped to think about it" (Hamdi 2010: 36).

The micro-interventions of hacktivist research are evaluated on their micro-changes to the systems they interfere with. But they also have a performative aspect, becoming examples of possible paths of action as they may encourage action and build agency by example. A similar trait could be drawn to the "existence proof" common in mathematics (Koskinen et al. 2011: 63). According to Koskinen et al., design researchers may want to experiment to see what is actually possible: "Researchers may want to show that a certain outcome is possible by building upon it, and there is no need to produce definitive proof beyond the construct" (ibid.: 63).

Existence makes possibilities imaginable, tangible and discussable. They produce discursive and imaginative models to possible futures and draw up courses of action. As mentioned by Hamdi, the aim is to produce proof that is convincing enough to encourage those who are close to acting. In this way, the small change intervention is an experiment of conviction, a tipping point towards new capabilities to act.

Building hacktivist capabilities

Hacking reassembles capabilities of design in new ways and orders them into a countersystem. As with PAR, tasks once delegated to professionals are reclaimed and redistributed in order to build empowered capabilities. The capabilities are similar to the approach put forward by Nobel laureate and economist Amartya Sen, and furthered by philosopher Martha Nussbaum. In this approach, Sen and Nussbaum critique the dominant perspective on societal development focused on economic growth and the measurement of development through the access to commodities (Sen 1985). As Sen notices, possessing a commodity does not mean one is able to use it; owning the commodity does not necessarily mean one has the capability to use it for furthering one's well-being (ibid.: 9). Thus, from Sen's perspective we need to shift focus from the inherent characteristics of commodities to instead look at "what the person succeeds in *doing* with the commodities and characteristics at his or her command" (ibid.: 10). This requires an approach which not only traces the activities of people and their skills, but also empowers their capabilities to act within everyday systems.

To Sen, capabilities should be understood as *what a person is able to do and be*. Sen and Nussbaum further differentiate between *internal* and *external* capabilities, they "are not just abilities residing inside a person but also freedoms and opportunities created by a combination of personal abilities and the political, social, and economic environment" (Nussbaum 2011: 20).

Hacktivism aims to build *abilities* to engage with our surrounding systems, to produce the critical skills to engage with the world, through a countersystem approach. A systemic knowledge is required to amplify this in the most dynamic way, and it resonates with the hacker ethic of sharing skills and plans, code and programs in order to facilitate further building on the code. From the engagement with material culture as point of departure, hacktivism amplifies something as small as limited skill of bicycle repair, the possibility to choose whether we take on a mechanical repair job ourselves or leave it to the bicycle mechanic, towards a system of social self-reliance. In this sense, hacktivism is the strategic application of interventions towards socially emancipatory goals. From a skill or capability, new small changes may emerge, and small business and new interactions and exchanges that were not there before. As Nussbaum put it: "The notion of *freedom to choose* is thus built into the notion of capability. . . . To promote capabilities is to promote areas of freedom" (Nussbaum 2011: 25).

In design, we usually take for granted that owning a commodity immediately transfers its characteristics onto us, making us able to use it. We may facilitate this process by making things 'user-friendly', but in this transaction the user is still not in control of the capabilities being transferred. Hacktivist research aims to actualise the skills, control and systemic capabilities to the users and participants as a form of radical pedagogy. The aim is to facilitate the *ability* to engage in systems, society and the everyday world through the tuning of material culture, in a direction of expanded human rights, participatory democracy and social justice. Hacktivism realises new, grounded freedoms in the realm of design through interventions in collaboration with participants, actualised on an individual as well as systemic scale, and beyond the parameters of the commodity culture's 'operating system'.

In summary, in my earlier research (von Busch 2008) I have suggested the practice of an engaged hacktivist designer; an edited list could be something like this:

- *Reawakening a spirit*: Inspiring and boosting the thirst for exploration and emergence, expanding action spaces and capabilities through simple examples, workshops and manuals to form new forms of attention and awareness.
- *Amplifying the voice of the silent*: Creating and cultivating a language of practice. Developing a critical usage of existing media channels as well as creating new ones to show examples and mobilise for action.
- *Going through informal channels*: Bypassing gatekeepers; finding your own, low-level paths of action.

- *Building self-reliance*: Teaching simple modular methods or subsystems that can easily be expanded into other interventions and creations, developing a trust and courage in one's skills.
- *Mobilising resources*: Reorganising production and opening new action spaces by re-circuiting existing ones; using the possibilities of what is considered as junk, making the leftovers of society your pool of treasures.
- *Provoking the 'taken-for-grantedness'*: Helping to make the virtual or possible imaginable and discussable; making models and visionary prototypes; challenging the participants' imagination.
- *Making micro-plans*: Thinking in small steps, plan small, but being open for serendipity. Making examples of how the single informal action might be turned into a stabilised activity and a sustainable project or business, at least resulting in richness of dignity and self-respect. Mapping relations and prototyping protocols for collaborations.
- *Forming alliances*: Engaging participants, sharing resources and skills, collaborating and building assemblages together. Be a rhizome, a pack of wolves, a swarm of rats. But be conscious of its risks and take seriously the responsibilities it demands.
- *Intensifying the power*: Plugging the project into a larger energy system, using its potentiality, connecting with other lines and riding their shared power, boosting the flows, accelerating the participation, celebrating a shared re-engagement.

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19
CREATIVE DESIGNERLY MAPPING
Using scenario thinking and co-design to inform a hybrid approach to design research

Kaye Shumack

Introduction

Design research engages with what are called 'wicked problems' (Buchanan, 1996) that are incommensurate, complex, layered and often beguiling and enigmatic assemblages, across past, present and future contexts. For design research, much of what is learnt through researching often occurs as a result of the designer being part of the process of the research itself, within the situation being explored (Findeli, 2001). A design research project often unfolds around a distinctively unique, situated and bounded problem space that includes a variety of actors and human and non-human factors and relations. Typically, both quantitative and qualitative data are engaged in this complex process of discovery, where the situated nature of the research question or context, and the iterative processes of design thinking, becomes highly significant in guiding and shaping any research findings (Lawson, 2006).

New, hybrid practices for design research are developing as interdisciplinary research approaches. For example, designers are utilising mapping methods using social science knowledge from critical cartography, where emergent practices engage with the availability and accessibility of digital imaging technologies. In these practices, the distinctions between map, diagram, plan and information visualisation are being blurred through the usage of a variety of mapping techniques and practices (Dodge, Perkins and Kitchin, 2009). In this way, data can indeed be made up of anything. These emerging mapping practices can defer the process of designing by calling attention to alternate possibilities and further inherent potentials of a situated context of place, space and/or time, thus contributing to what is understood as designerly ways of knowing (Cross, 2006).

These emerging mapping approaches offer researchers a means to engage with both quantitative and qualitative forms of data in often dynamic and speculative ways, calling attention to what has not been mapped, for what is not known, for what may emerge between the lines and spaces of a mapping of time, place and/or space. When carried out with participants, these creative processes can be similar to what is termed 'context mapping' where co-designing takes place (Sleeswijk Visser, Stappers, van der Lugt and Sanders, 2005), contributing a range of perspectives and experiences to a wicked design problem.

In the case of what is termed 'context mapping', the process is oriented around what is termed 'user design', where experiential inputs from participants help shape a design outcome as emerging product, system or service. Sanders and Stappers describe this user-oriented shift towards participatory design and co-designing as "creating new domains of collective creativity" (2008: 5), where participants are not always experts, but bring with them a range of everyday perspectives to inform and shape a design context. They also note that "the best known proponents of co-design originate from business or marketing and not from design practice" (ibid.: 8). Given the knowledge about co-designing that is already developed within business and marketing, it is useful to look more closely at how these approaches are described and applied. The objective is to potentially reframe a design research approach through understanding how these terms and practices are applied and understood in other disciplinary contexts.

In the field of future studies, there is an existing theoretical and practice-based literature around what is termed 'scenario thinking' offering insights into a framework that can inform and assist design researchers. When understood as a way to read social contexts, scenario thinking can be a practical analytical model for identifying potential strengths, weaknesses, opportunities or threats to a business venture and to unpick the mitigating contextual issues around these.

Sarpong and Maclean focus on the definition of scenario thinking as social practice as carried out by a group of people in a process of becoming: as an "everyday social practice played out in the day-to-day activities of a group of competent actors as an actualization of a continuous process of becoming" (Sarpong and Maclean, 2011: 1154).

By combining approaches from future studies with the co-designing practice of context mapping, underpinned by approaches in emerging critical cartography, a hybrid design research approach termed *creative designerly mapping* is proposed. The significance of creative designerly mapping is that it provides a way to begin to characterise any kind of data – as forms of social data domain or value set, thus providing a starting point for the process of dynamic mapping that is intended to be carried out using co-designing or collaborative approaches. After briefly describing key aspects of the theoretical framework for this hybrid research approach, three case studies are introduced and evaluated as instances of creative designerly mapping.

Critical cartography: data can be anything, anytime, anyplace

Contemporary mapping is evolving as a dynamic and diverse set of practices that engage with the everyday through material and virtual world data explorations.

Corner (1999) has stressed the emancipatory and creative possibilities of mapping, and, more recently, from the field of critical cartography in the social sciences, Dodge, Perkins and Kitchin (2009) argue that we need a shift in perspective, from seeking to understand the knowledge status of maps as objects, to examining their potential as dynamic knowledge practices and processes in themselves. Mapping is now understood as almost any activity of gathering, analysing and giving visual form to spatial data or any data that can be represented spatially. Increasingly, data can be anything – traffic movements, the distribution of a species in a geographic space, personal landmarks and memories, thoughts, mouse-clicks, recurring words in a text. Cultural mapping, mapping social networks, mapping the body, mind-mapping, cognitive mapping, concept mapping – these are all processes of dynamic mapping that explore identified sets or types of data.

A new understanding of mapping as a dynamic reframing practice is a significant critical perspective in contemporary cartographic studies. Dodge, Perkins and Kitchin comment:

> Studying mapping needs to progress outside controlled laboratory environments and to seek deeper ethnographic understanding of mapping in the 'wild' so to speak. Here

> the focus moves from measured responses to tests, towards situated observations and participation in the mapping process.
>
> *2009: 231*

Dodge, Perkins and Kitchin's (2009) manifesto for map studies focuses on 'modes, methods and moments of mapping', suggesting research might profitably question when and where mapping really matters by investigating points of change, the time-space rhythms of map performance, memories of mapping, academic praxis, places and times of failures and newly creative engagement with mapping practices.

The potential of emerging mapping methods and approaches as specifically participatory methods and practices is described by feminist researchers such as Kwan (2007) and post-constructivist mappings as forms of hybrid co-productions – as Del Casino and Hanna (2006) term 'performances' around the mapping process.

Co-design and context mapping: the power of collaboration and the emergence of new design purposes

Sanders and Stappers (2008) comment on the value of the co-design process as an opportunity for participants to engage in moments of decision, and also moments of idea generation. In their research, they note the significant value of using co-design at the start of a design process, and the ways that this process of participation breaks down traditional roles of research and subject. As a result, a more cooperative mindset is in place, and the role of the researcher shifts from being a translator to facilitator. They comment on how the process of co-design is likely to enhance and help develop a greater diversity of design purposes – including design for sustainability, emotion, interaction and transformation. Sanders and Stappers note these emerging fields for design as "new domains of collective creativity" (2008: 16), based around an exploration of experience and human emotion: "In the future we will be designing in virtual and hybrid domains. We are heading into a world where experience often trumps reality" (ibid.: 17).

The significance of creative designerly mapping is that it provides a way to begin to characterise any kind of data – as forms of data domain or value set that provides a starting point for further design research as dynamic mapping and that is intended to be carried out using co-designing or collaborative approaches.

Scenario thinking: characterisation of data domains for modeling possible futures

Drawing on business and marketing, Sarpong and Maclean describe scenario thinking as a means of unpacking uncertainty: "as the bundles of human actions and practices in context directed towards understanding the past and future in the present in order to cope with future uncertainties within the contingencies of the moment" (2011: 1156).

They describe four modes, or social data domains, that they suggest provide a bridge that links both reflexive and strategic thinking characteristics of an organisation, as social practices – "dynamic, speculation, morphostatic, and dysfunctional" (ibid.: 1157). Each mode is offered as a means to assess the relational and social dynamics taking place in a particular business or organisational setting, as interactions leading to, or not, potential for innovation. For the purposes of creative designerly mapping, these four modes of social data, and other principles from scenario thinking described below, can be used to reframe a particular context as a form of social data domain where social values and interactions can be identified amongst the actors involved in that specific data domain. This data domain can then be subject to a dynamic mapping process, using co-design principles and approaches, as a hybrid research approach that is termed 'creative designerly mapping'.

Further theoretical frames from future studies include the work of Jetter and Schweinfort (2011) to explore the use of 'Fuzzy Cognitive Maps' (FCM) as scenario-planning methods. These maps, developed by Kosko (1986), are based on causal cognitive modeling, where actors detail causal links between thought and action, relative to a situated context. To summarise, causal findings from FCM interviews and research sessions are visualised as maps of relationships across factors, and can be further analysed to identify hidden patterns, trends and links that can include a wide range of actors and stakeholders. Sanders and Stappers (2008) refer to the significance of the 'fuzzy front end' for co-designing as the initial stage where participants may be involved in moments of idea generation.

Whilst limited by the situated context of each study, the FCMs are described as useful methods by which to explore otherwise intangible qualities such as underlying values, linked to processes of behavior in business contexts. What is of interest in this approach is how it offers a means of analysis of complex but often-inconsistent qualitative data that can inform multiple scenario planning outcomes, identify 'weak' signals and emerging paradigm shifts.

Further theoretical frames from future studies include that of Tapinos (2013) who describes 'Critical Incident Analysis' (CIA), undertaken by actors within a business setting at the operational, not strategic, end of the business environment. Insights from this study suggest that scenario planning around the CIA provides a focus for self-critical reflection on work practices and processes that benefit workplace culture (O'Connor and Lai-chong, 2009). In particular, the unpacking of a critical incident by actors offers a way to tap into strong emotions and tacit forms of workplace knowledge. CIA offers a critical reframing of a situation, to learn from what took place and then consider the findings as a way to improve workplace practices.

Creative mapping scenarios case studies

The three case studies described here each reflect a different emphasis and approach as forms of creative designerly mapping as a hybrid form of design research. By aligning the research approaches of co-design with scenario thinking, as described above, we see the emergence of a layered set of research actions. That is, on the one hand, defining the problem itself as a specific data domain or problem sets up a way to then map the dynamic elements within it. The intention is for design research to suggest future directions or possibilities based on the process of co-designing.

The first case describes an interview with a local gardener at a suburban verge garden site critiqued as a form of 'conversation mapping'. This is a process of cooperative dialogue, a form of co-design that can be understood in a way as a reflection about a critical event, similar to CIA. The visualisation of an audio file from the conversation between the researcher and the gardener builds a narrative around an existing scenario that engages with past, present and future, and highlights the local context of community relationships as a primary driver for the ongoing viability of the site. The scenario site, as a data set, is similar to what Sarpong and Maclean (2011) term a 'dynamic scenario', where change has happened as a self-conscious process of reflection and change, as the verge garden site developed in a particular place, space and time. The process of conversation mapping is in itself a form of CIA as a close reading of a conversational dialogue.

The second case describes recommendations from a consultancy report as a given scenario about the development of an urban farm project. This scenario is mapped to reveal tensions and questions about how the project could be developed by the inclusion of a range of actors, and through reflection on a variety of human and non-human factors. The consultancy report can be understood as a 'speculative scenario' as it details a range of possible options and a preferred future planning outcome for the development of this heritage park-side location across two linked locations. The dynamic mapping process then seeks to engage with a multitude of inherent possibilities, aiming to break down the preferred outcome and re-think the connections between two urban locations. In this sense, it is also a form of creating FCM where a density of factors and influences are unpacked and the existing and potential relations between them considered. This process did not lead to one specific solution, rather, the process revealed the density of possibilities inherent within the project.

Third, walking routes through a local park that is a disused hospital site are mapped to reveal patterns of usage and memory linking people and place. The site itself can be characterised as a 'dysfunctional scenario' – an abandoned public space where planning and development is frozen in processes and lack of funding. The dynamic mapping of the routes of park users and local residents shows patterns of usage that include, and diverge from, established pathways and walkways. This mapping reveals the multiplicity of usage pathways across the park as a unique and special place. The findings from this study have potential value for the future planning and development of the site, with the participants being highly engaged park walkers invested in the quality of their everyday experiences.

Case #1: conversation mapping – a verge garden

Conversation mapping in this context is the analysis of an audio recording as text to isolate key themes that are visualised within a diagrammatic representation as a narrative form. The visualisation process transforms the text as an interpretative reading. Key themes are made evident as part of the interpretation, and links between and across the visual elements become apparent. In essence, any conversation might become an appropriate source for a conversation-mapping process, dependent on the situated context and the research themes being explored. In this study, the context is of a suburban verge gardener where the interview provides a means of exploring an existing scenario and the analysis of the conversation through the mapping provides a deeper insight into the potential for this particular site, as well as more transferable knowledge about practices of verge gardening in suburban areas.

The interview that takes place with the verge gardener is initially driven by questions asked by the researcher, and then progresses to a conversational exchange. As in most conversations, the flow of the discussion flips and weaves across past, present and future, and reveals personal details that are woven into the site itself. What emerges is a particular narrative that reveals links between the gardener, the local community and the past, present and future. As a narrative emerges, a strong sense of place and space is created through the use of words that can then be visualised in narrative form in a conversation map. Four thematic sections of the map emerge as a result of the visualisation process as shown in Figure 19.1:

1. the garden's status as both public and private space;
2. the productive capacity of the site;
3. the history of the street; and

4 the systems that underpin the process and the ways that these have impacted on the everyday lives of the residents as a set of interconnected relationships. These are identified in Figure 19.1 as emergent themes within the overall mapping visualisation.

As an existing site, where everyday activities take place as patterns and routines that have developed over time, the site as a data domain can be seen as ‘dynamic’. That is, it is characterised by a high level of strategic conversation, material interaction between human and non-human elements, and self-reflexivity in the everyday working environment, as a conversation between the researcher and the gardener (Sarpong and Maclean, 2011: 1157).

As a result of an initial mapping of this particular verge garden site, the project has begun to develop some clear thematic directions that could now be further developed by additional and similar mappings that extend the narrative to other situated verge garden contexts where there may be divergent modes of interaction and opportunities for innovation. These mappings would contribute to a growing body of new knowledge about the tacit and inherent qualitative data underlying verge garden sites in the context of a wider design-issues agenda around green equity and urban farming.

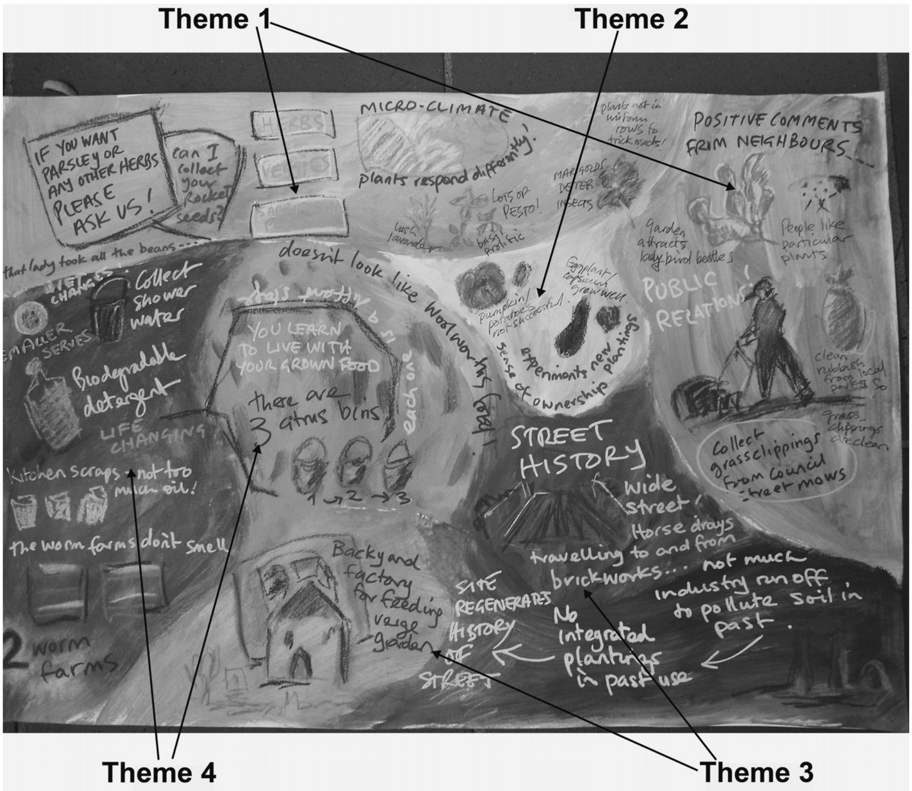

Figure 19.1 The narrative conversational map and linked theme sections

Case #2: urban farm consultant report mapping

In this project, recommendations from a consultancy report (City Farm Feasibility Study, 2010) were mapped to reveal the potentials and possibilities for implementation and future development. Whilst the report was undertaken with a wide-ranging community input, the findings point to a specific solution for the development of an urban farm project that links two sites together across an inner-city region. The intention of this recommendation was clearly to best utilise existing and limited urban space and resources, and to promote the project into the future with institutional support. However, it remains unclear as to exactly how this recommendation would be implemented over time, and with the support of community engagement. In terms of Sarpong and Maclean's (2011) data domains, this report can be characterised as 'speculative'. That is, the projected outcomes are not fully grounded in reality, and there is a high degree of ambiguity around how the projected outcomes would be achieved. As a data domain, the report is characterised as low in strategic conversation and interactions with the actual material conditions.

The consultancy report relies on the use of urban farm models from other global cities relating to the development of what is understood by a 'City Farm'. The report's recommendations were to establish the farm across two linked sites in the inner city, one with an educational focus and institutional support, and the other with the farming focus linked to the local council and community. Both operational and strategic aspects became the starting point for the collaborative mapping activity with a focus on the material and community oriented processes that would need to take place in order to develop the recommendations found in this proposal. The dynamic mapping process introduced a range of additional factors around community motivation and the specific interactions of actors living within the radius of both sites.

The mapping process explored various aspects of cause and effect, as well as the construction of a narrative about the impact of the farm on the local council boundaries; the possibilities for community engagement at both sites; the impacts of farming practices and the opportunities for building a sustainable community culture around these at both sites. The mapping activity raised a large number of questions for researchers, and also proposed new ways in which the City Farm as a scenario could be considered, with the ongoing input of residents and other participants.

The final outcome (as shown in Figure 19.2, left) is a very rough and unfinished cylindrical map that shows how individuals and communities might be connected across the two sites. This final map is as a form of 'becoming', as it seeks to speculate on potential human and non-human agencies across and through the two sites where themes are shown as directional pathways of pattern and flow. These include mappings of what grows where; underground spaces; backyard productions and access ways between the two sites; existing urban verge vegetation; existing retail food outlets and patterns of access and consumption; existing and past restaurants and food outlets; and building heights and possible elevated green spaces.

The findings from the collaborative process highlight the need for further research into the qualities of human and non-human elements in this particular project, and the interactions between them as the missing links of the report's findings. The status of the final rough map reflects the unfinished and raw qualities of this as a dynamic mapping project.

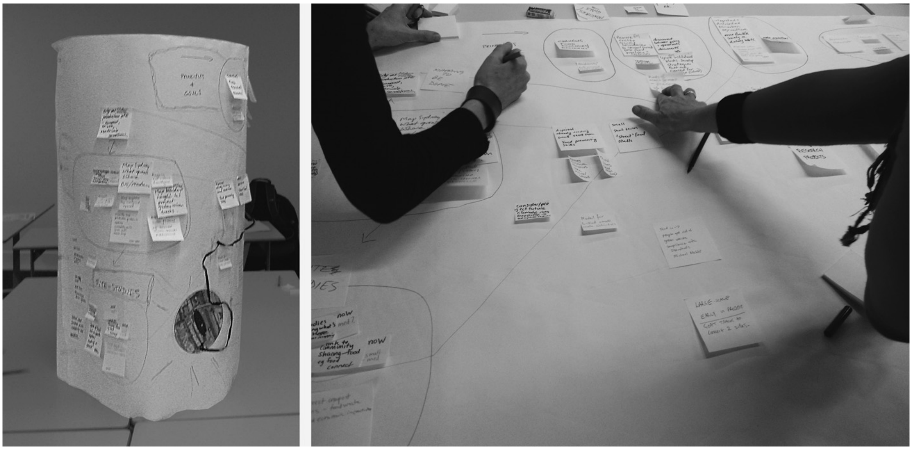

Figure 19.2 City Farm cylindrical map (left); idea generation and data linking (right)

Case #3: park walks mapping

The park walks collaborative mapping project seeks to reframe a local existing geographic space – calling into question existing assumptions about the space – and to open up new ways of thinking about the relationship of community users to that space. As scenario thinking, it falls into Sarpong and Maclean's (2011) data domain of 'dysfunctional scenario', given the social history of the actual site and the planning hiatus around any development. The dynamic mapping practice took place initially as a data-gathering process with 20 participants. These were then developed into mapping outcomes to reveal how walkers were moving through the park on a regular basis.

The starting point for the project involved a series of interviews with a limited number of park users over a specific time period. This involved them mapping their individual user journeys by hand onto local paper maps, using selected colour codings for different emotional journeys and the movement modes of walking, cycling, jogging. The participants also took part in conversations about their experiences and noted their significant memories of the park on the paper maps.

To begin the map-making process, Figure 19.3 shows how cartographic conventions are introduced to define the geographic boundaries that link the park with the surrounding suburb.

Each user journey is depicted within the boundaries as a translation of the data provided by 20 individuals. Figure 19.4 shows the set of individual movement journeys that are then combined into a composite journey map for the overall park site and surrounds in Figure 19.5.

What is revealed through these mapping processes is the density of walking pathways in the park space, showing how intensively the park space is used by local residents. In addition, the interviews reveal a tacit knowledge about the habits of dog-walkers, and about wild park animals such as possums in conflict with a resident feral cat community.

A further mapping in Figure 19.6 reveals place-based emotions of participants linked to memory and site history. This mapping outcome highlights the emotional qualities of park users in reflecting on their emotional connection to this place through regular everyday activity.

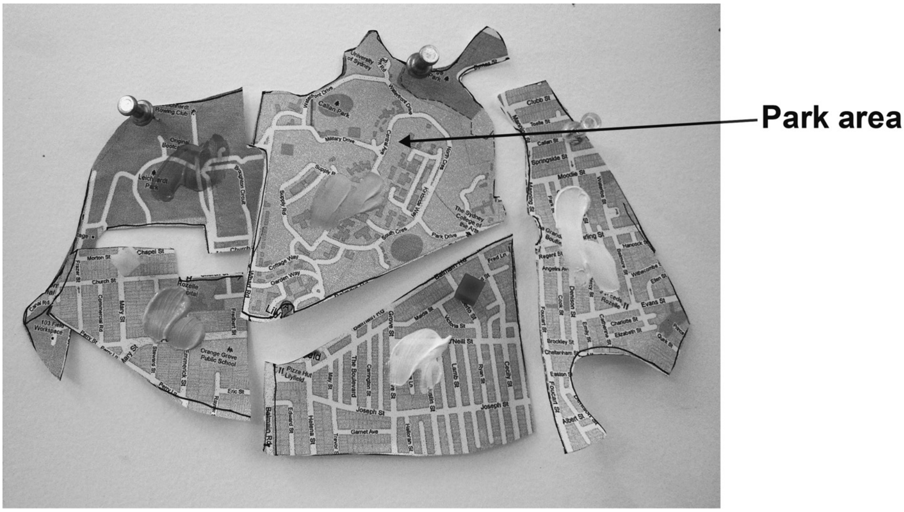

Figure 19.3 Cartographic conventions – the park and surrounding suburban context

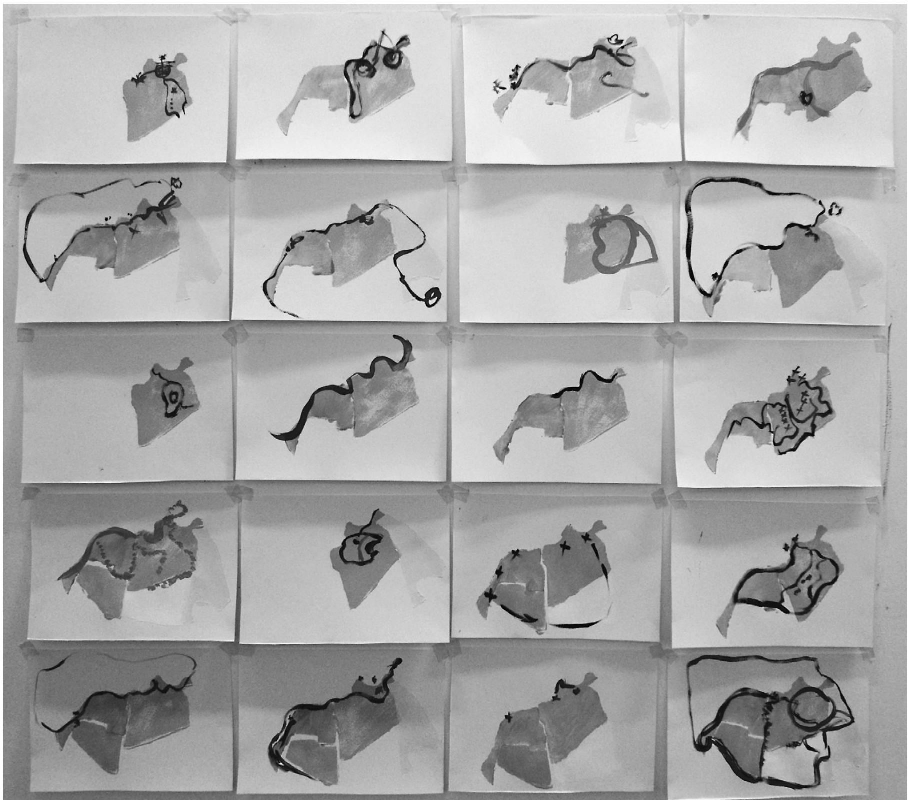

Figure 19.4 Individual user journey maps through the park

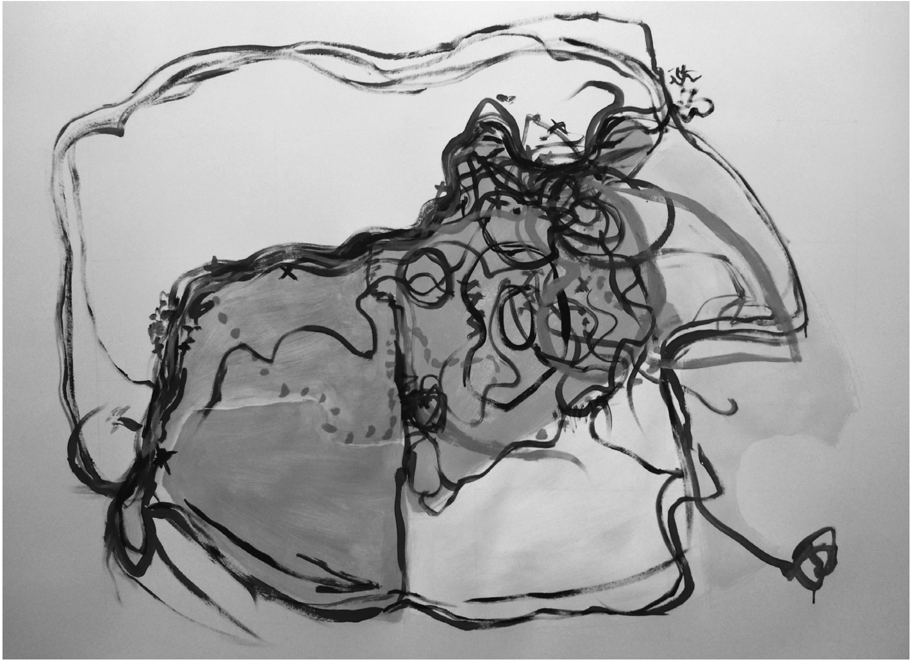

Figure 19.5 Composite walking map of park and surrounds

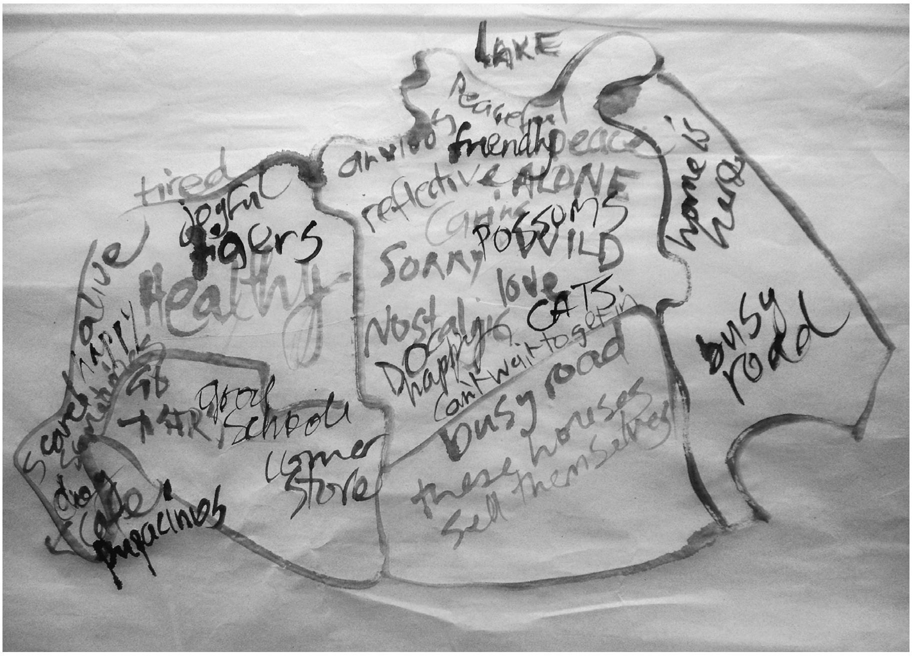

Figure 19.6 Composite emotion map of park walkers

Conclusions

The alignment of critical frameworks from cartography, co-designing and scenario thinking, as discussed above, provides a design research approach for developing collaborative tools for exploring diverse design contexts, complexities and problems. As an emerging practice, creative designerly mapping offers a useful and practical means by which to explore complexity across individual and collective understandings. This is shown as a process involving a staged and sequential research process – first, a diagnostic evaluation of the social qualities taking place within a specific data domain. This provides a point of entry for then identifying key factors to be mapped. What may then be mapped could be anything that relates to the social context of the problem, site or data domain. The form of mapping that is carried out is relative to the social context – in the cases above, the use of conversation mapping, for example, was a useful way to approach an audio file, as a way to delve further into a conversation with the gardener about the verge garden site, and its development over time. By comparison, the mapping of the City Farm consultant report at a distance from the authors resulted in a circular and open-ended map object that was a somewhat unfinished and frustrating outcome where many questions and issues emerged. The mapping techniques used in the park walk study draw upon the recorded journeys provided by participants as raw data that can be mapped back over and across the dysfunctional social domain of the park-land site. The mapping of experiential qualities in this study provides a rich picture of the commonality of experience for these park users, in contrast to the dysfunctional context of the scenario as a social data domain.

As a design research approach, creative designerly mapping offers exciting ways to conceptualise everyday experiences, identify deeper meanings and relationships with both human and non-human forms of agency, and suggest new understandings about space, place and time that can inform holistic approaches to design across a range of design purposes and intentions.

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20

DRAWING OUT

How designers analyse written texts in visual ways

Zoë Sadokierski and Kate Sweetapple

Within design discourse, much attention towards the written word is directed at typography – how words are arranged to visually communicate meaning. In this chapter, we consider the written word from a different perspective, revealing how designers analyse written texts for research and concept development. We describe three analytical methods we developed through our own practice and observed in the practice of other designers. We name these methods Visual Abstraction, Focused Data-mining and Exploratory Data-mining. Each method is supported by examples from our own work and the work of Stefanie Posavec and Sam Winston, who both describe analysing written texts as part of their design process.

Although these methods are commonly used in design practice, they are rarely reported in a research context. Therefore, it is valuable to reframe these practice-based methods as a meaningful contribution to design scholarship.[1]

Three methods for analysing written texts

This first section describes three methods designers use to analyse written texts:

1 Visual Abstraction – a way to see past the written narrative to reveal patterns and rhythms in a text.
2 Focused Data-mining – searching written texts for predetermined themes or ideas.
3 Exploratory Data-mining – searching written texts with undetermined focus, allowing focus to occur in the process of searching.

Visual Abstraction

Two examples where Visual Abstraction has been used to reveal rhythm and patterns in written documents are Stefanie Posavec's 'Writing Without Words' and Zoë Sadokierski's thumbnail schemas. In these examples the act of abstracting written text removes the distraction of the narrative in order to reveal patterns and find new readings of the text.

Stefanie Posavec completed an MA in Communication Design from Central Saint Martins College of Art and Design, London, in 2006. Posavec's final work, 'Writing Without Words', treats classic novels as data sets; she extracts quantitative information from the books in order to communicate something about the text other than the author's narrative. Posavec describes this work as "a project that explores methods of visually representing text" in order to visualise "differences in writing styles of various authors" (Posavec 2007, cited in Chevalier and Diamond 2010). The result is a set of diagrams, posters and books that visually represent the texts.

'First Chapters' are diagrams visualising the first chapters of classic novels – the number of words per sentence determines the length of the line and each new sentence turns the line 90° (see Figure 20.1). Abstracting sentences to lines renders the narrative unreadable, allowing the viewer to focus on the 'units of language' that compose each book. As a collection, these drawings quickly describe the different writing styles of the various authors. Explaining the variations in sentence length would be lengthy and potentially boring to read – displaying them as a collection of juxtaposed drawings makes a concise point, that can be further 'read' the longer the viewer spends comparing the diagrams with each other.

Interpreting the sentence lengths and paragraph structure is not the same as interpreting the narrative. Each sentence diagram is a visual onomatopoeia of the written text – as well as the length of sentences, they reveal the rhythm and pattern of the writing style.

For example, compare Hemingway's and Kerouac's diagrams. Hemingway is known for his pared-back prose and conversely Kerouac for his unpunctuated rambling. The visual language of these maps succinctly reveals the different writing styles.

While Posavec abstracts novels into quantifiable data to understand and communicate something about different writing styles, Sadokierski abstracts novels into thumbnail schemas in order to understand image placement within hybrid novels. Her 2010 doctoral thesis analysed hybrid novels – novels in which graphic images such as photographs, drawings and diagrams are integrated in the written narrative. The appearance of graphic images on the pages of novels is unusual; novels are conventionally a purely written literary form. In order to understand what kinds of graphic elements appear within a hybrid novel, and where they appear in relation to the written text, Sadokierski sketched thumbnail schemas for a range of novels. The thumbnail schema is coded using different colours to represent different types of image (see Figure 20.2).

Designers generate thumbnail sketches to map out a document (print or digital), creating a schema similar to the floor plan of a building or a tailor's pattern. This schema allows the designer to plan where compositional and graphic elements appear and to establish rhythm within the layout (considering how design decisions affect the pace of reading and comprehension of the text). A thumbnail schema helps the designer envision the document as a whole – to make decisions about individual design elements in the context of the whole document.

Figure 20.1 'First Chapters' – Hemingway and Kerouac

Source: Posavec 2007, cited in Chevalier and Diamond 2010 (to see this work in colour, see www.notcot.com/archives/2008/04/stefanie-posave.php/; see www.pagescreenstudio.com for other colour images of the figures featured in this chapter)

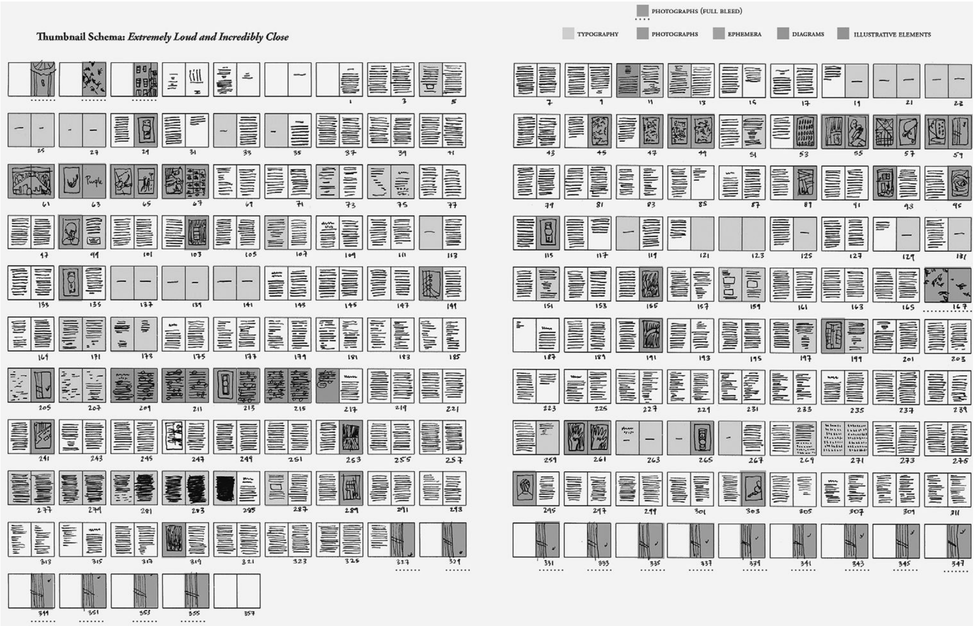


Figure 20.2 Thumbnail schema of Jonathan Safran Foer's novel *Extremely Loud and Incredibly Close* (Sadokierski 2010)

Although thumbnailing is generally used in the planning stages of a design project, this example shows how it can be an analytical tool; deconstructing the composition of a book to reveal insights about how written and graphic elements relate. The schema allows us to consider the kinds of questions a designer would ask: Could the placement of graphic devices be related to printing specifications?[2]; Is there visual rhythm that orchestrates the placement of graphic devices? The thumbnail schema has the effect of 'flattening the landscape'; it removes all the cues a visual person would be distracted by – typeface, line length and other compositional elements – in order to think about a text as a map. This method analyses a written text by abstracting it completely, revealing insights that may have been missed by looking at the book as a 'codex' – page by page, rather than as a schema.

Sketching thumbnails is a meditative exercise that encourages a 'conversation'[3] with the text, revealing new insights about the design of each page without the distraction of reading the narrative. Committing pen to paper – sketching the graphics – requires breaking down the composition of the page in order to sketch it. The slowness of the process encourages reflection; for between an hour and an hour and a half – the time it took to sketch the schema for an entire novel – focus was entirely on the compositional elements. The thumbnailing exercise encourages looking with a 'curious eye' – actively seeking what is not yet known, placing it in the context of a research method not a design planning tool.[4]

Posavec also discusses the value of performing her initial text analysis by hand, rather than using computer programs:

> Much of what I do is with pencil and paper. . . . I find a subject that I love, and try to find within it something I can map, or markdown on paper. Then I spend lots of time reading and rereading the text and counting words or counting numbers or just going

> through a subject matter repeatedly until I have all the data in a notebook . . . by reading and rereading these texts, I'm able to understand more about a specific text or a specific subject matter than I would otherwise, than I would if I wrote a computer program to analyse that text for me.
>
> *Protein TV 2011*

Diagramming and thumbnailing force the researcher to engage with a text with her hand as well as her eye. Richard Sennett (2008) discusses the 'link between the head and hand', in his book *The Craftsman*. For craftspeople – including writers and designers – planning and drafting are vital stages in the creative process. In 'thinking' through the hand, ideas are fleshed out in action, through the process of making, and reflecting on making. Le Corbusier, an advocate of sketching, wrote:

> Once the impression has been recorded by the pencil, it stays for good, entered, registered, inscribed. . . . To draw oneself, to trace the lines, handle the volumes, organize the surface . . . all this means first to look, and then to observe and finally perhaps to discover . . . and it is then that inspiration may come.
>
> *in Anthony 1966, p. 280*

These examples demonstrate that revealing rhythm and pattern is a particular strength of the visual. Through the process of turning text into 'data', we stop reading the narrative and start to read something else. Here, that something else is a visual language that the designer has created to explore the text in non-traditional ways. From these abstractions, we read the visual language of the designer, not the original text. The visual language is a kind of coding using design elements such as colour, line, shape, pattern and hierarchy.

These two examples use drawing to reduce written texts to abstract compositions, allowing readings of the text beyond the narrative. These new readings provide insights and interpretations otherwise difficult to access through non-visual methods.

Focused Data-mining

Focused Data-mining is a method that involves mining a written text for specific information, followed by categorisation and coding of that information. This is a type of Content Analysis. Stemming from the field of social science, Content Analysis is a way to systematically identify words, phrases, themes or ideas in a text, which reveal key elements or ideas from that text. In social science, and as a design research tool, this is a method of data reduction – a way to pick through large volumes of text to find specific things. What is unique about the examples discussed below is the capacity to simultaneously conduct analysis and produce a visualisation of the findings. The way designers' conduct content analysis is unique in that graphic qualities, such as colour, type size and composition, are imbedded in the method. In the examples below, the use of graphic elements enables the analysis to become a point of communication; the data analysis communicates the findings.

In her doctoral research, Sadokierski examined book reviews to determine how literary critics discussed the graphic devices in hybrid novels. For each novel, she chose ten reviews from a variety of publications – from book blogs to literary journals – and streamed all the review text into a single document with the same typeface, size and leading. Different colours code where a reviewer discusses: the general format/genre (in dark blue); comparisons to other hybrid works (in light blue); and the presence of graphic devices (in red). Many reviewers noted the presence of graphics without critiquing them, so where reviewers discuss the *effectiveness* of graphic devices, these words/phrases are enlarged in point size. This 'word mapping' technique abstracts some elements of the text (the smaller, grey typography is difficult to read) and gives visual hierarchy to specific words or phrases (colour and size draw attention to important descriptions). Figure 20.3 shows a scaled down map of Umberto Eco's novel *The Mysterious Flame of Queen Loana*.

Each map visualises where graphic devices are simply mentioned (in colour, shown here by variation in tone), and where critique of their function is given (enlarged point size). Examining a single map, it is visually apparent where the critique of graphic devices is repeated in different reviews. Comparing the maps for different novels also visually identifies patterns in the critique of different books, as did the sentence diagrams and thumbnails schemas discussed previously.

Producing these maps revealed an important insight. Descriptive adjectives such as 'gimmickry' and 'trickery' frequently appear in reviews of hybrid novels. To clearly communicate this insight, all the descriptive adjectives for graphic devices used in 124 published reviews of hybrid novels were converted into a word cloud. The size of the word is directly proportional to the number of times it appeared in the various reviews.[5]

This unexpected discovery provoked a shift in the research focus. The term 'gimmick' carries connotations of being superfluous – a supplementary incentive to purchase (free steak knives, a cereal box trinket). Transferred to a literary context, describing graphic devices as gimmicks dismisses them as supplementary marketing strategies rather than integral literary devices. To investigate whether the term was being used in a dismissive way, this analytical process was next applied to the reviews of individual books, but for each book the list of adjectives was split into three smaller clouds indicating whether the term was used in a positive, negative or neutral way by the reviewer (see Figure 20.4).

These adjective word clouds map the reviews of a single book to quickly communicate how reviewers respond to the graphic devices in a particular novel, regardless of the way the reviewers critiqued the plot or writing style. Further, the word clouds can be used for comparative analysis – comparing the adjective word clouds of several hybrid novels reveals how different hybrid novels were critically received in terms of their graphic elements and not plot or writing style.

Sam Winston is another designer who uses Focused Data-mining to extract themes from a written text and communicate his findings through visualisation. Winston deconstructs Shakespeare's *Romeo and Juliet* by catagorising the text into three emotional states – passion,

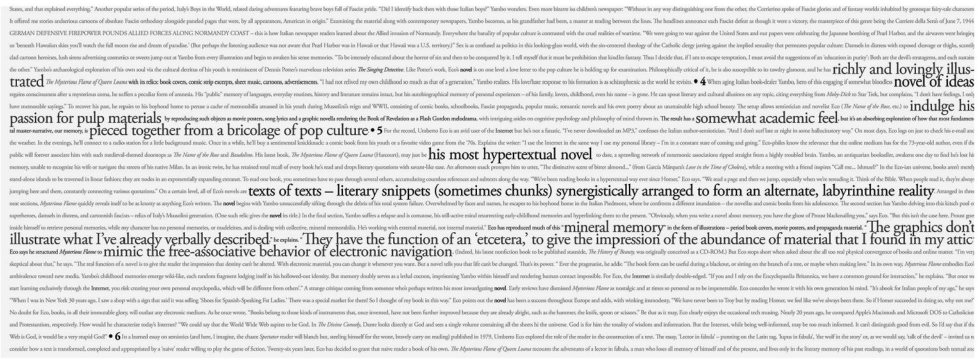


Figure 20.3 Detail from word map of Umberto Eco's novel *The Mysterious Flame of Queen Loana*

Source: Sadokierski 2010, pp. 100–101

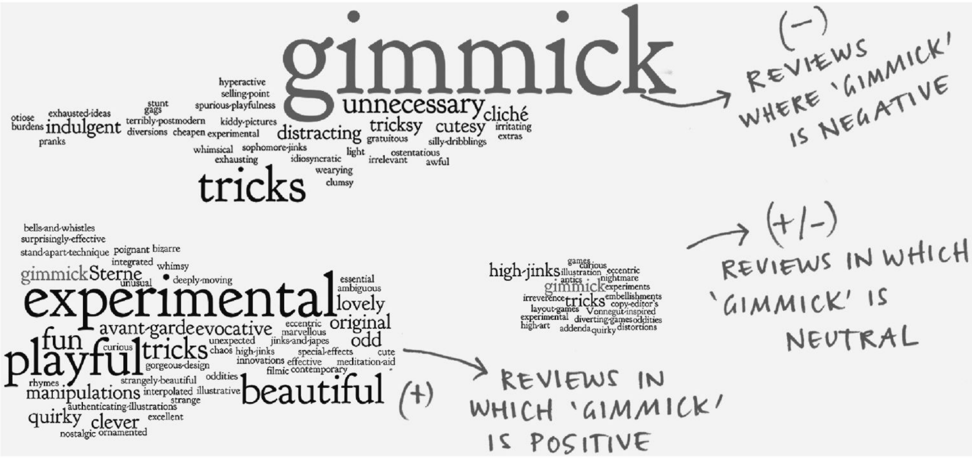


Figure 20.4 'Adjective word cloud' for a single hybrid novel – where adjectives are split into positive, negative and neutral

rage and solace. By typesetting these new data sets, Winston creates visualisations that communicate the emotive qualities embedded in the language, as well as providing a quantitative account of language use. He then takes the text from each data set and creates collages that abstractly visualise each emotional state. As described on 'this is art' (www.thisisart.eu/): "These collages create a new visual catalogue for the emotions expressed by the play's protagonists, displacing the linear narrative of literature for a chronology that's much more apt for our chaotic internet age."

The text in Winston's collages is no longer legible – Winston intentionally cuts each letterform so that it is unreadable and composes the form of the collages to suggest rage, passion or solace (see Figure 20.5). These three themes are now understood through shape. Winston replaces the written text with an abstract visual language.

These two examples show how designers use the methods of Focused Data-mining and Visual Abstraction to create new knowledge of a text and the means by which to communicate it.

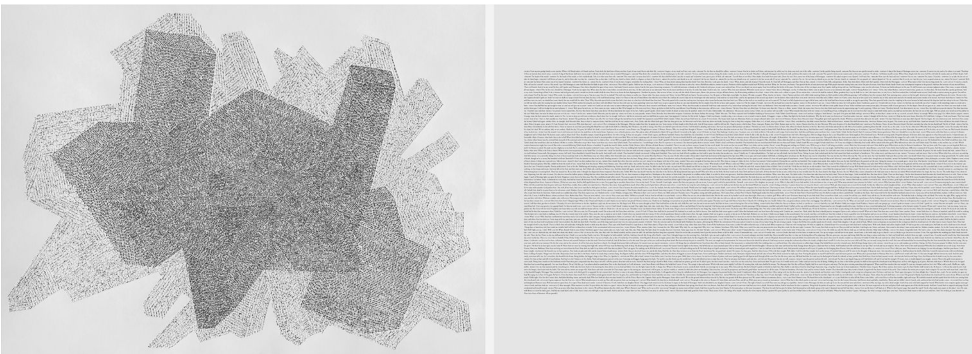


Figure 20.5 'Rage' by Sam Winston – final collage (left); original text (right)

Exploratory Data-mining

The third method that we have identified to analyse written texts is Exploratory Data-mining: searching written texts with an undetermined focus.

Every researcher tells a story of looking for one thing only to discover something far more interesting in the process. When this occurs, the researcher's initial focus can shift or dissolve, which opens up new possibilities and turns the task of searching – looking for a predetermined theme or idea – into exploration – looking without a clear motive. Kate Sweetapple used Exploratory Data-mining in the initial stages of her experimental cartographic maps of Sydney.

When briefed to design an alternative map of Sydney, Sweetapple started to read the *Sydney White Pages* – the 2010 telephone directory for Sydney residents – with little more than a vague notion that surnames might prove to be an interesting starting point.[6] Although the exact purpose was unclear, the approach was analytical: each surname was read and assessed for its potential value. 'Is this surname interesting (amusing, unusual, unexpected) or not?' The measure of value is highly subjective, which is problematic for a demographer but less so for a designer looking for a new angle on Sydney. The process of separating out potentially useful surnames (Burger, Mule, Tooth) from the less so (Barnard, Gibbs, Smith) is an interpretive method. It is a method that removes Sydney residents from the logic of A–Z and places them into a coarser categorisation system – 'yes', 'no' and 'maybe.'

The visual aspect of this analysis lies in the particularity of what a designer finds interesting. For Sweetapple, the surnames that were initially interesting were sets of names that could be: rendered visually (e.g. the Blacks, Whites, Greens); paired (e.g. Salt and Pepper, Waugh and Peace, Gin and Tonic); categories of names (e.g. cars, trees, birds); and, actions (e.g. Chase, Hug, Hurt). At some stage during the process loose fields of interest began to tighten, as Sweetapple noticed that surnames that were part of large groups began to emerge as a theme: birds (Crow, Eagle, Quail); heavenly bodies (Mars, Moon, Pluto); fish (Bass, Herring, Pilcher); trees (Gum, Oak, Wattle); cars (Audi, Ford, Holden), etc. Yet there was still too much data, and no clear way of representing it – further editing was required. Sweetapple noticed some subsets had more visual potential than others. The birds, fish and heavenly bodies all clustered: birds in a flock, fish in a school and heavenly bodies in a constellation. For example, by plotting each residential location of an individual, couple or family with an avian surname, a flock that traced the geography of Sydney emerged.[7]

If we understand Exploratory Data-mining as looking in a particular way, even if it is not for a particular thing, then this particular way could be termed 'designerly'; revealing insights into a data set only afforded by the perspective of a designer.

Below, we discuss a collaborative project that was driven by our analysis of a written text, using a combination of Exploratory and Focused Data-mining.

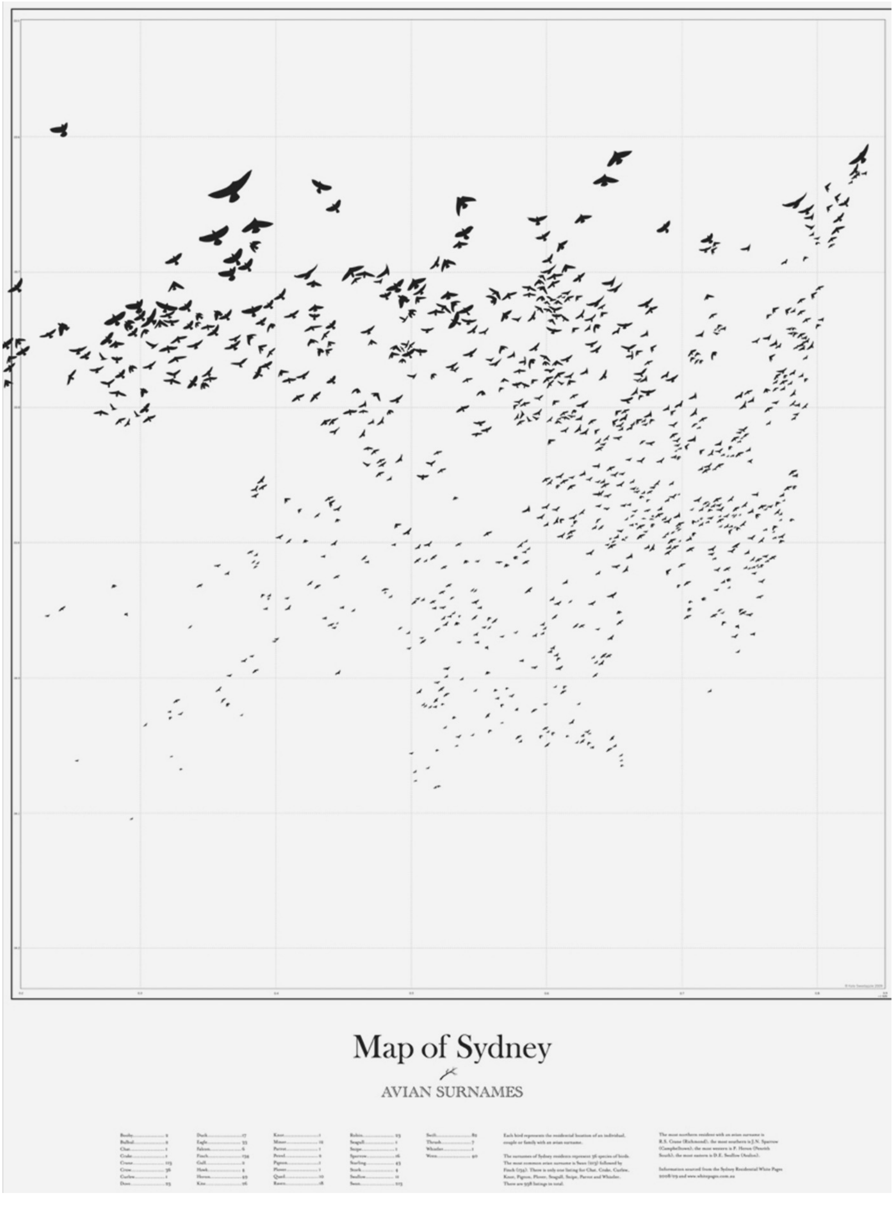


Figure 20.6 'Map of Sydney: Avian Surnames' by Sweetapple, 2009

Case study: 'Unlikely Avian Taxonomies'

Unlikely Avian Taxonomies is a speculative project, exploring the potential to represent a well-known data set in a new way. The aim of the project was to analyse a particular data set – bird names – in order to reveal alternate narratives about birds and bird naming.

In 2009 we realised that through independent avian-related projects, we were both spending large amounts of time reading ornithological texts and delighting in bird names. This avian affinity led to ongoing conversations about language, ordering and information visualisation. Before long, we had a random collection of odd bird names – *Sandwich Tern*, *Satanic Nightjar*, *Bare-faced Go-Away-Bird*, to name a few. This early collection of names was drawn haphazardly from a range of sources and search methods: online, print, in conversation. We were uncertain where this process would lead, but sensed it was worth pursuing. To develop this into a research project, a more systematic categorisation approach was needed, starting with a comprehensive list of birds. We chose the International Ornithological Committee (IOC) World Bird List because it contains 31,500+ names. Systematically, we read each bird name in the database and copied curious names into loose groups, only knowing what we were looking for when we found it: a process of Exploratory Data-mining. We were searching the List with designers' understanding of the way in which recontextualisation can form new narratives.

Through Exploratory Data-mining, the categories we created most quickly were based on graphic qualities such as colour (*Pink-footed Goose*, *Red Goshawk*, *Blue-bellied Parrot*) and pattern (*Dot-winged Crake*, *Spotted Sandpiper*, *Striped Flufftail*). In time, we formed more poetic categories, based around word play in the names. We noticed birds that sounded terrifying (*Cut-throat Finch*), amusing (*Helmeted Pygmy Tyrant*), sorrowful (*Greyish Mourner*) and just plain ridiculous (*Spangled Drongo*). Birds that sounded as if they were hiding something – *Hooded Grebe*, *Masked Duck* – were categorised as 'Birds Incognito'. 'Regal Birds' are plentiful – *Emperor Penguin*, *Royal Tern*, *Imperial Shag*.

Exploratory Data-mining allowed us to develop a set of fledgling categories. Through this process we also developed sensitivity to the language in bird names, and realised we may have overlooked some birds that belonged to the categories. To ensure comprehensiveness, we turned to Focused Data-mining. We returned to the IOC database, this time searching for the predetermined bird-categories formed through Exploratory Data-mining. However, rather than re-reading the whole database, we used the search function to locate particular birds – for instance, searching for 'red' allowed us to find all the red birds – making the process more efficient than the initial data-mining.

Through a combination of Exploratory Data-mining and Focused Data-mining, we generated new data sets to work with. Below, we discuss how we translated three of these data sets into visualisations. The first – birds by colour – is based on visual references within the bird names, the second two – antisocial and incognito – are based on social sounding qualities within the names.

1. Birds by colour

Initially, to visualise birds with colour in their names, we planned to create charts of bird silhouettes using single colours – for example, a chart of yellow birds, a chart of green birds, etc. However, as we searched, the number of colours and the number of birds of each colour grew to an extent we had not anticipated. In the end we had 3,442 birds categorised into 87 different colours. This was

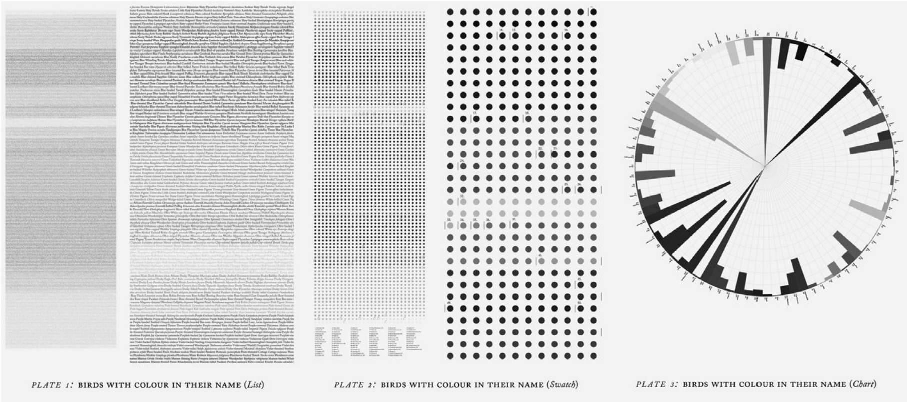


Figure 20.7 Birds with colour in their names (list, dots and chart form)

by far the largest data set we collected, and would take a whole book of bird charts to communicate. In addition, the process of cataloguing the colours revealed other stories: the variety of colours (87 that we identified), the quantities of each colour (only 20 'pink' but 52 'dusky'), colour names (we found words we knew were colours but not what colours they were – flavescent and rufuous – and colours that we did not know were colours at all – cinerious, fuscous and malachite). Below are three of the visualisations we created from this data set.

'Avian Taxonomy 2a' is a list (see Figure 20.7, left). We typeset each bird name in its appropriate colour and arranged the names into a spectrum. This approach enabled us to give an overview of the range of colours, while showing the richness of the names: Emerald-bellied Puffleg; Fire-maned Bowerbird; Azure Dollarbird.

Although this visualisation allows the viewer to read the bird names, it does not efficiently communicate the precise number birds with a particular colour in their name. The varying length of the bird names distorts the information, as some are longer than others. In 'Avian Taxonomy 2b', quantity is more accurately depicted using dots of a standard measure (one dot = one bird) (see Figure 20.7, middle).

While 11 birds will always equal 11 dots, the length of the names of 11 'red' birds will differ from the length of the names of 11 'cinnamon' birds. Using dots as colour swatches also more clearly shows the variations in colour across our spectrum.

While the swatch taxonomy resolves issues of efficient visual quantification and the communication of subtle shifts in colour, it does not visualise the colours in bird names as a continuous spectrum, nor does it provide, at a glance, the most and least common colours. We created 'Avian Taxonomy 2c' (a hybrid pie and radar chart) to allow an accurate comparison of quantities of colours from any point in the spectrum (see Figure 20.7, right).

An accurate data set was required to visualise the range and quantity of colours that appear in bird names to produce the Birds by Colour taxonomies. Therefore, the comprehensiveness afforded by Focused Data-mining was important. For the more poetic taxonomies discussed below, quantitative comprehensiveness was less important than an editorial process to develop narratives based on word play. Focused Data-mining was still used in these poetic taxonomies, although in a different way.

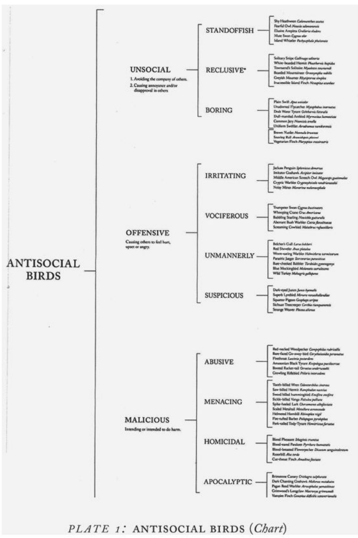
What kept us engaged through the slow process of reading the IOC List was our tendency to anthropomorphise bird names – to assume that a Greyish Mourner is actually depressed, or a Red-necked Woodpecker is small minded and abusive.[8] Below we discuss two of the taxonomies we created that explore the poetics of bird names.

2. Antisocial birds

We compiled numerous lists of birds that were loosely associated by a 'social' quality in their name. In contrast to flamboyant sounding birds – *Splendid Sunbird*, *Festive Amazon*, *Spangled Coquette* – birds that sounded boring appealed to us – *Plain Swift*, *Unadorned Flycatcher*, *Solitary Snipe*. Annoying sounding birds also stood out – *Screaming Cowbird*, *Whooper Swan*, *Belcher's Gull*. Birds with violent names are alarmingly common – *Blood Pheasant*, *Razorbill*, *Grimwood's Longclaw*. We ended up with a data set containing hundreds of bird names that reflect human qualities. To create a cohesive narrative from this, we used Focused Data-mining as an editing tool.

'Avian Taxonomy 3a' communicates antisocial sounding birds. We placed the names into a hierarchy of antisocial tendencies, from the harmless *Solitary Snipe* to the homicidal *Cut-throat Finch*. These tendencies are organised into three categories – Unsocial, Offensive and Malicious. Subcategories further clarify how to read the bird names in relation to these categories. For example, Unsocial birds were divided into Standoffish, Reclusive and Boring. The 'Bearded Mountaineer' may not easily be understood as 'Antisocial' without the further qualifiers of being 'Unsocial' and 'Reclusive'.

For this taxonomy to communicate effectively we needed to edit out duplicates. If there were multiple birds with 'common' in their name, we chose the most 'common' sounding example; the



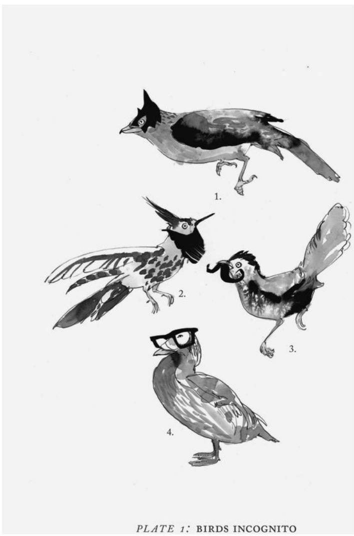


Figure 20.8 Antisocial birds (left) and Birds incognito (right)

Common Jery sounded more boring than the *Common Blackhawk*. Once we structured the taxonomy, we could be more playful within it. For example, birds with 'plain', 'common', 'drab', 'dull' in their names were categorised as boring, but we also included the *Vegetarian Finch*, to highlight the subjectivity of these categories.

Many of these bird names have great illustrative potential – *Satanic Nightjar*, *Fire-tufted Barbet*, *Jackass Penguin*. However, we felt that illustrations would detract from the subtlety of the taxonomy, which aims to communicate the implied antisocial behaviour within the names. Therefore, this chart is the most conventionally 'taxonomic' looking (see Figure 20.8). Visually, it threatens to be dull reading, which makes it more surprising when the unlikely taxonomy is revealed. To extend this rhetorical strategy, the diagram was distorted subtly on a photocopier (first printed out on a laser printer, then photocopied smaller and larger to blur the text), and reproduced in the purple hue associated with old stencil prints students were given at school, before desktop printers.

Conversely, to visually communicate 'Birds incognito', we opted to illustrate a small sample of the collection, in order to emphasise the elements that would clarify the taxonomy. Although it seemed obvious to us that masked, bearded, moustached and spectacled birds might be disguising their true identity, we weren't convinced all viewers would make the conceptual link. We illustrated four birds in ink, each with one of these words in its name, and collaged a paper-cut of the 'disguise' slightly clumsily on top to draw attention to the 'prop' and clarify the concept (see Figure 20.8).

We presented this work as an exhibition, so it was important to quickly communicate our process of Exploratory Data-mining; without understanding that these are all real bird names laboriously plucked from a definitive world bird name database, the work has less impact. We printed the entire database of English and Latin names on a large-format plotting printer, mounted it on the back wall of the gallery, then repeated our data-mining using coloured markers. The seven-hour process can be viewed as a stop-motion animation on our website. In repeating this process, we began forming new taxonomies: birds to take camping (*Firewood-gather*, *Canvasback*, *Ovenbird*, *Fishing Owl*, *Spiderhunter*, *Sunbird*) and fiscal birds (*Dollarbird*, *Green-backed Firecrown*, *Rothschild's Swift*), birds who should never cohabitate (*Morningbird* and *Nightjar*, *Immaculate Antbird* and *Short-billed Leaftosser*, *Oilbird* and *Water Pipit*). This shows that the process can be repeated.

This case study shows how Exploratory Data-mining and Focused Data-mining can be used in tandem within a design research process, and in the process of visualising the findings of the research.

Conclusion

The methods we present in this chapter analyse written texts in visual ways or for visual ends. They are methods designers use in practice, shown here in the context of research.

It is important to stress that Visual Abstraction, Focused Data-mining and Exploratory Data-mining are analytical methods – tools for inquiry, not to be mistaken solely as visualisations of existing knowledge. That the insights or findings take a visual form is inherent in the methods themselves. The act of conducting visual analysis always produces an outcome. Whether those outcomes are visually refined, such as Winston's Romeo and Juliet work, or less refined, such as the thumbnail schemas, is irrelevant in a research context. What matters is that these methods are simultaneously analytical and communicative, whether they remain in the researcher's notebook or are shared with a wider audience.

It is worth noting that the examples we have used here are from designers – all are explicit and articulate about the research process that drove the projects.[9] Designers using visual methods to analyse written texts are mindful of scholarly conventions, particularly reproducibility. It was important to Posavec that her sentence diagramming method was reproducible:

> although I wanted to create a grand, large analysis of *On the Road* I still wanted all of the strategies to be easily adaptable to other works of literature (minus the colour-coding, of course). This was one of my main concerns throughout the project.
>
> *Posavec 2011*

Posavec's concern for reproducibility highlights that these are research tools, not simply drawings. Likewise for Sadokierski, the reproducibility of the 'gimmick clouds' allowed comparison between a range of novels.

Although our background is in Visual Communication design, the methods we describe here could be applied to the analysis of written texts within any field. As practitioner-researchers we bring methods that would otherwise remain embedded in practice to the field of design research.

Notes

1 Although there are many approaches to the analysis of written texts, for example: semiotic (Kress and van Leeuwen 2001, 2006); content (Krippendorff 2004); discourse (Gee 1999); and, more recently visual methods (Rose 2007), none of these methods directly address how designers draw out ideas, understanding and inspiration from written texts.

2 Sections of specialty paper may be 'tipped in' so graphics are printed at a higher quality, or colour graphics may be printed only on certain pages to reduce production costs.

3 Donald Schön discusses the notion of a conversation between designer and their sketch (Schön 1983).

4 Further findings from this method can be found in Sadokierski 2010: 79–84.

5 An online resource generates these cloud maps when you submit a list of data: www.wordle.net

6 Commissioned by Dr Naomi Stead as part of the exhibition, *Mapping Sydney: Experimental Cartography and the Imagined City*. DAB LAB Research Gallery, University of Technology Sydney, August 2009.

7 At this point the search became more focused, switching to an online phonebook and typing in avian names, rather than reading the entire directory. However, beginning in exploratory mode made possible the discovery of different avian surnames – the idea would not have been realised by starting with a focused search, as Sweetapple did not yet know what she was looking for.

8 Other researchers also link human and avian behaviour. Keith Tester extends Levi-Strauss' writing on humankind's fascination with birds:

> Birds are totally removed from human social relations, and this distance means that their relationships can be perceived as a metaphor of our own (they are a parallel society). Now, because birds are a metaphor for humans – it is possible to speak of them as if they were use – their names can be metonymical to human names.
>
> *Tester 1991: 35*

9 See Sadokierski 2010 for a more detailed discussion of the distinction between practitioner and practitioner-researcher.

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21

PROTOTYPES AND PROTOTYPING IN DESIGN RESEARCH

Stephan Wensveen and Ben Matthews

A hallmark of many forms of design research is that they entail the design and deployment of prototypes in some role. If there is a unique character to design research in comparison to research approaches in other fields, it is likely to relate to the role of and focus on designed things as components of the research process. In this chapter, we will discuss the spectrum of roles that prototypes and processes of prototyping play in design research, illustrating these different roles through published examples. The role of prototypes as vehicles for design has been well documented in previous research. Houde and Hill's (1997: 369) article, 'What do prototypes prototype?', defines prototype as "any representation of a design idea, regardless of medium". Basing their discussion on years of practice in prototyping at Apple, Houde and Hill distinguish three dimensions of the design space of questions that prototypes explore in design practice: the 'Role' of a product, its 'Look and Feel' and its 'Implementation'. Lim et al. (2008: 7.3–7.4) propose a similar but more extensive discussion of prototypes in design, defining prototypes as "filters that traverse a design space" and as "manifestations of design ideas that concretize and externalize conceptual ideas". From these studies and others (e.g. Lichter et al. 1994), the field has developed a comprehensive account of the usefulness of prototyping to design practice.

In contrast, our focus will be on the roles of prototypes as vehicles for research about, for and through design. We focus on prototyping within research processes that necessarily involve design activities, which we will refer to as *constructive design research*, i.e. "research that imagines and builds new things and describes and explains these constructions" (Koskinen et al. 2011: 6). Our aim is to present a rough typology of the various ways that designed things appear in design research methods. We do this in order to identify and differentiate the range of possibilities open to design researchers for whom design practice is an essential component of their modes of investigation.

Research and practice

One of the central intersections between design research and design practice is the role that artefacts can play in the research process. We are quick to note, however, that the relationship between design *research* and design *practice* is often blurry. Design research, by which we refer to the discipline that aims to produce knowledge concerning design, often addresses research questions that cannot be answered without doing some kind of design activity. If we want to know how to design aesthetic interactions, for instance (cf. Ross & Wensveen 2010), no amount of desk research or armchair philosophy is likely to present us with a very convincing answer to that question. In order to know, we will very likely have to design something, as Ross (2008) in fact did. Clearly there are a number of forms of design research that necessarily involve some form of design practice.

On the other hand, design practice may result in research. Design practice engages in the conception, development and realisation of new forms, functions, systems and interactions. These, if contextualised within a research field and presented as a contribution to it, may justifiably constitute research. For example, having designed, constructed and evaluated a three-wheeled physically programmable robot ('Curlybot'), Frei et al. (2000: 129) present Curlybot as a 'new class of computational toy'. The research contribution is not the product itself, but what it is that the product illustrates or exemplifies. Their argument is not that the product itself is new (even though it is), but that it opens a space of interactive design possibilities that, in Curlybot's specific case, shows how complex mathematical concepts can be experienced in the behaviour of a product and experimented with through its interactivity.

For such reasons, design research and design practice can sometimes be difficult to distinguish, especially when design methods and research methods become confused with each other. Although cultural probes (Gaver et al. 1999) were originally deployed as a design method (analogous to the way moodboards or brainstorming are design methods, used for inspiration and as aids to the designers' imaginations), in its many subsequent incarnations (some bastardised) it has more often been deployed as something much more akin to a research-oriented kit for enticing users to volunteer ethnographic material about themselves.

The research/practice distinction is vital for a discussion of prototypes in design research, primarily because the existing discussions of prototypes in design focus on their roles as vehicles for furthering design agendas – helping generate and test new forms, functions, systems, etc. for design. However, when prototypes are used as vehicles for research where they are aids to providing answers to research questions and making contributions to knowledge, a different set of their properties comes into view.

In the following, we outline some different roles that prototypes have played in research. The set of distinctions we present is not intended to be exhaustive. We are certain it is incomplete – the diversity of design research is unlikely to be adequately captured in any one typology. However, these distinctions do serve some important purposes. In laying them out like this, we hope to erode the idea that 'research through design' is a (singular) research method or approach, in favour of the view that there are a multitude of legitimate intersections between design research and practice. There is not a method, but rather many different ways that design practice (specifically the practice of building prototypes) may feature centrally in the production of contributions to our knowledge of design.

In looking at the roles that prototyping plays in research, there is a distinct advantage in using cases with which one has some intimate familiarity. The published presentation of research is (necessarily) a somewhat 'glossy' version of what is often a messy process behind the scenes. This is somewhat characteristic of the kind of open-ended practice-based research that is common in design. For this reason, the majority of the examples we consider in detail below have been drawn from our own (or our students') research. The consideration of our own work, whatever its other failings, will allow us to present some of the back-story to the involvement of prototypes in research. This enables us to explore some topics that we could not address by drawing only on others' published research accounts, things like the extent to which the design researcher's initial intentions for creating the prototype were consequential (or ancillary) to the research contribution, or how deliberate (or serendipitous) the findings actually were.

Prototypes and prototyping processes in research

When we look at the ways that prototypes can function in research, we will distinguish between cases where the research is driven by or conducted through the prototype, and cases where the *process* of prototyping is the vehicle for inquiry. In all we will present four different roles of prototypes in design research. Roles 1, 2 and 3 distinguish different functions of the prototype in research; role 4 treats the processes of prototyping in design research as vehicles for inquiry.

We had difficulty settling on an order of presentation for these roles because we imagine that different reading audiences will bring different priorities to this chapter. Readers trained as researchers, versed in established methodological traditions, will likely expect a discussion of how prototypes feature in an easily identifiable research method (e.g. hypothesis-testing lab experiments or action research, for instance). Readers who are trained as design practitioners, versed in the design process, may instead be looking for ways in which a design process – involving the conception and prototyping of an artefact or system – can contribute to design research. We do hope to meet both of these expectations in the following sections; however, our order of presentation of the roles begins with the most clearly recognisable research method: a lab experiment that probes a hypothesis. We might suggest that designers who are interested in doing design research may prefer to read the roles of this chapter in reverse order, since in practice, a prototyping process always precedes the creation of an artefact. In the discussion we will return to this issue.

Role 1: the prototype as an experimental component

Cases where prototypes function as the necessary component in an experiment are, especially from a 'scientific' research perspective, easily recognised as research contributions. Often times in these cases, the prototype itself is the object about which design knowledge is sought through the experimental setup. Examples range from formal tests such as usability tests of the prototypes, experiential trials to assess the design attributes such as aesthetics, or cases where the prototype is treated as a physical hypothesis.

Examples from our research, or our close colleagues', are Stienstra's (2003) interactive toys, the Alarm Clock (Wensveen et al. 2002), Frens' camera interface variations (2006), the Intelligent Lamp (Ross 2008) and recent work from Deckers (2013) on perceptual crossing. In all of these examples the prototypes are components of controlled experiments that are designed to test specific hypotheses that are physically embedded in the artefact. The experimental methods used are in support of descriptive, explanatory and/or theoretical research.

In their paper on "The anatomy of prototypes" Lim et al. (2008) talk about the 'filtering' dimensions of prototypes. Filtering dimensions include *appearance* (size, colour, shape, proportion, etc.), *functionality* and *interactivity* (the input and output behaviour for the product or system). When prototypes function as an experimental component, such 'filtering' dimensions can be treated as independent variables, which are systematically varied to better learn how they influence the behaviour of the dependant variables. To take the example of Frens' camera, his prototype interfaces were varied on interactivity (see Figure 21.1). The different variations were evaluated by the participants of the experiment on the dependent variables of pragmatic and hedonic qualities. Frens left the other filtering dimensions of the prototype unchanged (size, shape, etc.) so as not to influence the dependent variables. Changes in one dimension of a prototype are assumed not to unduly affect other dimensions (within reason).

Relatedly, Stienstra's (2003) experiments with prototypes were designed to test theories in developmental psychology about gender differences in children's play. One particular theory

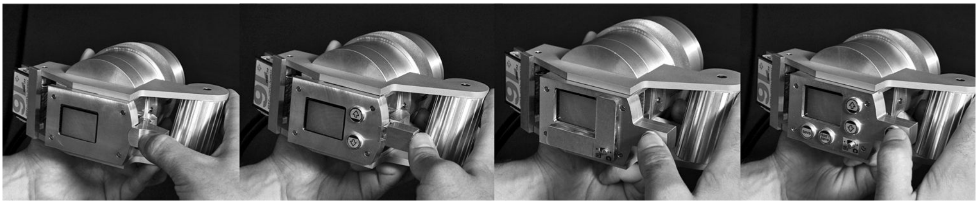

Figure 21.1 The four interface variations of Frens' camera prototype from left to right: the 'Rich Actions Cam', the 'Mixed Actions Cam', the 'Light Controls Cam' and the 'Conventional Buttons Cam'

Source: Frens 2006: 146

she worked with suggests that boys tend to prefer play that consists of gross motor movements, whereas girls prefer fine motor play. In this case, Stienstra constructed three working prototypes in which she systematically varied the scale at which the children had to interact with the three interactive toys (see Figure 21.2): one required body-sized gestures (left), one hand-sized manipulation of magnetic figures (middle) and one required room-sized actions, including climbing and running (right).[1] As each of the toys was functionally identical (they each served as a user interface for the same maze game), she was able to set up an experiment to test for the differences in gender preferences for the scales of play demanded by the different toys.

Ross (2008: 160) articulates similar considerations relevant for the experimental testing of the prototype, in addition to those that come out of his own research demands. As he wants to focus on the interactive behaviour of the product, he kept a single body for the prototype with three different interactive behaviours. His argument is that "[t]he 'cleanest' comparison is made when all other factors remain as constant as possible". Likewise, he argues for the lamp's body (e.g. its static shape, materials and colours) to be as 'neutral' as possible.

In other cases the prototype is kept constant and the context of use of the experiment is systematically varied. For example, Wensveen's alarm clock (Wensveen et al. 2002) was evaluated in a formal experiment to investigate the relation between a person's emotional or affective state and their expressive behaviour when setting the alarm clock. The underlying research question, and departure for the development of the design, was whether design

Figure 21.2 Three interactive toy prototypes

Source: Stienstra 2003

Figure 21.3 Snapshots of three different lamp behaviours within a single body; targeting the social value Helpfulness (left), Social Power (middle) and the value Creativity (right)

Source: Ross 2008

principles from tangible interaction could be used to invite users to express their emotion to products in such a way that the product could recognise this expression. It was hypothesised that the alarm clock would be able to detect a person's affective state and level of urgency from the way he or she set the alarm time. This was tested through several experiments and statistically significant relations were found between the parameters describing the expressive behaviour and the affective state of the persons, which was induced by film clips validated for emotional valence and arousal. Although we hoped to find this relationship, some serendipitous findings also emerged in the analysis of the data. The results showed an unexpected relation where people in a positive state seemed to create more aesthetically pleasing patterns of balance and symmetry.

More complicated experiments need to be set up to investigate interaction effects, where both the context of use and the interactivity behaviours of the prototype are varied in the experiment (as in Ross's case). This also requires more careful statistical analyses to test for the interdependence of the variables.

In each of these cases, the prototype was designed to probe specific, design-relevant relationships that could be systematically tested through experiments where people used and evaluated the artefacts. As an experimental component, there are slightly different roles the

Figure 21.4 Setting the sliders of the working prototype for Wensveen's (Wensveen et al. 2002) alarm clock (left) and different final slider settings of expressive behaviours (right)

prototype (Wensveen), prototype variations (Frens, Ross) or set of prototypes (Stienstra) serve. In some cases, the prototype is a *physical hypothesis*, in which its form, function, interactivity, etc. embodies a theoretical proposition that can be subjected to tests. This role suits Stienstra's and Frens' cases quite well. But we can see that in Wensveen's case, the hypothesis is not constituted in the design of the artefact in the same way. Instead the hypothesis consists in the combination of the artefact *plus the experimental conditions*. It is the fact that the alarm clock permits a multiplicity of interaction possibilities in the performance of a single function that is exploited by the experiment, in order to test a specific relation between affect and interaction. Nothing affective is inherent in the clock. So while the prototype performs very similar roles in each of these cases, the experimental design is equally crucial in the successful extraction of research out of these designed artefacts.

Role 2: the prototype as a means of inquiry

Prototypes have been developed and deployed as instruments of inquiry, in much the way that scientists use specifically designed instruments to collect, record and measure phenomena. A clear example of prototypes used in design research in this way is 'technology probes' (Hutchinson et al. 2003). Technology probes were small, functional prototypes that were sent out to households as a kind of research instrument (although it is worth us noting that Hutchinson et al. specifically declare that technology probes are not prototypes, presumably to distance the probes they created from products that might be produced on the model of their probes. We, however, are using the term 'prototype' in a much more universal fashion than in a 'precursor to a product' sense). The two probes they deployed were MessageProbe and VideoProbe, each of which were designed to be a kind of portal between relatives' residences, and each of which collected data about how they were used, when, how long for, by whom in the family, etc. Both probes were developed within a larger project on domestic and family communication. The probes were informative of the families' uses (and neglect) of these technologies; they were also technological interventions into these families' ordinary communicative practices. The role of the prototype in such a case is as a means of creating design relevant data. It is probably worth noting that although the technology probes actually collected data (logging details about their own use by families), Hutchinson et al. do not draw upon any of this data in outlining what was learned about family practices through the deployment of the probes. Instead, the themes they present are distilled and exemplified through other data, such as interviews that were conducted with the families.

A similar role is played by 'provotypes' (Mogensen 1992), which are prototypes that are used to provoke reactions and insights, designed to expose taken-for-granted aspects of users' values and practices. In a recent extension of this work, Boer and Donovan (2012) developed provotypes (see Figure 21.5) to investigate "people's experience and understanding of indoor climate 'comfort' . . . in order to open up new development directions for the building industry". For the design researcher, provotypes were used to challenge developers' assumptions about use contexts and users' experiences of comfort. Each provotype was developed to deliberately provoke organisations to experience their own indoor climate in new or unanticipated ways, and to reflect on what this might mean in light of new product or service development. In the course of the project, one particular tension emerged between the building industry's understanding of indoor climate and how ordinary people experienced their environment. The building industry tended to think about indoor climate quality as an optimal aggregate of measurable parameters such as light, temperature, humidity and air quality. Ordinary people, however, experienced comfort much more holistically and impressionistically. Boer's

Figure 21.5 Boer's provotypes with the Render-Lamp on the far right

Source: Boer & Donovan 2012

provotype, the Render-Lamp (see Figure 21.5, far right) played on this tension. The Render-Lamp has sensors that measure five different indoor climate parameters, representing these abstractly in dynamic luminous behaviour. The lamp was deployed in users' homes and in building industry workplaces. This opened up a space of reflection for these stakeholders from industry and use contexts, as the lamp brought to the fore the question whether indoor climate is something we can understand objectively or something we relate to individually. As a result of bringing the lamp into homes and organisations, at least during the project period, the language used by organisational stakeholders shifted from understanding indoor climate towards supporting users' indoor climate practices, suggesting that the provotypes were successful in juxtaposing and challenging different conceptions of comfort.

Unlike experiments, nothing specific is being tested when deploying technology probes or provotypes – they are sent out as open-ended explorations of a hybrid and unsettled design/use space. Several other kinds of research that involve prototypes would generally fall into this category. Anything that treats design as an intervention in the world and studies its consequences, or work that deploys prototypes in the field and analyses their use (e.g. Matthews et al. 2008) in order to make a contribution to design discourse, clearly employs prototypes in a similar manner – to create a context for study that is informative of design-relevant issues.

Role 3: the prototype as a research archetype

A visible mode in which prototypes participate in design research is standing as what we will refer to as a 'research archetype'. Research archetypes are physical embodiments of concepts, understandings or design spaces that can be argued to constitute contributions to the discipline. In contrast to functioning as a means of inquiry (role 2, where prototypes are deployed to generate understandings about contexts of use or users themselves), the role the prototype plays in this contribution is usually exemplary or ostensive. Examples of prototypes that serve as research archetypes are plentiful in the design literature; we will run through a few clear examples here. Curlybot (Frei et al. 2000), mentioned earlier, is one example of a research archetype. Anthony Dunne's (1999) 'Faraday chair' is another. Dunne designed the chair in the course of a series of conceptual product explorations that make the ubiquity of ambient electromagnetic radiation noticeable, remarkable and confrontational. The Faraday chair (see http://collections.vam.ac.uk/item/O63805/) is an acrylic rectangular prism that functions as an electromagnetic shield, equipped with a snorkel mouthpiece and air hose. The prism is mounted on a bare aluminium frame about the size of a park bench. The space enclosed in acrylic is claustrophobically small, only permitting an adult to assume a foetal position within it. Dunne presents the Faraday chair as a design archetype (he prefers 'genotype') that realises, and reifies in its form and dystopian scenario, a nuanced techno-ideological agenda. The research contribution here is conceptual and methodological: Dunne does not just populate a new 'hertzian' design space with exemplars like the Faraday chair, but in theoretically positioning his concepts he opens up an approach to design that carries novel emphases such as criticality, estrangement, reflection and dysfunction.

In work of our own, we have presented a series of artefacts as a means of gradually elucidating a research contribution (e.g. Djajadiningrat et al. 2004; Djajadiningrat et al. 2007). In Djajadiningrat et al. (2004), a gradual understanding of the perceptual and motor skill design possibilities provided through tangible interaction is articulated through a series of prototypes that were developed within the authors' (Djajadiningrat 1998, Wensveen 2005, Frens 2006) PhD studies. In the paper, each artefact is used to illustrate unique design lessons that exemplify different aspects of that general agenda. The general perspective and the specific instantiations are mutually elaborative – the general perspective is what ties the specific examples together, and what makes each of them important, and yet it is only through the examples that it is possible to understand the general perspective that is being advanced. In this way the prototype and perspective form a hermeneutic circle. In Djajadiningrat et al. (2004), for instance, the general 'perceptual-motor' perspective consists in the meaningful coupling of appearance, function, action, behaviour and inherent feedback of the product. This perspective is elaborated by specific products that display their functional state through their appearance, such as a VCR whose physical form displays that it is currently playing a tape, or an alarm clock whose external configuration displays that the wake up time of 6:03am was set by the user in an agitated state of haste.

In each case here, the prototype functions as a research archetype – a physical embodiment of research concepts or perspectives that have broad application, but also that require specific examples to demonstrate their potential and justify that they constitute a contribution. Prototypes that are research archetypes are principally illustrative, elaborative or ostensive, even (and especially) when they are illustrating or exposing confrontational or contradictory agendas.

In the cases we have so far considered, the actual process of prototyping has been invisible. And if you read most of the papers that we have cited, you will struggle to find an account of the prototyping process – the stepwise evolution of a concept into the form in which it makes its appearance in research. You may find an account of the design rationale of the artefact, or critical reflections on what was learned through evaluating the prototype. But in our cases above, the actual making of the prototype, or the iterative construction of the artefact, is generally inessential to the function of the prototype in making a research contribution. In the following section, we focus on types of research in which the process of prototyping (more than the prototype itself) is essential to the generation of a research contribution.

Role 4: the process of prototyping as a vehicle for inquiry

There are a number of ways that the process of making an artefact is instrumental in doing design research. In these cases, the process of prototyping becomes a means of inquiry, akin to a research method. The process is documented, analysed, critically assessed and written up, and the research contribution is tied not to the artefact itself as much as to how the artefact was crafted. As we consider a few examples, you will see that the types of research contributions that have been made in this way can vary dramatically. However, the role of the prototyping process is much the same in each.

Newbury (1996) discussed a fascinating (but uncredited) example in his lucid discussion of research in art and design. While this case is perhaps closer to the traditional crafts than it is to design, it is highly relevant here for the nature and attention it gives to the process of creating artefacts. Newbury describes a Doctoral glassmaking project that aimed:

> to offer a new theory for the production of Hellenistic and Roman mosaic glass. The starting point of the proposal was the [candidate's] intuitive feeling that theories put forward by archaeologists, concerning the production of mosaic glass from this period, did not ring true from a glassmaker's point of view. . . . The process of research involves putting to the test of this intuition, and developing a new theory of production based on practical experimentation. . . . [T]he contribution to knowledge will clearly derive as much from the practical as from the theoretical work.
>
> *Newbury 1996: 218–219*

In this case, a new practice of making glass is both the method of the research (experimentation with glassmaking practices is necessarily the process of inquiry) and the research outcome (a historically plausible glassmaking practice is 'discovered' through experimentation). One of the respects in which Newbury's example is so sharp is that it is a case where it so obviously takes a glassmaker to conduct this kind of research, yet the knowledge gained is not just practical – the contribution is more pervasive than just a new way of making glass.

In a paper with similar aims to Newbury's, Scrivener (2000) clarifies the criteria for conducting research through (design) practice by drawing a comparison to research undertaken in engineering, such as building a robot arm that can, e.g., pick up an egg without breaking it. Scrivener's discussion is valuable for the criteria he identifies that distinguish research through practice from (just) practice. But the robot arm example is also one in which the contribution to knowledge can only be produced through an iterative prototyping process: we cannot discover the principles or requirements for building such a robot arm without thinking through design possibilities, proposing, building, testing, reconfiguring, etc. an artefact that iteratively clarifies our understanding of this particular design space. From such a process, codifiable knowledge can be derived about material selection, functional consequences of different robot arm design configurations, material resistance, useful algorithms for controlling the movement of the arm and so on. That knowledge is, in some sense, 'embodied' in the resultant robot arm that successfully picks up eggs without breaking them; yet it is gained only in a stepwise fashion through the construction and trial of multiple prototypes.

Other kinds of research have been conducted through prototyping processes. Horst (2011), conducting a PhD project while working as a design consultant, constructed an interactive prototype of the user interface for a programmable thermostat for indoor radiators. The company had hired him to create a prototype that they could use to run usability tests of the interface. For the purposes of his research, however, Horst wanted to experiment with the prototype. Instead of simply producing a simulated interface to the specifications the company had given him, he designed the software in such a way that the code (and hence the functionality and interactivity of the interface) could be modified in near real time. This enabled him to play with the prototyping (and user evaluation) processes. For instance, he ran 'live prototyping' sessions (see Figure 21.6) internally in the company, where stakeholders from different internal

Figure 21.6 Horst's live prototype being used in a participatory workshop (left), the virtual prototype (middle) and the final prototype (right)

departments (marketing, sales, hardware, production) participated in trying out the interface as users, discovering potential usability problems, recommending changes, seeing those changes implemented then and there, and trying out the 'new' version of the interface. This had some fairly profound (internal) consequences, as it enabled a number of company people who were not a part of the interface development team to actually shape the interface. It turned out that the original interface specifications Horst had been given never became a version of the interface that was used in a usability test because the 'live' prototype he created allowed the company to rapidly try out and evaluate several versions of the interface prior to sending it out to be formally tested. These experiments enabled Horst to write a thesis on the possibilities of deliberately crafting prototypes as 'platforms for participation' in iterative design. While the prototype of the programmable thermostat interface was interesting, the research contribution here is intimately tied to the way in which collaborative prototyping sessions were run inside the company (and later, with potential users as well). This is the prototyping process that became both the method of and object of research.

Subdisciplines of design research that work extensively with design methods also belong in this category. A healthy proportion of research in participatory design, for instance, is concerned with the development of codesign activities; these have often involved a form of prototyping (e.g. Greenbaum & Kyng 1992) in which the process of making a prototype is precisely the process that is being experimented with in the creation of new formats for design and participation (as in Sanders 2000; Mitchell & Buur 2010).

Discussion

In the above we have outlined the different roles that prototypes and the practice of prototyping have played in research illustrated through published case examples. All of these cases have made research contributions in various ways, using diverse methods and approaches. Each case also, to different extents, required the prototype or prototyping process in order to generate that research contribution. If we think about 'research through design', where design practice is understood as a basis for research, we can easily see from the spectrum of examples and roles we have discussed that 'research though design' is not a singular research method or approach to doing design research (cf. Mattelmäki & Matthews 2009).

We chose the distinctions between the roles and the order of the presentation to outline clarity and recognisability of prototypes and prototyping as research contributions. However, designers who are doing, or are interested in doing, design research will realise that the roles can and often do overlap. In many cases the same prototype can feature in different roles in the pursuit of different research contributions. Some of the work we have described (re-)presents the same prototype in the course of different research arguments at different times. For example,

Table 21.1 Comparative overview of the characteristics of the different roles that prototypes and the practice of prototyping have played in design research

	Prototype as…			*Prototyping as…*
	Experimental component	*Means of inquiry*	*Research archetype*	*Vehicle for inquiry*
	Role 1	*Role 2*	*Role 3*	*Role 4*
Purpose and role	Test of specific hypotheses	Open-ended exploration	Illustration or demonstration	Driver for the research direction
	Systematic variations of prototype or context of use	Instrument to collect, record and measure phenomena	Physical embodiment of research concept, understanding or design research space	Research contribution is tied to the process of crafting the artifacts
Special considerations	Design of the experiment is equally crucial	Often combined with doing interviews	Critical perspective is equally crucial	Process is documented, analysed and critically assessed.
Data	Primarily quantitative data (e.g. data logging, questionnaire)	Qualitative (e.g. interviews) and/or quantitative (e.g. data logging)	Designed artifacts that form the basis of critical analysis	Qualitative case study
Method of analysis	Statistical analysis	Ethnographic analysis	Expository analysis	Case analysis
Type of research contribution	Empirical, theoretical	Empirical	Conceptual, Methodological	Methodological
Published examples	Interactive Toys (Stienstra 2003) Interactive Lamp Behavior (Ross 2008) Camera interfaces (Frens 2006)	Technology Probes (Hutchinson et al. 2003) Provotypes (Boer & Donovan 2012)	Faraday chair (Dunne 1999) Tangible Products (Djajadiningrat et al. 2004)	Participatory Prototyping (Horst 2011), Co-design literature

Stienstra's toys appear in an experimental role in her thesis (Stienstra 2003), as a means of inquiry in Matthews et al. (2008) and as a research archetype in Djajadiningrat et al. (2007). So an important point is that it may only be in retrospect that some of the important features of a product or prototype surface after further reflection, analysis or theoretical development. So even though the practice of prototyping as a means of inquiry often receives the least attention as a research contribution, it is often the case that a prototyping process has been vital for the exploration and further development of research directions, or has provided a conceptual background for the later stages of research where prototypes were developed to function as research archetype or experimental component. As an illustration, before the prototyping of the four interface variations as experimental components, Frens had already used prototyping as a tool to 'traverse a design [research] space' of interaction paradigms (analogous to the sense that Lim et al. (2008) conceptualise prototypes as tools for traversing a design space where possible design alternatives and their rationales can be explored (Goel & Pirolli 1992; Moran & Carroll 1996). Themes for these paradigms were defined, balancing real-world design problems and ongoing trends in Human Computer Interaction (HCI) research, to cover a large area of that space. Here, Frens made many cardboard models of cameras and used prototyping as means of inquiry into that space. One specific prototype was identified and described as a research archetype for the paradigm of 'rich interaction'. This initial cardboard version was further developed from a research archetype into a fully working camera with electronics to compare the use of its four interface variations (see Figure 21.7).

In the case of Wensveen's alarm clock, the initial design direction based on theoretical notions was further developed after a large set of prototypes generated from an educational exercise was analysed. This set of prototypes served an essential role as means of inquiry to explore and describe a conceptual design research space. A specific corner of the design research space was then targeted for the subsequent prototyping of an alarm clock. The design and the resulting prototype of the alarm clock were developed to serve the dual role of being both a research archetype of the conceptual design direction of a tangibility approach to affective interaction (which as a case was reported in Djajadiningrat et al. 2004) and as the essential component in an experiment (Wensveen et al. 2002). As a research archetype, the prototype needed to have some real world design value, hence the clear functionality (including a waking-up sound, although this was not used in the experiment) and choice of colours. Other design research

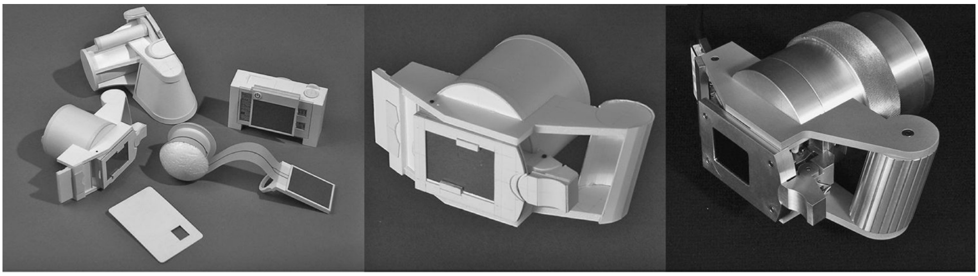

Figure 21.7 Five of Frens' initial cardboard prototypes as means of inquiry into a design research space (left); one of the set (middle) was the physical embodiment of his conceptual argument and was described as a research archetype for 'rich interaction'; a fully working prototype (right) was developed for the final experiment where four systematically varied interfaces were compared on pragmatic and hedonic qualities

Source: Frens 2006

decisions were made for the prototype to function as a component in an experiment. The most notable decisions were leaving out functionalities that would have made the design a 'better' alarm clock (excluding light, although this was a highly liked feature coming out of initial probe research), and including technology that could produce electronic read-outs of the setting of the alarm time to be used as quantitative data for the experiment.

Deckers (2013) separated these roles between her prototypes (see Figure 21.8). Her PeP pillar was developed as an experimental component purposely stripped of any functionality and context of use to focus the research on the explaining of theoretical relation between the interactive behaviour of the designed object and the emergence of perceptual crossing between the pillar and the participant. In parallel, she developed the PeR carpet as a research archetype to demonstrate the concepts and imagine the value behind Designing for Perceptual Crossing in a design with the potential to be an actual product.

We raise these issues to clarify some of the differences between prototypes for design research and prototypes for design. Although they can share many properties, the value of a prototype for the purposes of research is dependent on what it has the potential to *contribute to an inquiry*; the value of a prototype for the purposes of design is usually tied to what aspects of product, system or use it can reliably model for the purposes of refining the concept in development.

The skills required to design – to conceive, craft and construct an artefact or system for a particular purpose – are just as vital to the creation of research prototypes as they are to design prototypes. However, these design skills are also not sufficient to turn a prototype into a vehicle for research. In order to stand as research, the prototype (or prototyping process) must also become an object of analysis, it must figure in an argument and it must help demonstrate a new and valuable contribution to the knowledge of a field. Our principal point is that there are a number of different ways that prototypes can so feature.

Summary

We have broadly identified four different roles of prototypes in design research. As an experimental component, prototypes (plus the design of the experimental conditions) act as a physical hypothesis that can be tested. When introduced and studied in use, prototypes can

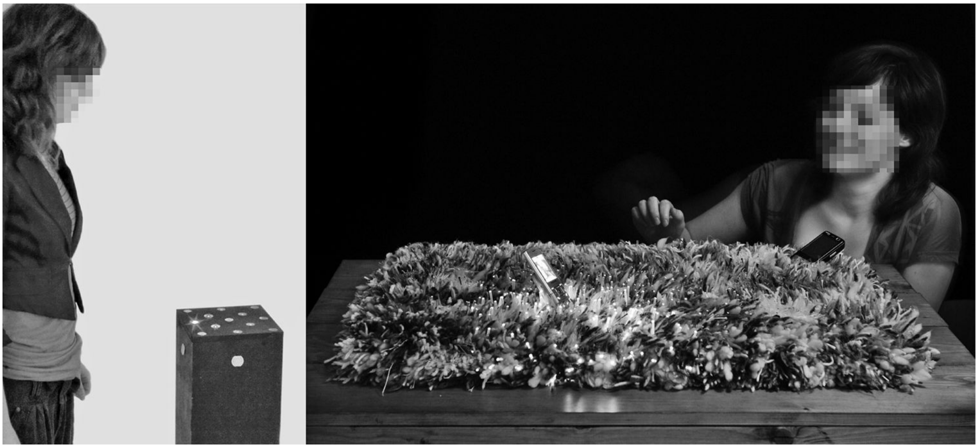

Figure 21.8 Deckers' PeP pillar prototype (left) functioned in the role of an experimental component; she also developed the PeR carpet as a research archetype (right)

become a means of inquiring into a context of use or of creating a situation or circumstance for the purposes of analysis, i.e. a way of generating new data for research reflection. Prototypes also feature in conceptual arguments, standing as a research archetype that illustrates or elaborates a new perspective about, for and/or through design. Furthermore, the process of prototyping can equally serve as a means of inquiry and a basis for experimentation with design practice. There are many intersections of design practice and research about, for and through design. That diversity is something to be celebrated.

Note

1 In Stienstra's studies, the variation of the scale of interaction (an 'appearance' dimension according to Lim et al.'s (2008) framework) actually had profound consequences for functionality and interactivity of the toys, demonstrating that the various families of prototyping dimensions Lim et al. identify are (or can be) interdependent in practice.

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22

THE VISUAL THINKING METHOD

Tools and approaches for rapidly decoding design research data

Simon Bolton

Introduction

The ability to decode and translate design research issues into useable ideas is of growing significance within design-driven innovation practices (Verganti, 2009); and the need to identify unmet needs, hidden innovation opportunities (Miles and Green, 2008) and translate them into breakthrough ideas has become of increasing value to many organisations (Ulrich, 2011). Within this context, the role of design thinking in achieving these objectives is therefore becoming ever more significant (Brown, 2009; Lockwood, 2010).

Not only is there a need for radical ideas, but there is a necessity for them to be delivered more rapidly via a rapid innovation process. Fraser (2010) suggests that for organisations to be able to deliver faster breakthrough ideas, they need to be able to create high-value concept solutions derived from deep consumer understanding; place more emphasis on the visualisation of concepts in order to help organisations and teams envision new possibilities through multi-functional engagement; and extract more strategic intent from these concepts in order to help them recast new strategic business models.

When attempting to achieve these goals, it is important to consider that most companies appear to struggle to create radical products through disruptive innovation, and are typically more confident and effective at delivering incremental improvement (Christensen, 1997). Chesterton appears to have pinpointed the underlying problem by suggesting that: "it isn't that they (organisations) can't see the solution. It is that they can't see the problem" (1935: 686).

There are two points that highlight the essence of the dilemma that has been at the heart of the development of the Visual Thinking Method (VTM): (1) that many organisations do not have the capabilities to rapidly see radical innovation opportunities; and (2) they experience greater levels of uncertainty and anxiety when undertaking radical versus incremental innovation.

The VTM has been developed to help reduce uncertainty and assist individuals and multi-disciplinary teams in front-end design-driven innovation. It improves their ability to rapidly and clearly see radical innovation opportunities. Below, we explore the question 'what is visual thinking?', articulate the key principles of decoding, provide an overview of the rapid innovation process and present a concise case study example. We conclude by summarising emergent themes.

What is visual thinking?

The Visual Thinking Method (VTM) is not a graphical visualisation technique for recording and facilitating meetings (Sibbett, 2010). It is a blended design research method that fosters a design attitude (Boland and Collopy, 2004) through the adoption of 'designerly ways of knowing' (Cross, 2006) in order to tackle wicked problems (Buchanan, 1992). It is delivered through a five-step rapid innovation process driven by deep consumer understanding (Eisenberg, 2011; Barczak et al., 2009).

The development and evolution of the VTM has not happened in isolation. Over the last ten years, changes to the global economy have initiated a recalibration of design-driven problem-solving and innovation activities within academia and industry, impacting on a range of issues from socio-economic change through to pressure on natural resources, and challenges related to climate change.

The following section provides context by reviewing contributions of key authors, presenting drivers that have shaped the development of the VTM and exploring underlying core concepts.

Disruptive thinking

The VTM reflects the continual academic and professional development of approaches to design research and design thinking in recent years (Brown, 2009; Lockwood, 2010). Brown (2009) and IDEO have been central to the promotion of the value and growth in use of design thinking within business domains underpinned by the notion of deep consumer insight. They have successfully emphasised the power of divergent thinking and the effectiveness of creative and disruptive ideas. The adoption of design thinking is being driven by the increasing complexity and depth of current problems that many organisations face. Martin (2009) reinforces the importance of a 'designerly way of thinking' when he states that within the context of complex problems, the over reliance on the use of old questions will not produce valid answers.

The VTM embraces the duality of design from its role in (a) explaining, identifying issues, trends and phenomena in the design domain through effective enquiry (creative research methods and tools), and (b) producing or influencing better design in the real world through effective delivery (five-step rapid innovation process). It centres on tackling complex undefined or partially defined research problems (areas of uncertainty) that typically have an observable user scenario and/or user group. To address these multifaceted research challenges, a blended approach has been adopted. In the front-end stages of the rapid innovation process, it adopts an exploratory-based research methodology that focuses on identifying and defining the research problem or question (why, how, when and where). It then moves to an empirically based research method focused on testing the feasibility of issues and/or solutions (which one, how often, how many).

An influential factor in the development of the VTM was the realisation of the importance of the impact of an individual's mind-set on the success of the team and/or project. The work of Fraser (2010) and Dyer et al. (2011) helped guide our thinking. Fraser (2010) identified a series of innovation mind-set qualities that individuals within teams must have. The VTM embeds and encourages the adoption of several of these mind-set qualities through its creative approaches, tools and individual steps within the process. It specifically encourages open-minded collaboration; abductive thinking; permission to risk early failure; allowing imperfection and iteration early in the process; and encouraging creative resolutions through embracing trade-offs and constraints. The importance of accepting failure as part of the process has also been identified as a critical dimension within creative entrepreneurship (Ries, 2011). The similarities in the challenges that creative entrepreneurship and radical innovation practices both face is an interesting area for future research.

The method embeds the key activities of questioning, observing, networking and experimenting in order trigger what Dyer et al. (2011) refer to as 'associational thinking' – the cognitive skill of associating, that encourages individuals and teams to think and behave differently. These skills support and develop the core principles of the VTM, that of pattern recognition. By developing associational thinking in individuals and teams, it helps improve their ability to recognise connected and unconnected issues, opportunities and problems. They can then link them together in obvious and non-obvious ways in order to produce original ideas that solve or address defined issues, opportunities and/or problems.

Systematic reflection

A key notion behind the VTM is that it blends two distinct types of design practice. It brings together the notions of 'reflective practice' pioneered by Schön (1983) and evolved by Gibbs (1988) and the use of systematic practice advocated by key pioneers in design research such as Jones and Thornley (1963) and Archer (1965) through to Pugh (1991) and Pahl et al. (1995). The author defines this blended practice approach as systematic reflection.

The systematic reflection approach mixes the capacity to reflect on actions as a means of engaging in a continuous process of learning, with systematic approaches to analysis and synthesis as a means of achieving deep holistic thinking and solutions, underpinned by targeted bodies of knowledge. This blended approach embeds the designer's capacity to deal with the uncertainty of not having to know what the outcome will be before they start (Buchanan, 2001) by harnessing the ability to rapidly learn what you are doing while you are doing it, based on a repertoire of design thinking based skills (Schön, 1983). At the same time it incorporates principles of systematic design practice that focus on the visualisation of crucial factors in order to bring about greater levels of integrations (Pugh, 1991).

The systematic reflection methods and tools have been developed (see Figure 22.1) to help break down complexity and uncertainty by enabling individuals and collaborative teams to systematically take apart, sift and filter difficult and intricate issues and problems. This is underpinned by helping design researchers to formalise distinctions between random elements and/or non-random factors, correlated by definable interactions between the parts.

A critical function of the VTM relates to reducing uncertainty. We have built upon Hubbard's definitions of uncertainty and risk, with uncertainty being "the lack of complete certainty, that is, the existence of more than one possibility" (2010: 763–764). The author also defines risk as a state of uncertainty, where some possibilities involve a loss, or other undesirable outcomes. This approach addresses two associated weaknesses. First, it addresses the often perceived openness of reflective design practices that can sometimes result in innovative but often impractical ideas. Second, it addresses the stated weaknesses that many engineering systematic design methods are too discipline-dependent, often primarily oriented towards core design activities and the delivery of 'product design specification' (Pugh, 1991).

Its strength lies in its ability to embed the concepts of a designerly way of thinking and at the same time reduce the emphasis on pure intuition by placing greater emphasis on achieving informed creativity. This is achieved through the creative use of multiple targeted bodies of knowledge (for example, user, market, design, technology, visual and non-visual research data).

The VTM embeds the notion of visualisation at its heart. We refer to this as the process of 'bringing to life' issues and opportunities, enabling the visualisation of multiple possibilities through a series of methods and tools (innovation templates and conceptual frameworks) that

Figure 22.1 Associational thinking – making connections between issues and opportunities

Figure 22.2 Pattern recognition – seeing patterns in things that others do not see

help break down issues (managing uncertainty) into manageable, quantifiable and measurable components (managing risk). This endorses Hubbard's (2010) view that observable and quantitatively definable issues help reduce uncertainty. Hubbard defines the measurement of uncertainty as "a quantitatively expressed reduction of uncertainty based on one or more observations" (2010: 23). These principles, in a simplified form, have been embedded into the visual thinking approach and are key to its success. They build upon the notion that designers are typically better equipped to manage uncertainty, as they are more often required to work with unfamiliar scenarios (Buchanan, 2001).

Visualisation of complexity

Central to the VTM is the visualisation of issues and opportunities to help describe and communicate data; facilitate pattern recognition; and connect issues and opportunities. Morphological analysis principles have been adapted and adopted due the approach's ability to visualise issues and encourage analysis, synthesis and idea generation through associational thinking – making connections between issues and opportunities (see Figure 22.1). Zwicky and Wilson (1967) developed the morphological analysis approach to solve complex, multi-dimensional problems at NASA. It has since been simplified and developed over time as a method for encouraging exploratory creativity rather than normative innovation according to Majaro (1991).

In the context of the VTM, the morphological analysis approach has been adapted as a tool for helping individuals and teams to visualise and decode the interrelationship between specified context and issue parameters in collected data. It functions as a cognitive map (Tolman, 1948) helping individuals and teams acquire, code, store, recall and decode information. The tool has two distinctive uses and phases: first it is used for data collection mapping, enabling the systematic visualisation of acquired information and coding of data; and second for the analysis and decoding of data to identify emergent patterns through systematic analysis and reflective synthesis. The second phase is referred to as opportunity mapping. Cognitive mapping serves to help the user visualise content to reduce cognitive load and enhance recall and learning of information and results in improved processing of tasks (Kitchin, 1994). These capabilities permit the reduction of uncertainty (breaking down complexity) via facilitation of rapid observation of obvious and non-obvious connections (Hubbard, 2010).

Systematic trigger mechanisms

The VTM blends a combination of creativity triggering methods, such as different research stimulus data (trends, materials and technology, for example), with more structured approaches, such as innovation templates, to find novel ideas, as advocated by Eppler et al. (2011). The author defines these as systematic trigger mechanisms. The VTM also adopts the use of innovation templates, based on the attribute dependency approach developed by Goldenberg et al. (1999), as these are proven to be useful in the context of ideation activities.

Conceptual frameworks are used within the VTM to support problem-solving and deconstruction of complex issues (Goodman and Lawless, 1994). Conceptual frameworks, within the context of the VTM, are used to outline possible courses of action or present a preferred approach to an idea or thought derived from systematic literature review findings. Innovation templates embed appropriate effective best practice issues based upon research data and/or literature review findings that are distilled into the conceptual frameworks. They aim to provide a non-prescriptive tool for breaking down and structuring issues and information. Innovation templates are flexible and can be used for both exploratory and generative activities. Innovation tools and templates have also been proven to help improve team performance (von Hippel, 2001).

The use of the conceptual frameworks and innovation templates support four major components of pattern recognition: data acquisition and collection; feature extraction and representation; similarity detection and pattern classifier design; and performance evaluation (Rosenfeld and Wechsler, 2000). They act as systematic trigger mechanisms within the VTM and have proven themselves to support the deconstruction of complexity, reduction of uncertainty, encouragement of deeper analysis and synthesis of issues and opportunities. They do this by encouraging systematic reflection.

Creative analytical problem-solving

Einstein and Infield captured the essence of the importance of creative analytical problem-solving in their famous quote: "the formulation of a problem is often more essential than its solution. To raise new questions, new possibilities, to regard old questions from a new angle, requires creative imagination" (Einstein and Infield, 1938: 92). The work of Majaro has greatly influenced the initial thinking of the author in how one might help others to put into practice the spirit of Einstein and Infields' quote.

Majaro (1991) brought to life the anxiety that problems cause for many people. His work helped to focus attention on how design thinking methods could be combined with more systematic approaches to help individuals and teams better understand the cause-and-effect relationship between symptoms and their underlying causes.

The VTM adapted and adopted Majaro's (1991) basic assumptions that defining the problem statement is a vital stage in the problem-solving cycle. His articulation and break-down of the problem definition process helped to bring to life its importance to achieving success. Hodnett (1955) summarises succinctly the importance of defining a good problem statement as often including (a) what is known; (b) what is unknown; and (c) what is sought. This underlines the fact that before attempting to generate a creative solution, considerable time and effort is required from the problem solver prior to starting the process.

Pivot points

According to Ries (2011), teams under pressure often feel that they have a lack of time to analyse root causes. In order to address this identified weakness, the VTM adopts and adapts a 'root cause analysis' (RCA) approach in order to help individuals and teams to rapidly drill down into questions and issues. This builds upon the principles of Majaro (1991) and helps to accelerate decision-making.

A key example of the RCA approach is the 'Five Why' systematic problem-solving tool developed by Ohno (2006), reputed father of the Toyota Production System. It deploys a 'waterfall type' questioning approach that aims to unpack each question layer before cascading through five layers via associated questioning.

A weakness of this 'Five Why' approach is that the tool does not naturally lend itself to asking 'how'-based questions, which are a prerequisite of an empirical orientation. The VTM therefore derives its specific RCA capabilities from the 5WH tool developed originally for journalists, which encourages deep dive principles and embeds the 'how'-based questions. This method of working has been effectively integrated into the creative approaches of the VTM, which underpin the actions undertaken within the typical three phases of each step of the rapid innovation process.

The ability to make critical decisions and identify root causes helps significantly in improving the researchers' propensity to recognise key decision points. Ries (2011) refers to these moments as 'pivot points'. Improving the researchers' consciousness of 'pivot points' within the process helps to accelerate their decision-making, reduce uncertainty and facilitate greater depth of thinking. This aids in the transition from identifying and describing to analysing and decoding of issues and opportunities.

Principles of decoding

In developing the principles of decoding design research data it has been possible to break down and identify a series of factors that help facilitate and grow decoding capabilities in both people and projects. The following information will introduce and discuss the key values that underpin the core VTM decoding activities: pattern recognition; analysis and synthesis; creative approaches and tools.

Pattern recognition

The ability to recognise patterns in visual and non-visual data is fundamental to the VTM. Pink (2006) argues that the future of the advanced world will belong to people with mind-sets who will be creators and empathisers, pattern recognisers and meaning makers (see Figure 22.2). The VTM pattern recognition process is driven by a systematic approach to identifying the repeated existence of activities, actions, sequences and/or events within a defined context. It has been predicated upon principles of pattern recognition: data acquisition and collection, feature extraction and representation, similarity detection and pattern classifier design and performance evaluation (Rosenfeld and Wechsler, 2000).

The VTM pattern recognition technique is reliant on the 'systematic reflection' approach to drive analysis and decoding. In turn, the ability to recognise new and emergent patterns influences the effectiveness of synthesis – i.e. the capability to combine novel and feasible innovation drivers in new ways that create added value. The ability to rapidly recognise patterns in design research data fuels the analysis and syntheses activities, which are the engine of decoding.

Figure 22.3
4Cs Method – the systematic collection, clustering, categorising and classifying of visual and non-visual data

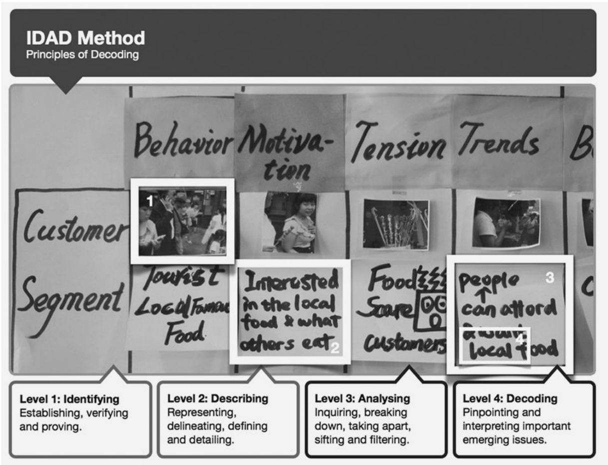

Figure 22.4
IDAD Method – identifying, describing, analysing and decoding

The capability and capacity to recognise patterns is developed through the use of the 4Cs Method. This involves the systematic collection, clustering, categorising and classifying of visual and non-visual data (see Figure 22.3). The 4Cs Method fosters a culture of creative enquiry by combining both systematic and reflective practice in order to help the design researcher learn from what they are doing while they are doing it (Schön, 1983), whilst underpinning this with knowledge and a repertoire of visual based design research tools. The ability to externalise data and work with visual based information are crucial factors of the VTM.

Analysis and synthesis

Analysis is the engine of synthesis. Brown (2005) argues that analysis and synthesis are the natural complements to divergent and convergent thinking. The VTM is driven by the 'Iterative Deep Dive Analysis' approach, which develops the ability to iteratively interrogate, deliberate and define the essential nature, qualities and/or characteristics of proposed questions, issues and opportunities. This approach ensures that an acute and accurate penetration of issues and/or activities has been reflected upon, understood and an appropriate outcome achieved.

The primary purpose of the analytical-based activities is to help identify and define the important emerging issues and/or opportunities from the collected data. Decoding is central to achieving this goal. The analysis and synthesis activities involve four principal levels of identifying, describing, analysing and decoding. These concurrent activities help to break down complexity, target and interpret specific parameters and/or issues in a systematic way. We refer to this as the IDAD Method (see Figure 22.4).

Observing and evaluating multiple design research projects over a five-year period, it has been interesting to see that many design researchers appear to stall at level two – that of describing what they have identified. This finding emerged through evaluating the effectiveness of our activities where it became evident that data being presented was frequently descriptive in nature. We found that the information presented was often effective in helping to define, represent and detail a specific context and/or issue but did not go to the next level of critically highlighting the key issues often enough. The reason for this may be due to the need for analysis that requires an in-depth understanding of a complex assembly of interrelated issues.

This phenomena appears to be attributed to two factors: (1) the problems associated with dealing with unknown and/or uncertain situations, which are ever present in radical design-driven innovation scenarios; and (2) formalising the distinctions between elements and correlating the interrelationships between the important factors. This refers to what Weaver (1948) defines as 'disorganised' and 'organised complexity'. This is where the importance of the 4Cs Method comes into play: it helps early career design researchers to categorise the distinctions (4Cs step three: categorising) and distinguish the classification of the interrelations between important elements (4Cs step four: classify).

Levels three and four of the IDAD Method have been identified within our research as key activities that assist the design researcher in pinpointing specific issues and helping them to break down and filter out important factors. As more and more learning was gained from undertaking design research projects with the VTM, it became possible to assess a design researcher's effectiveness based on their ability to decode. Serial innovators are often defined by their ability to repeatedly decode opportunities (Dyer et al., 2011). We observed that developing the researchers' ability to decode moved their capabilities from being descriptive to being more critical and informative.

Synthesis relies on the collective act of putting either connected or unconnected pieces of information together in order to create whole ideas (associational thinking); it is the act of extracting meaningful patterns from raw information (Brown, 2005). Decoding and synthesis activities are interconnected. For example, the quality of the decoded outputs directly impacts the value of combined innovation elements. This is why it can be argued that the engine driving the synthesis function is that of analysis.

The primary phase of the IDAD Method is concerned with determining the value of key characteristics and attributes of emergent issues and opportunities in the data (evaluating). The second phase of combining revolves around fusing together individual innovation elements to create increased value. The change in the designer researcher's capability to synthesise appears to happen within level one of the IDAD Method as they develop their ability to verify and prove, and in level two when they have acquired the skills to critically delineate and detail the descriptive elements. These capabilities are fundamental to generating data that can be broken down (analysed) in order to be able to pinpoint emergent issues (decoded).

Creative approaches and tools

Success appears to be linked to achieving a balance between providing a coherent framework, supported by key tools, underpinned by creative approaches (see Figure 22.5) that can foster creative enquiry and critical decision-making. A series of creative approaches were developed, based on the above understandings that link and underpin the rapid innovation common framework (see Figure 22.7). Creative approaches help facilitate agreement and create momentum in projects and generate a mechanism for encouraging reflection in activities and people. They have been identified as one of the critical factors in delivering success in our projects.

The VTM focuses on breaking down the research process into specific research activities underpinned by formalised steps and clearly defined phases (see Figure 22.8). These structured steps and formalised phases are supported by a series of core creative tools. Structuring and formalising the activities has enabled the identification of core creative tools. Additional tools are typically introduced depending on the type and nature of the design research activity. One observation during development of these tools was that many are well recognised (four-box tool) but not well understood.

The core tools aim to help energise the flow of activities (listing tools) and encourage active comparison (clustering tools) within data collection and analysis activities. Tools for building combinations (grid-based tools) are used to support data analysis and synthesis. Growing understanding is facilitated through the use of diagram-based tools. As the complexity of issues increases there is a need to move beyond the simple core tools. A creative tool kit has evolved over time that provides a comprehensive range of tools to support the key rapid innovation steps (see Figure 22.6).

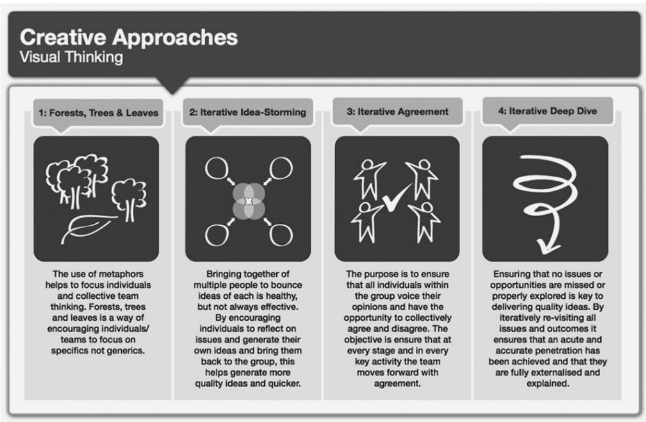

Figure 22.5
Creative approaches

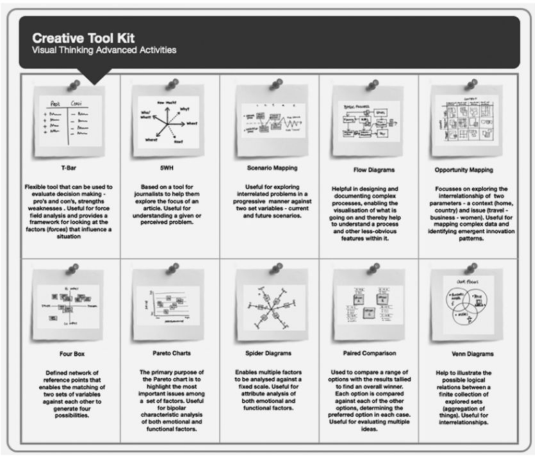

Figure 22.6
Creative tool kit

Rapid innovation process

The VTM is delivered through a 12–15-week rapid innovation process that comprises of five steps building upon the Design Council's 4D model. The process adopts the concepts of discovery, defining, developing and delivering that all embed divergent and convergent activities (see Figure 22.8). Research shows that many development processes are inefficient, some due to an inability to narrow and define the real focus of activities, as problems in organisations tend to be more complex (McGuinness, 1990). Therefore an additional front-end step of establishing has been added to address this weakness.

The establishing step centres on determining the focus of the project before starting the discovery phase, which is in-line with current thinking (Khurana and Rosenthal, 1998; Nilsson et al., 2002). The following information will briefly introduce and discuss the key components of the rapid innovation process, specifically the common framework.

Common framework

The rapid innovation process has been developed around a common framework driven by four core principles (see Figure 22.7):

1) *A step*: the rapid innovation process entails five defined steps, each with a specified course of action aimed at moving a design-driven innovation project towards a defined goal.
2) *An input*: this is the starting point for each step. Its primary objective is to establish a clearly defined starting point supported by necessary objectives and research data/information required for each specific step (see Figure 22.7, item 2). The outputs from step one, two, three and four become the starting points for two, three, four and five – this is what we define as the 'linked innovation model'.
3) *Defined actions*: these are the core activities of each step. They focus on defining and delivering the specific activities needed to move each step towards its defined goal and comprise of four sub-elements:
   - (3.1) Phases: there are three distinct identifiable points within each activity. They act as the heart of each step.
   - (3.2) Tools: are the specific means of systematically carrying out the specified tasks.
   - (3.3) Creative approaches: these are a series of techniques designed to foster creative-team-based behaviour and culture.
   - (3.4) Iterative reflection: is the approach developed to encourage repeated systematic reflection.
4) *Outputs*: are the assessable deliverables from each step that are aimed at achieving agreed objective(s).

Steps

The purpose of the five-step rapid innovation process is to deliver the blended design research approach by adopting a systematic but reflective process. The five-step process has been developed to maximise the capabilities of individuals and teams to rapidly see radical innovation issues and opportunities. It also helps to reduce levels of uncertainty and anxiety when undertaking a radical innovation process by helping them to break down complexities at each step.

The framework and associated steps provide sufficient direction to avoid getting lost or confused but retain enough flexibility and freedom to support disruptive thinking without being

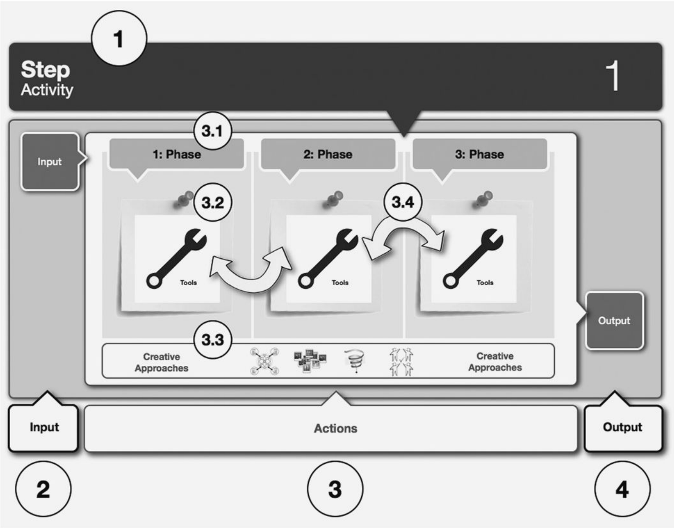

Figure 22.7
Rapid innovation common framework

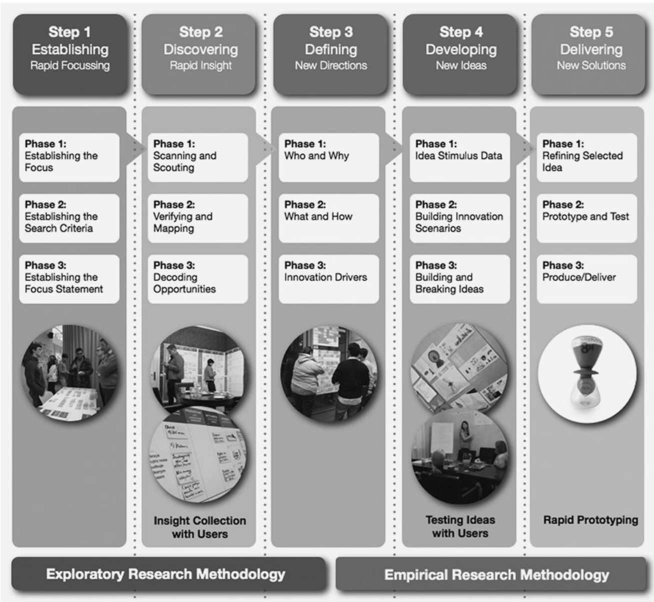

Figure 22.8
Rapid innovation process

prescriptive. The five-step rapid innovation process provides a framework in which to utilise the core principles of disruptive thinking, systematic reflection and decoding.

Innovation proceeds through logical steps, however this does not mean that they occur in a strictly linear manner but rather each step must be effectively addressed before moving on (Markham et al., 2010). Each step has a name which is self-explanatory (see Figure 22.8): Step 1: Establishing the focus; Step 2: Discovering new insight opportunities; Step 3: Defining new directions; Step 4: Developing new ideas; and Step 5: Delivering new solutions. The blending of the design research methodology from exploratory to empirically based activities takes place in Step 3. This is the pivot point from exploratory to empirical.

Case study

Often one of the criticisms of new design thinking processes is their complexity and narrow focus. The following case study has been selected as it demonstrates the flexibility of the VTM and how it can be rapidly adopted within an untrained group. The VTM and its decoding techniques have been developed on academic and commercially funded applied research projects over the last five years. The case study described is a design research workshop run with 20 Post Graduate students from Tsinghua University Design Management Research Lab in China.

The case study illustrates the ability of design researchers to undertake a two-and-a-half-day applied research project that involved undertaking primary research, interviewing users and tackling the process: (one) establishing the focus; (two) discovering new insight opportunities; (three) defining new directions; (four) developing new ideas; and (five) delivery.

The case study demonstrates the benefits of using process frameworks and core analytic and synthesis tools in the delivery of quality outputs. The frameworks helped the groups navigate the study but did not prescribe solutions. The exercise facilitated deep critical enquiry and creative thinking, which was consistently fed-back from the participants.

The workshop focused on a common research question. It was group-based with five people per team. Each team was asked to identify and develop a new street food experience and consider what makes 'good' street food successful and how this can be developed into a quality brand experience. A common emerging theme from the decoding activities was that of 'local', i.e. taste the local experience. The project took place in Beijing, where the population is constituted from many different regions of China. The research established that non-Beijingers like to experience local food that reminds them of home.

The case study brings to life the issues and core principles, tools and methods discussed earlier. It demonstrates the flexibility and ease of adoption of the decoding methods. In particular, it highlights the use of associational thinking (step 2 in Figure 22.9); data collection and opportunity mapping (step 2 in Figure 22.9) and the use of innovation templates to help teams to rapidly dive deep into issues (step 3 in Figure 22.9).

Conclusions

The development journey has fused theory into practice and practice back into theory. It has involved rigorous testing and re-testing over a five-year period through multiple exploratory applied research based projects. This has resulted in the development of a robust methodology, a systematic and reflective set of tools and approaches and a novel rapid innovation process for delivery. It has brought together enthusiastic and like-minded people from academia (in particular, the author's research group[1]) and industry partners from around the world, making it a truly cross-cultural (Europe, South America, India and Asia) and multi-disciplinary process (design, management and engineering).

The strength of the method and part of its credibility is based on the fact that it has been developed and tested on multiple real-life complex scenarios. The author is very grateful for the major support from industry, in particular with Procter and Gamble (P&G), Nokia, Braun and British Sky Broadcasting (BSkyB), who have enabled the VTM to bridge the gap between theory and practice. It has been exciting to demonstrate the impact of re-thinking problems

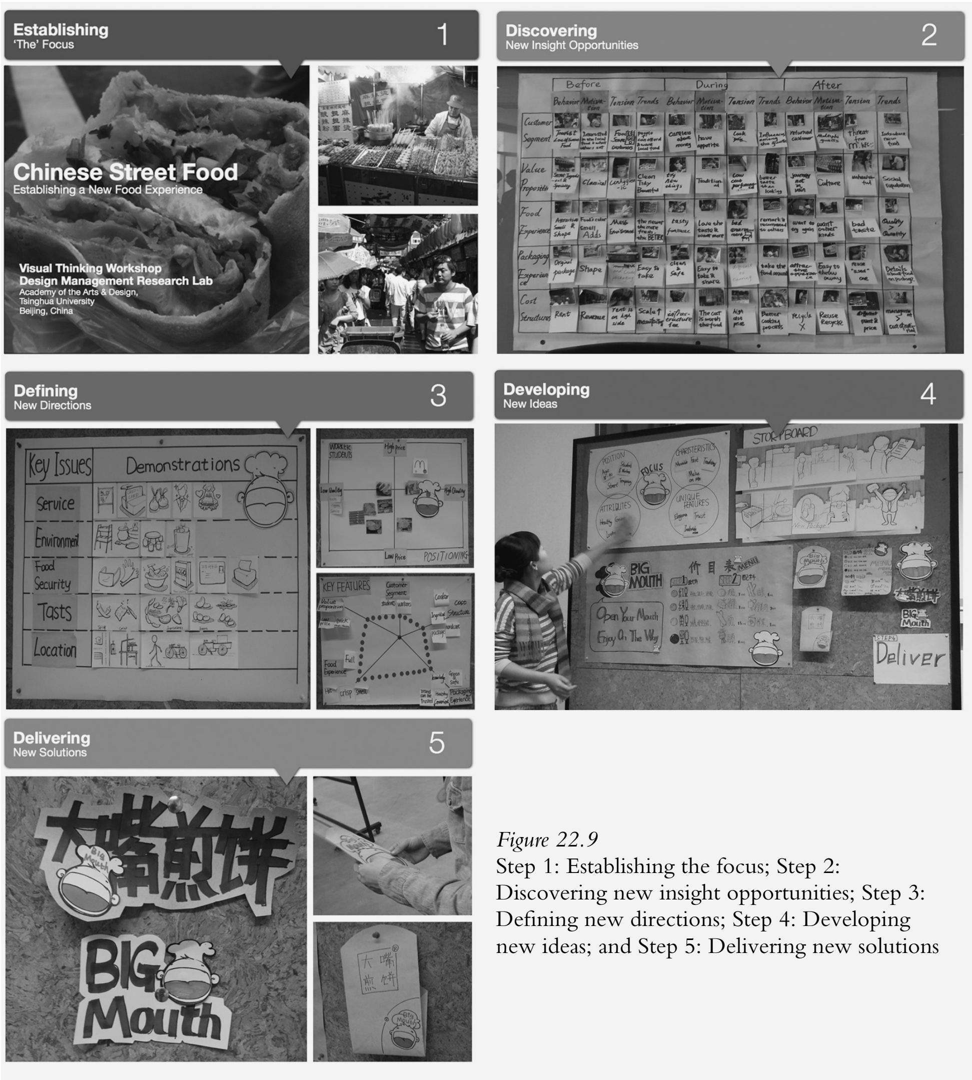

Figure 22.9
Step 1: Establishing the focus; Step 2: Discovering new insight opportunities; Step 3: Defining new directions; Step 4: Developing new ideas; and Step 5: Delivering new solutions

and how introducing new ways to look at sticky issues (von Hippel, 1994) has helped to bring to life new issues, disruptive opportunities and reduce uncertainty.

The important emergent themes relate to the observations that: (a) early career researchers stall at the describing stage when dealing with unfamiliarity, and (b) the creative approaches exert a positive impact in changing mind-sets and in fostering a proactive group culture. These two issues have led to exploration of the notion of 'creative confidence' and its impact on design-driven performance in idea generation scenarios. This is just one new research theme that our research group will continue to explore.

Note

1 Special thanks go to two researchers under my supervision, Camille Chinneck and Marta Perez.

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23

AN INTERPRETATION DESIGN PATTERN LANGUAGE

Margaret Woodward

Introduction

Ideas and information about natural and cultural heritage are communicated through the designed interface of heritage 'interpretation', which in museum and heritage settings refers to the presentation of a place or an object to an audience. This chapter will present interpretation design as an emerging field of design as communication designers work on complex, large-scale interpretation projects that present information about natural and cultural heritage sites and objects. First, interpretation design will be examined as a contemporary form of design practice which demands high levels of collaboration and interdisciplinary knowledge between designers and other professionals. Then a pattern language approach will be presented as a strategy to facilitate the sharing of knowledge and professional expertise by interdisciplinary teams working on interpretation design projects. The chapter concludes with the practice of interpretation design as an example, to discuss suitability of a pattern language approach as a research tool for contemporary designers.

The emergence of interpretation design

Heralding the global upswing in nature-based tourism, the relatively recent appearance of visitor and interpretive centres has become a feature of the cultural landscape of tourism. In Australia, these centres play a key role in managing and protecting fragile environments, in part from tourists themselves. While the activities of tourism potentially pose a threat to Australia's environment, it is widely accepted that tourism and heritage interpretation also contribute to the conservation and sustainability of Australia's biodiversity, natural environment and host communities (Moscardo 1999, Preece et al. 1996, Stewart et al. 1998, Weiler 2002). The fostering of protective attitudes towards Australia's natural heritage pivots on the successful communication of information, both regulatory and educational, to visitors and tourists through the practice of 'interpretation'. Interpretation is essentially a communication strategy originating from a long tradition of storytelling, conversations and talks presented by guides, whose commentary was documented in Ancient Greece as a form of early travel guide known as a perigesis. In the nineteenth century, activities including guided tours, lectures, outdoor sketching, re-enactments and the Grand European tour emerged as manifestations of tourism. Technological advances in photography and printing enabled wide circulation of designed visual artefacts including: postcards, guidebooks, photographs, commodities, arcades, dioramas, mirrors and plate-glass windows (Urry 2002: 148), all of which can be considered as forerunners to interpretation design.

The contemporary practice of interpretation has now evolved to include a range of influences and strategies from many professional fields. Many of its approaches have emerged from education, and it also employs the persuasive tactics of marketing and advertising. Contemporary interpretation uses the visual rhetoric of communication design combined with insights from behavioural psychology – all enacted against a backdrop of tourism, leisure and recreational settings. Interpretation is now an activity that integrates the communication of information, ideas, stories and experiences, primarily through language-based activities, with a visual and experiential dimension. Design professionals, including graphic designers, interior designers and architects, play a central role in interpretation projects to create engaging spaces and memorable experiences at sites of national heritage significance. The contribution of designers to the professional practice of interpretation has resulted in an emerging specialised area of design, which I define as 'interpretation design' (Woodward 2009). Interpretation design creates the visible interface for the delivery of critical messages about education, conservation, safety, history and ecology. Interpretation design forms an emerging yet distinctive field as its focus is on the presentation of objects and places to audiences in a range of heritage and tourism settings. The related design fields of exhibition design, experience design, service design and emotion design share with interpretation design common aims and strategies to engage their publics in a meaningful and user-centred way. There are several distinguishing characteristics that see interpretation design emerging as a specialised field of design. First, the projects of interpretation design are generated by the professional practice of interpretation, giving visible form to what has previously been primarily an oral tradition. Second, the emphasis on place and history, and the concern with communicating about natural and cultural heritage, means interpretation projects are frequently located in situ at a site of natural or cultural significance, rather than located in museums or exhibitions, giving them a particular site specificity. Third, this specialised form of design has evolved in Australia and elsewhere since the 1980s when a heightened heritage awareness and legislation, combined with an increase in tourism, has given rise to large-scale, complex interpretation projects such as visitor centres. Although closely aligned with exhibition and museum design, the emerging field of interpretation design has developed in response to the practical and conceptual challenges of communicating about places and objects that goes beyond display and labeling and has a combined emphasis on education, experience and engagement with a specific place, object or event. These distinctions will be further developed later in the chapter.

Epoch transformations

Dedicated visitor and heritage centres have emerged since the 1980s. In the discipline of design, this same era has been marked by dramatic shifts in design practice. Across many fields of design this period is characterised by an increased participation in the knowledge economy, a greater interest in cross-disciplinary projects and the subsequent emergence of hybrid fields of design. This period has also seen designers contend with increasingly complex problems, demanding a transformation in practice and an orientation towards ongoing conceptually and technically challenging projects. Design is no longer seen as a value-added extra; instead it is seen as an activity linked by networks of multiple stakeholders where the process of design is regarded as involving a larger enterprise – from problem identification, research, solution strategies, project management through to production.

The last three decades have also seen the graphic design profession evolve into an increasingly differentiated practice which designer Neal Haslem describes:

> No longer is graphic design about how to produce visual material for mechanical reproduction. It has become about the whys and the wherefores of the impulse to produce such material and the strategic application of such material along with any other incarnation to achieve desired ends. It is about strategy, meaning, responsibility, and context and it has started to take itself seriously.
>
> *Neal Haslem, personal communication, 14/02/2007*

This more expansive activity brings into question the adequacy of the term graphic design. Designers no longer just design the 'graphic', the final product, the designed artefact; instead they are engaged with an intricate system of activities which has surpassed its print-centred origins. This dramatic shift in practice, I argue, demands a more accurate description to distinguish and describe this multi-layered and differentiated activity. What was formerly known as graphic design is better described in today's context as communication design as print and publishing media no longer dominate and both the message and the media are critical for effective communication. The transition to communication design has been accompanied by fragmentation and specialisation necessitating designers to collaborate, out-source and to form teams of specialists, with solo designers rarely able to master all the skills and knowledge to undertake progressively more complex projects. In the twenty-first century, designers are being described in language familiar from management in which Friedman describes a successful contemporary designer as "a leader who organises teams when one range of talents is not enough" (Friedman 2008: 11). Contemporary designers now operate in a professional arena where traditional discipline and media boundaries are blurred, niche products and markets are important and where the internet transcends the physical limits of print media.

By the beginning of the twenty-first century, design has evolved to become part of the knowledge industry, with designers actively engaged in helping to address large-scale social and complex challenges in unprecedented ways (Conklin et al. 2007). As specialists cluster together into project teams, designers are being exposed to new fields of professional and discipline knowledge as design operates as an inherently "integrative discipline, placed at the intersection of several large fields" (Friedman 2003: 508). Participating in and contributing to the knowledge industry requires designers to look to fields outside of traditional design arenas in order to acquire research skills and knowledge seeing the emergence of cross-disciplinary teams incorporating a wider pool of expertise beyond design.

Interpretation design projects

The transformations that have been broadly observed in the last three decades in design practice have been amplified through interpretation design projects. As boundaries have dissolved and blurred across media, professions and disciplines, in interpretation projects, this has generated designed artefacts that are non-media specific, that utilise both two- and three-dimensional elements, and integrate digital, video, screen-based, audio, mobile and web-based media. The design focus is human-centred and site-specific, with an emphasis on systems of educative and multi-sensory experiences.

Through interpretation design projects, designers are exposed to larger bodies of knowledge that come from outside the usual boundaries of design knowledge. Ballantyne and Uzzell (1999) note that contemporary interpretation practice is now informed by a much broader multi-disciplinary theoretical base with input from research in education, psychology, sociology, cultural studies and tourism. How to harness these fields of knowledge beyond the traditional concerns of design became the starting point for developing the interpretation design pattern language, which I will come to later in the chapter.

In Australia, interpretation design projects are located in some of the most controversial and ecologically fragile land in post-European contact history, and designers are instrumental in shaping public attitudes and debate about issues such as contested land use, indigenous culture, environmental issues and European settler history. Designers taking on such projects demonstrate a willingness to engage thoughtfully and more deeply with issues, debate and 'interpretation' in its fullest sense. For designers, presenting controversial issues means being sensitive to the tensions that arise from conflicted views, and also balancing the needs of both the client and audience. This is a complex process, which for some resonates with their ideological and professional commitment to communicate responsibly and ethically about difficult issues. When interviewed, designers signaled their ideological stance to the issues and content of interpretation projects as an important dimension of their work, conveyed in the following responses:

> I think it's a great privilege to work on these jobs: the work has lasting worth (we hope), and in that sense is less ephemeral than much of the work that graphic designers do (Designer 4).

> I consider it a privilege to work in this area and a chance to make a difference. As well as the work I do for the Parks and Wildlife Service, I have undertaken projects for Forestry Tasmania for exactly these reasons, because the more people know about what they do, the more informed debate there can be (Designer 6).

Interpretation design takes a holistic approach to designing the visitor's total experience, through a human-centred, multi-sensory approach. Interpretation design extends the visitor experience beyond the confines of a gallery or museum and the design of displays and exhibits, and is linked to more expansive systems of knowledge, experience and concerns about natural and cultural heritage. Distinctive features of interpretation design include collaborative problem solving, diverse media platforms, a focus on human-centred approaches and a combination of information design and interpretive strategies. For example, the visitor centre at Lake St Clair, interpreting the Tasmanian Wilderness World Heritage area, engaged a team of designers, indigenous artists, National Parks personnel, architects, historians, scientists and geologists to interpret and render visible the centre's themes of geology and glaciation, flora and fauna, Aboriginal and European history, recreation, and issues of management and control in a fragile world heritage area. In creating the communication interface, diverse media – including touch screens, holograms, historical and natural objects, illustrations, information panels, stereoscopic images, sculptural elements and an Aboriginal weaving project – were used to communicate complex themes in a contested heritage site.[1]

Interpretation design projects are typically led by designers but are given direction by other stakeholders including the commissioning agent, interpreters, architects and site managers. Designers are usually engaged on interpretation projects either as individual contractors or as part of a collaborative team, responding to an interpretation brief through a tendering process. Prior to the involvement of a designer or team is the development of a brief for a particular interpretation programme and the preparation of an interpretation plan. All aspects of the interpretation project are guided by the interpretation policy of the client organisation, which provides a general philosophical framework for action in managing heritage assets. Interpreters or interpretation consultants are engaged to write interpretation plans, and it is the role of the designer to translate the plans of an interpreter into a tangible physical reality. Depending on the scale of their business, some specialist interpretation designers will have in-house researchers, designers and writers. Others will align themselves with specialist contractors and consultants in response to a particular project, and form a team to respond to a particular brief or tender document. Designers may also be contracted individually by a particular agency such as a national parks authority and will work in collaboration with a team selected by that agency.

Challenges of interpretation design

Despite their appeal, these projects also pose real challenges for designers, which stem from the need to work with a range of different professions and discipline backgrounds and the scale and complexity of projects. The initial impetus for this research came from discussions at a forum of interpretation designers, that I chaired, which indicated a fundamental problem with the emerging field, that of knowledge management, collaboration and communication. Panel members identified the need for better dialogue between designers and interpretation professionals who in this forum included: rangers, interpreters, historians, writers, zookeepers, education officers, curators, interpretation consultants and public servants. Designers frequently found themselves taking on the double role of project managers and designers on interpretation projects. They lamented the fact that as a relatively new field of design there were no established precedents providing guidelines for interpretation design and that the insights and experience gained from previous projects was not captured or built upon, and that with each new project designers felt they were starting from scratch and that problems and successes were not communicated well from previous interpretation projects.

These comments raised further questions about the nature of collaborative practice in contemporary design and whether the experience of the panel members was a reflection of a larger shift in design generally, or whether they were in fact leading and giving shape to an emerging cross-disciplinary collaborative form of contemporary design. Further interviews with interpretation designers revealed that the importance of good collaboration in interpretation projects was critical with the positive aspects of working collaboratively described as stimulating, creative and 'achieving an integrated dynamic'. The comments of the following designers sum up the strengths of working collaboratively and highlight the increasingly blurred boundaries between disciplines:

> Coming up with the initial concepts, as a member of a team has been a great experience of my professional life; I guess if you have the right people together it is a very creative milieu. With the people I was involved with, we didn't stick rigidly to our areas of expertise, and felt able to contribute ideas across the board. It worked very well (Designer 3).

Responses also acknowledged the difficulties of collaboration, including working with inexperienced team members, working with people with little business or commission experience, lack of co-ordination between team members, dominating egos and personality problems. For example:

> But after the initial ideas are set up, it can be problematic. After the concepts and writing, the writer often loses interest (and hasn't budgeted sufficient time to stay

> involved). The person doing the construction/production gets sick of waiting for the material to move through the approvals process, and loses interest (Designer 3).
>
> Sometimes you find yourself teamed up with a loose cannon, and that is really scary. Ideas have to be able to be realised in practical terms or there's no sense spending time working them through. You do build up experience in what will work, but I often find myself working with clients and team members with very little experience (Designer 3).

In general discourse, collaboration is linked with innovation and creative industries and is seen as essential in forming strategic partnerships between education, government and the private sector (Cox Review 2005: 12). Design literature flags collaboration as critical to new modes of future-focused design practice (Conklin et al. 2007, Thackera 2006, 2007, Brickwood et al. 2007) and the connection between collaboration and innovation is also stressed, as Rothstein and Wolf argue that: "Designers have also abandoned the 'lone genius' approach and embraced teams as a way to super-charge innovation. Product development – cross functional teamwork, in other words, collaboration, is critical to engage the 'innovation opportunity'" (2005: 64).

The designers who were interviewed all indicated that successful collaboration could not be assumed to be unproblematic. Knowledge management and transfer were also highlighted as fundamental to achieving positive collaboration, and the need to develop a way to synthesise and communicate practice-based knowledge developed from project to project. Evidence from the literature and from interviewing interpretation designers indicated that what was missing was an integrative process to bring together the large intersecting fields of knowledge that informed both interpretation and design. Moscardo observed that a framework which integrates interpretation and design and theory had not yet been developed and clearly absent was an integrative theoretical framework to guide both future visitor studies and the design of interpretation (1996: 380). It was this observation that led me to consider a pattern language approach to provide the foundation for such a framework, which would facilitate the flow and continuity of knowledge and experience between designers, projects, professions and disciplines.

A pattern language approach

A 'pattern language' approach was chosen for its capacity as a conceptual tool to draw on a wider base of knowledge beyond design and for its potential to enhance team-based collaborations. The approach is inspired by the work of architect and mathematician Christopher Alexander whose pattern language was initially developed in the 1970s as a critique of modernist architecture. Alexander's seminal work *A pattern language* (Alexander et al. 1977) proposed the pattern language as a conceptual and practical strategy to be used in architecture, building and urban design. A significant motivation in Alexander's philosophy, expressed throughout his work, is to capture what Alexander refers to as a 'quality without a name', which was present in buildings that fulfilled the needs of their occupants but was difficult to define, formalise or prescribe. The aim was to encapsulate certain commonly occurring problems observed cross-culturally in the planning and building of houses, communities and regions. In response, 'patterns' were developed as approaches to fulfil the real needs of people who lived and worked in buildings.

Pattern language – background

The design methods movement of the 1960s influenced the development of the pattern language (Jessop 2004). Of particular interest to Alexander was Fritz Zwicky, a Swiss-American astrophysicist and aerospace scientist based at the Californian Institute of Technology, and his work on morphological analysis of objects (Zwicky 1967). Morphology, the study of form or pattern, is used in disciplines where the analysis of formal structure is important, such as geology, anatomy or biology. Zwicky developed a structuralist method called 'morphological analysis' for identifying and investigating the total set of possible relationships or 'configurations' contained in a given problem complex (Ritchie 2003). The Zwicky Box, a conceptual tool often used by designers to generate random property combinations in the early stages of concept development, is a legacy of his work. Zwicky was not only interested in the material characteristics of objects (e.g. shape, geometry, texture, size and colour), but also the more abstract structural interrelations among phenomena, concepts and ideas (Zwicky 1969: 34). This approach influenced Alexander in developing a pattern language; his own form of morphological analysis (Jessop 2004: 458). The focus for Alexander was architecture, urban and regional planning; where he sought to present existing examples of best practice solutions to design problems from which he identified and described commonly occurring 'patterns'. Each pattern consists of a simple description of an observed recurring problem, and a suggestion for its solution. Salingaros (2000) describes the pattern language as an approach which has a phenomenological foundation built from observation. For Alexander, being a mathematician, the way the patterns linked together in systems and being able to model and represent those systems was important. One of his main criticisms of modern urban planning was that it exhibited a hierarchical tree-like structure, whereas instead, he conceived of cities as being more complex systems full of overlaps and ambiguities more like a semi lattice or network than a tree (Mehaffy 2007).

Alexander's seminal paper 'A city is not a tree', written in 1965, details what he sees as the failure of that era's planning (Alexander 1965), and by rejecting hierarchical tree-like structures, Alexander searched for a design method to provide an alternative construct. Instead he conceived of a system that saw patterns linking and overlapping with other patterns, thus forming a web of patterns or what Alexander calls 'a language'. Alexander and his colleagues Sara Ishikawa, Murray Silverstein, Max Jacobson, Ingrid Fiksdahl-King and Shlomo Angel published *A pattern language* in 1977. The book contains 253 patterns presented as solutions to commonly occurring problems, to assist architects and non-architects to design elements of the built environment, from single architectural components of dwellings at one end of the spectrum up to complex regional urban design systems at the other. Alexander described the patterns as interconnected entities; each pattern understood only in relation to other patterns in the language:

> In short, no pattern is an isolated entity. Each pattern can exist in the world, only to the extent that it is supported by other patterns; the larger patterns in which it is embedded, the patterns of the same size that surround it, and the smaller patterns which are embedded in it.
>
> *Alexander et al. 1977: xiii*

Alexander and his co-authors generated the pattern language by capturing patterns that they regarded as archetypal, occurring widely across cultures and time. The patterns (which used together form a 'language') are presented, each consisting of a problem statement followed by a discussion of the problem supported by an illustration. The book, much more than a 'how to' manual for building, expresses Alexander's philosophical position against modern soulless architecture, and has become a manifesto used by architects and non-architects alike, such as home builders, furniture designers and landscape architects. Alexander's patterns rather than being fixed, prescriptive solutions were generalisations that could be adapted and extended for locally appropriate settings. Despite criticism of Alexander's work, particularly from within the field of architecture (Protzen 1980, Dovey 1990, Saunders 2002), the pattern language approach has been widely adopted by many other disciplines including the field of human computer interface design, industrial design, education, organisational management (Salingaros 2004) and architecture (Kaplan et al. 1998).

Interpretation design pattern language

As a practical tool that can be applied to many contexts, the pattern language approach is particularly well suited to interdisciplinary projects where a diverse range of professionals need to share concepts, constructs and ideas while working towards common project goals. Erickson argues that Alexander's methodology is well suited for any project where multi-disciplinary teams need a *lingua franca*, or shared language, to be able to communicate with each other (Erickson 2000).

The interpretation pattern language was developed using two sources of information, first from responses gathered from interviewing designers and second from a synthesis of research findings in related disciplines. Eight Australian interpretation designers were interviewed representing a broad cross-section of projects including those projects for national parks, local councils, interpretive trails, zoos, forestry, private forest industry, sporting organisations, conservation organisations, indigenous heritage and historic sites. The designers represented have worked on interpretation projects in Australia spanning from 1991 to the present. Many of their projects include major visitor centres for heritage management clients including national parks. Survey responses were collected, grouped and coded with several patterns emerging that related to common issues and themes for interpretation designers. The responses were grouped around these issues:

- complexity and the interdisciplinary nature of interpretation projects,
- experience of collaboration,
- challenging aspects of interpretation projects,
- skills needed for interpretation projects,
- design management and project management,
- ideological commitment.

The majority of designers agreed that interpretation projects differed significantly from more traditional graphic design projects, and they identified interpretation projects as being more complex technically, spatially and from a project management perspective. Designers' comments also revealed the interdisciplinary nature of interpretation projects, and the potential for this aspect to enlarge and extend the designers' repertoire. One designer responded:

> Also in some cases there is the creative melding of other professions; architects, interior designers, writers and artists into the process that can stimulate and offer another way of viewing which takes it beyond the normal scope of work this designer does in the every day (Designer 1).

Contribution of literature to the pattern language

A second strategy leading to the development of the pattern language came from conducting a literature review which yielded a large body of under-utilised, yet relevant, professional and academic knowledge in interpretation. Research findings from the fields of education, psychology, tourism studies, museum studies and visitor studies as well as literature about the professional practice of interpretation were examined to establish common problems and patterns in interpretation settings. Findings were synthesised and existing literature reviewed by Bitgood and Patterson (1988) and a framework developed by Moscardo (1999) was extended. Despite this body of research coming from diverse discipline perspectives it was evident that clear groupings of findings and patterns were emerging. The patterns form a cluster particularly suited for interpretation design problems, but the same patterns may also be relevant or apply to other communication design problems and other design disciplines. The first group of patterns (1–7) are human-centred and are led by the research findings from the discipline's visitor studies, museum studies, psychology and education and can be summarised as:

1. **Control** – Visitors need to be given control over their experience.
2. **Comfort** – Visitors need to feel safe in an environmentally comfortable setting.
3. **Personal connection** – Communication needs to connect with visitor's personal experience.
4. **Challenge/curiosity** – Communication should challenge, intrigue and encourage questions from visitors.
5. **Participation/interaction** – Interactive and participatory experiences and exhibits lead to high levels of visitor attention and recall.
6. **Variety/multi-sensory** – Communication using multi-sensory attributes has more impact.
7. **Flow** – Interpretive settings can be personally enriching, rewarding and restorative enabling people to have 'flow' experiences.

A second set of patterns (8–10) assist designers and teams to find a common language and sense of place for the local project site. These patterns relate to place-based interpretation:

8. **Reading place**
9. **Lexicon for place**
10. **Visual metaphors**

This group use designer-led approaches to the site itself and are to be used to enable team members to respond to place and establish a communicative vocabulary of both text and image. These patterns assist in generating a visual language for the project, a common language between interpreters and designers using a human-centred approach. Primarily, the patterns focus on the visible dimensions that visual communicators or communication designers work with; however, as designers are engaged in designing holistic experiences, the patterns may also include non-visual aspects such as sound, taste, touch and smell. The interpretation design pattern language was developed in three stages:

1. Summary of findings
2. Problem identification
3. Design responses to the problem

First, findings from the literature review and designers' responses were summarised to identify ten patterns. The first stage of the pattern is to identify and name the problem. Next, the pattern is phrased as a problem, for example in Pattern 1, *Control*, when phrased as a problem becomes *Lack of control*. When visitors encounter a lack of control in visitor and tourist settings, researchers have documented negative experiences including a passive distancing from the meaning of exhibits (Tyler 1995), insecurity (Kaplan et al. 1998), incompetence (Olds 1990), mindlessness (Moscardo 1996), anxiety (Pearce 1988, Pearce and Black 1984), fatigue (Gilman 1916, Robinson 1928) and a general sense of being overwhelmed by the amount of information to process. Following Alexander's system, this can now be named as the problem statement as follows:

People can feel overwhelmed by and distanced from information in museum and interpretive settings.

Within the interpretation design pattern language framework, design strategies that deal with the problem are suggested and an example from an existing interpretation design project provided as an example. Following Alexander's model, these are not fail safe, prescriptive solutions, but can be read as generalised strategies that can be customised for specific local projects and settings. The scope of this chapter only allows for the description of one set of patterns that together form a language. In keeping with Alexander's description it would be laid out in the following format, in Figure 23.1. In the spirit of Alexander's original pattern language set, these patterns have been written for use by all participants in the design process – for designers, interpreters, other team members, collaborators and stakeholders, not necessarily at an 'expert' design level, but devised in such a way that makes the language open and accessible (Woodward 2009).

PATTERN 1: CONTROL

Problem: People can feel overwhelmed by information in museum and interpretive settings

Design strategies

- Create interpretation environments that reveal structured information in a staggered way, and allow audiences to control the flow and pace of information.
- Use *visual hierarchy* strategies to deliver information in a structured and gradual way.
- Use *layering* to reveal information in a staggered way.

Therefore

Using the design strategies of *visual hierarchy* and *layering* enables audiences to feel more in control, as they are able to direct their own experience in interpretation settings. When audiences can engage with heritage spaces through interactivity, rather than simply having institutional values and information reinforced, they can actively participate with, and in some cases contribute to, exhibits and experience. When the flow and pace of information has been designed using structured visual hierarchies, information is more accessible and less overwhelming.

Visual hierarchies

The use of visual hierarchy as a strategy to deliver information in a gradual manner is a principle utilised in many design systems found within interpretation design. Using systems of hierarchies to regulate the pace of information helps to reduce the effect of overwhelming visitors with information. Designers develop systems of visual hierarchies to prioritise certain information, and to give order to the remaining detail. For example, hierarchies regulate the layout of type and image on a page, the composition of a sign or poster, the navigational space on a website or computer interactive as well as the physical layout of an architectural space.

Layering

Layering, revealing and staggering are further ways to create visual hierarchies, whereby the physical structure of the communication is revealed in a gradual manner. The visitor may be required to interact with a three-dimensional structure to reveal all the segments of a story or layers of meaning; or information may be made available through audio visual information delivered at different points.

EXAMPLE: MARIA ISLAND COFFEE PALACE MUSEUM

The Coffee Palace visitor centre on Maria Island National Park, Tasmania, allows visitors to interact with the heritage building, inviting them to occupy and use what was old 'coffee palace' accommodation. In the dining room visitors can sit at dinner tables whose settings correspond to particular years of the building's history. Sitting at the table triggers an audio presentation relating information from the appropriate historical period. Visitors are also encouraged to play the piano, take reading material from bookcases or inspect collections of objects nestled in sliding drawers in the drawing room. Hierarchies and structured visual systems are used to layer messages and information, held within drawers, in books and via the audio environment. The tempo of the communicative atmosphere is quiet and relaxing, where visitors can sample from a diverse menu of offerings, selecting media they feel most comfortable with.

Figure 23.1
Layout of Pattern 1: Control

Interactive dinner table setting with audio

Maria Island Coffee Palace Museum, Maria Island National Park, Tasmania

Source: Margaret Woodward

Suitability of a pattern language

There are several significant aspects of Alexander's work that make it relevant to design research and as a useful tool for design practice. These include his sensitivity to place-based projects, the pattern language methodology as providing a *lingua franca* for interpretation teams and stakeholders, and as a conceptual tool which can be adapted to suit locally appropriate solutions.

Alexander's pattern is highly suited to a profession like interpretation that relies on language to express ideas, feelings and qualitative attributes of places, people and objects. The 'quality without a name' that Alexander speaks about resonates with the language of interpretation that describes it as interpretation as 'mysterious', 'unfathomable' and 'just out of reach' (Beck and Cable, 2002: 7). It also echoes the intangible qualities of place that interpreters seek to tap into and communicate about. This propositional tool aims to orient interpretation designers towards confronting the indeterminacy that characterises design. Yee and Bremner argue that:

> Indeterminacy (not-knowing) is important as both the beginning and the end point because of the nature of design, which is to project possible future scenarios based on past and present conditions. It requires a platform or model from which to operate within an area of indeterminacy but also a structure that will ensure an end result.
>
> *Yee and Bremner 2011*

The pattern language approach balances the provision for both indeterminacy and a structured framework.

The interpretation design pattern language is integrative and synthesising bringing together knowledge from a range of disciplines. Practically, the tool aims to develop a shared language which has a relational and multi-path approach to the type of problems encountered in interpretation design. Elsewhere I propose that a pattern language approach is suited to a post-modernised form of practice such as interpretation design, which requires a relational, recombinant approach and is complex and multi-voiced rather than universal and linear (Woodward 2009). The interpretation design pattern language is designer-led, initiated by a desire for better collaboration between designers and other professions. As interpretation design is already highly collaborative, outward looking and cross-disciplinary, it is important to have frameworks that support and encourage effective communication, the capacity for teams to envision projects together, seek partnerships and share knowledge with other professions. Finally, a pattern language approach has an emphasis on language; a tool for communicating; a chance to explicate what is meant and understood by particular terms often taken for granted by the 'home' discipline. A pattern language approach involves deconstructing that which has become naturalised inside particular disciplines and making it accessible and visible. Articulating shared concepts from the fields of interpretation and design as a common pattern language aims to strengthen the professional practice nexus between the fields of design and interpretation.

The patterns and strategies here are not new or ground breaking, as they draw from well-established practice and expertise. What is new is the synthesis of design and interpretation wisdom into a practical form. The patterns developed from this research are a starting point, with more patterns to be added over time with use on particular projects. It is motivated by exploring the territory beyond and between the different professions, less interested in differencing and more interested in what Conklin calls the nuanced middle ground, while still being respectful of other disciplines (Conklin et al. 2007). The pattern language aims to place the culture of expertise in the team and in the professional community. In harnessing a richer resource of collective experience, knowledge and professional wisdom from other disciplines than either of the fields of design and interpretation individually have available, interpretation design will continue to strengthen as a field, be agile and adaptive to change, future focused and continue to evolve as a significant contributor to dialogue and communication about natural and cultural heritage.

Note

1 The interpretation design for the Leeawaleena Lake St Clair visitor centre was designed by ECP Design Associates and commissioned by the Tasmanian Parks and Wildlife Service.

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24

ACTION RESEARCH APPROACH IN DESIGN RESEARCH

Beatrice Villari

Design research: a brief introduction

Design is a complex practice that requires different skills and the ability to dialogue with other disciplines. It focuses on skill-based competencies and on learning processes based on practice. More in general, the design goals are centred on solving problems, understanding needs, enhancing situations, creating something new or useful (Friedman, 2003) to change existing situations into preferred ones (Simon, 1982). Design research is an interdisciplinary process focused on theory, practice, design epistemology, design praxeology, design phenomenology and humanities-based design studies (Almquist and Lupton, 2009). Moreover, the design research objects can be focused on ontological and epistemological questions, contextual and procedural enquiries that need to be organised, examined in depth and communicable (Cross, 1995). The research process is about knowing the context of study, the capacity to transform research questions in design problems, the understanding of necessary data to be collected and the tools to be used to reach the information, and consequently the connections between data, the capacity to interpret them and prefigure concepts (Friedman, 1997). Swann (2002) affirms that design is a form of qualitative research suited to human beings aimed at interpreting human actions. Furthermore, connecting research and practice is one of the main issues in design and the transition from the reflective dimension to design practice is not always a linear process: the idea of reflection is associated with the cognitive process involving both problem finding and problem solving and the transition from abstracting to realising often corresponds to a crisis (a 'wicked problem' – Buchanan, 1996).

Dickson (2002) describes design research as a process in which design researchers and others from different disciplines enquire in the design field, as in 'Research in Design' when the focuses are design methodologies and processes and the activities are carried out by designers, and in 'Research through Design' when the research is used to enquire other disciplines other than design. These categories revoke the famous distinction of research *into*, *for* and *through* design made by Frayling (1993/4) who associated action research to the third category.

One research strategy that merges theory and practice is Action Research, an inquiry model that, as the name suggests, links the reflective dimension to practice. Therefore, Action Research is also used in the design discipline, as well as representing a systematic enquiry aimed at acquiring, converting and experimenting with new information, ideas and processes through concrete actions (Archer, 1995).

The following paragraphs lay out the main features of Action Research related to design or design research. The link between these two areas is based on the following premises:

- The design process is a *situated* process, namely it depends on the circumstances in which it is developed.
- The design process is by nature participatory and, therefore, always implies a social dimension, more and more entailing the blurring of the boundaries between designers, users and other professionals.
- The design process is iterative and the problems are revisited, analysed and synthesised through different and revised solutions.
- The design process could be considered a clinical activity (Buchanan, 1996; Archer, 1995) often requiring simulations and field tests to solve specific problems in specific settings.

The nature of Action Research

The term Action Research refers to empirical research methods mainly used in social studies. Action Research is based on the connection between theoretical and practical activities and on the close relationship between researchers and the '*other communities*' involved in the research process.

In the mid-forties, Kurt Lewin and his colleagues of the Centre for Group Dynamics theorised a new research method aimed at introducing real changes into social contexts and coined the expression Action Research as a way to suggest practical solutions in response to social issues blurring the boundaries between pure research and applied research. In particular, Lewin described the process as a spiral of steps composed of planning, action and evaluation (Kemmis and McTaggert, 1990).

Reason and Bradbury (2001) describe Action Research as a *family of research approaches* characterised by common elements: the participatory nature, the focus on experiential dimensions and the emphasis on action, on dialogue among participants, on practice and on learning processes. These features are also related to the theoretical approach known as Action Science, which refers to organisational change studies (Argyris et al., 1985; Friedman, 2001) defined as a form of social practices focused on the use of knowledge and learning process among individuals and specific contexts (Friedman, 2001).

Argyris, Friedman and Reason (Argyris et al. 1985; Friedman, 2001; Reason, 2006) consider the stakeholders involved in the Action Research process as members of specific *communities of inquiry* – connected to the idea of *community of practice* – whose main purpose is the production of new knowledge in relation to specific disciplinary matters, professional practice and the specific context where Action Research takes place and develops. This idea opens another important theoretical strand connected to learning processes based on sharing practices pinpointing the participatory and democratic features and the role of individuals and their communities (Reason and Bradbury cited in Reason, 2006). Therefore, the relationship between researchers and the other actors involved is central to determining participation procedures in the whole process that also means giving attention to the collective, collaborative and self-reflective actions representing a critical part of the process.

The participatory dimension involves at least two concepts. The first concerns managing the decision processes. Martin (2001) depicts Action Research as a tool for improving and promoting the active involvement of communities in social changes in which the communities themselves play an active role throughout the research process. The second issue is related to knowledge exchange within so-called *communities of inquiry*. Archer (1995) underlines the importance of producing communicable knowledge through practical actions reinforcing the central role of learning among participants.

In this process the researcher plays an important role. The investigator has to clarify the objective of the intervention also explicating his/her theoretical, ethical and theoretical position. In more general terms, the researcher's role is twofold. On the one hand, he/she contributes to increasing disciplinary knowledge within his/her own scientific and professional community. On the other hand, he/she plays a specific role (enabling, monitoring, mediating, coordinating, planning, etc.) within the target communities. The participatory and relational attitudes and the negotiating skills are pinpointed by Reason (2006) who describes Action Research as a negotiation of power in knowledge creation involving people who enhance their capacity to engage in enquires. Grundy (1988) describes three modes of Action Research: technical, practical and emancipatory. The first one underlines how the nature of the collaboration between the researcher and the practitioner is technical and based on facilitation with the main aim to test an intervention based on a pre-specified theoretical framework. Moreover, the researcher has an external role acting like an expert whose aim is to support stakeholders' interests in the research; in the second one, the researcher and the other participants work more closely to identify problems and manage the interventions, whereby the communication flows need to be supported among all participants; the third one encourages emancipatory processes for all the participants and consequently the role of the researcher is to enable professionals and members in identifying their needs and supporting them in managing the change process through more collaborative processes.

As introduced by Lewin, Action Research is accomplished in a process where hypotheses, experimentation and test phases are cyclical. Observation, interpretation and action (Stringer, 1999) are reiterated over time to build a knowledge structure incrementally. In general terms, the Action Research process incorporates different activities related to the research planning and the goal's definition, the description of the theoretical framework including the tools to be considered, the planning of the activities *on the field* and the learning process, the organisation of data analysis and its explanation, and the evaluation and monitoring of the whole process and its results. These have to be visible and self-evaluated through the activities documentation and monitoring.

Action Research can be considered a continuous learning process (see Figure 24.1) where investigation, data analysis, the implementation phase and evaluation activities are repeated over time (Dick, 1997). Another similar way to describe the process is proposed by Zuber-Skerrit in their CRASP (Critical, Reflective, Accountable, Self-evaluating, Participative) model: "Critical collaborative enquiry by Reflective practitioners being Accountable and making the results of their enquiry public, Self-evaluating their practice and engaged in Participative problem-solving and continuing professional development" (Zuber-Skerritt, 1992: 15).

The experimental nature of Action Research affects research outcome. In some circumstances, outcome may not be generalised or applied to other situations. However, it does not invalidate the data collected and the process; they can be considered useful for facilitating further experiments by other researchers involved in similar activities (Cohen and Manion, 1984).

Action Research and design

Starting from the features outlined above, an Action Research model will be set out and contextualised in design practice. Design knowledge, like other forms of knowing related to a practice, is essentially tacit. Therefore, to become a socialised, shared resource, it requires clarification and codification (Nonaka and Takeuchi, 1995).

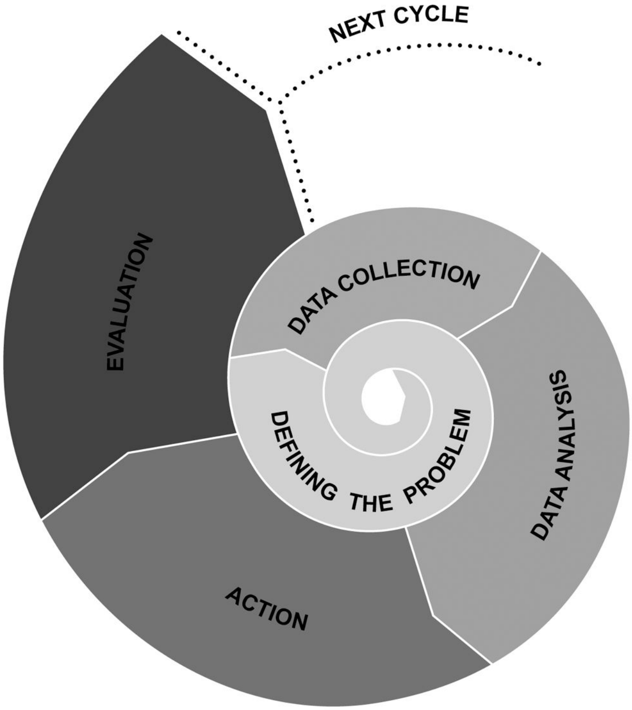

Figure 24.1
Action Research process
Source: Adapted from Kolb, 1984

In this paragraph, an Action Research process of design intervention is described and visualised using a matrix where the learning and acting polarities are placed along the horizontal axis, and on the vertical axis abstracting and concretising are the two poles. This matrix visualises the Action Research process and sets up a frame composed of four quadrants, each focusing on one phase or objective.

The process is detailed through phases and tools that designers could use to experiment design research in specific contexts, faced with specific topics, such as social innovation issues, services for urban contexts, new services and processes for public sector, user participation in complex systems, citizens' involvement in designing and developing new products and services for organisations, or on a wider scale, to have an active role in politics, just to list a few examples.

The presented process is described in four stages of an iterative process aimed at analysing contexts and data, interpreting information, creating a design vision and experimenting it on the field, and also evaluating the overall research process and its on-going results.

The Action Research approach is a context-dependent activity, therefore the activities need to be developed in a real context: the process starts from the recognition of the existing resources characterising the design context. This means that researchers have to recognise and analyse first the material resources (i.e. environments, infrastructure, natural resources, products and so on) and immaterial resources (i.e. relationships among people, knowledge and know-how, cultural resources, etc.) and then start and plan the activities in relation to what are the peculiarities of the selected context. To better analyse these resources, action researchers have to include field activities in order to reach a deep knowledge about people, places, enterprises and organisations and recognise their links. Moreover, Action Research processes are based on collaborative and bottom-up practices, and often results are connected to the variety of resources and competences involved. This is related to the idea of empowerment that Action Research supports. People (e.g. non-designers, citizens, practitioners, policy makers, opinion leaders) need to be able to participate and have an active role throughout the process and collaborate with researchers/ designers in order to promote innovations coherent to the context analysed. The other face of the coin is that adopting participatory research processes often require a greater use of resources in terms of people and time, therefore organisation and coordination tasks are instrumental to achieve the final objectives.

After developing the research questions and performing desk and field research, the designer/researcher faces the interpretative phase aimed at creating some *scenarios*, namely possible design solutions that mean defining a strategy to transform the research outputs in design concepts. These phases are followed by the ones more connected to the design practice. The designer/researcher has to propose design concepts (about products, services, strategies, new connections between actors, design tools, design approaches – depending on the main aims of the Action Research) able to exploit and enhance the context of action.

More in general, the connection between Action Research and design is proposed through a process characterised by:

- four phases (main aims) include sequential, interdependent activities connecting research and practice;
- the involvement of a system of stakeholders, activities and tools related to specific tasks;
- cyclical and iterative actions, so that reviewed activities are carried out continuously throughout the process; and
- negotiation and decision-making processes and also self-evaluation.

Specifically, the four main stages are described in: analysing, interpreting, designing and implementing (see Figure 24.2).

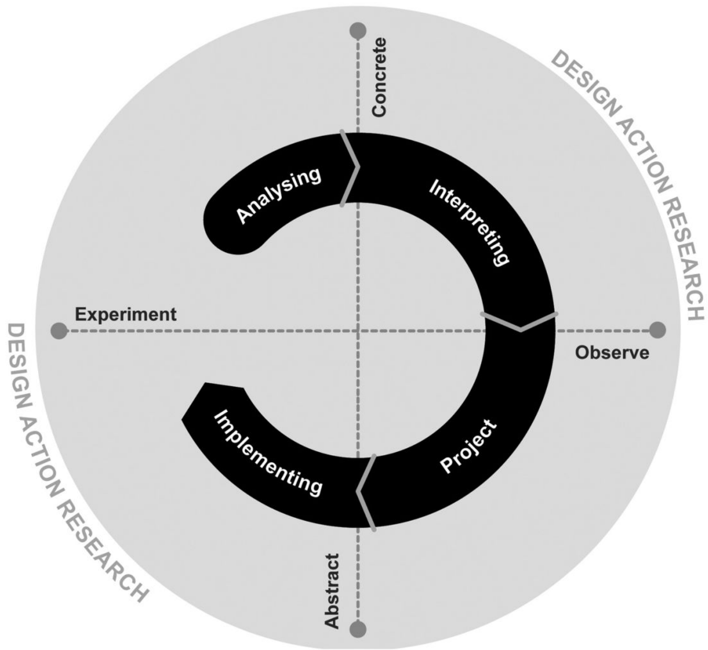

Figure 24.2
Design in Action Research process

Source: Adapted from Villari, 2012

Following this structure, the aims, the tasks and the tools characterising the research and the design actions are briefly described in the following parts.

Analysing and interpreting phases (research and understand)

As in any problem-solving process, in design activities, at the beginning of the process, the analysis is a fundamental part of thinking about the solution or creating it. The Action Research purpose is to bring positive change in specific contexts; consequently researcher and professionals have to exchange their knowledge through field observations, listening, interviewing and collecting data.

The main activities in this phase concern setting the context and identifying research problems, describing those involved in the process (researchers, stakeholders, practitioners, users) and identifying all resources needed for developing the research (skills, time, people). As underlined by Dorst (2006), the 'design problem' is hard to identify because it evolves in the design process, so in the initial phases it is necessary to focus and structure the overall aims of the research and share them among all participants involved. For example, if researchers are involved in a social innovation process to promote local businesses, the research might focus on understanding the characteristics of the local production, the peculiarities of entrepreneurs and the strategies of public and private actors that support local economies and on understanding the social/environmental and economical issues having a specific impact on the local resources. Important activities at an early stage are also the creation of the network of actors and the community-building process. This is related to the importance of *social empowerment*: organisations and people that are able to *feed* contexts where bureaucracy, lack of resources and difficulties in promoting innovation play important roles in creating links between small and large entities, public and private actors, reinforcing the connections between people, places, companies and institutions (MacCallum et al., 2009).

This entails the definition of sharing goals, the common interests and the explanation of the different roles involved in the project. During this phase, participants' various roles are outlined, while participation models, the scope of inquiry and common goals are defined in detail. Building the community means that researchers/designers have to describe and understand the different stakeholders' skills and profiles and set the research framework and *languages* adopted, for example designers, sociologists, managers, policy makers and citizens need to define a common ground to facilitate the dialogue between them.

That is also why communication and tools to support information and knowledge-sharing contribute to building a recognisable and communicable identity of the wider *design community* (Villari, 2012) involved in the Action Research process. Design tools for communicating, sharing, socialising and participating (i.e mind maps, storytelling, actors' maps, gaming) in the *community-building* process are also, from a disciplinary point of view, specific design objects. Researchers' actions are situation-based and context-specific which means that Action Research needs to be pursued in and on the real world; namely the reliability of the results depend on specific places, people and circumstances (Archer, 1995).

The first part of the process is mainly dedicated to analysing environments, people, businesses, trends and economical and social issues. It consists of adopting desk and field research strategies and tools to understand and represent complex factors affecting organisations, communities and the system of stakeholders involved. To achieve an adequate knowledge of the target context (i.e. local communities, neighbourhoods, network of enterprises, organisations, firms), direct and indirect data also have to be collected, partly through field surveys. Data collection involves different skills and can be facilitated with ethnographic techniques and other design tools for analysis and field observation, such as photographic reportage, video interviews and design probes (Gaver et al., 1999, Mattelmäki, 2006) specially designed for collaborative research. Activity on the field is also participatory. It involves not only researchers but also the other stakeholders (practitioners, citizens, representatives of institutions, firms, communities of interests and so on). Design ethnography approaches can be useful to understand people and contexts in depth; the researchers/designers need to be immersed in the field of study, participating in the activities, which can be useful to generate insights in a way that data gathering cannot.

Desk and field research will produce a shared knowledge and specific data to support the following research activities. The data analysis needs to be defined in order to develop reflections and interpretations involving all the participants. The main goal of the interpretative phase is to build a shared *design approach* to describe the critical elements identified during analysis and the opportunities emerged (the design areas) related to the research context. For example, if the Action Research is aimed at understanding how to involve citizens in designing new neighbourhood services, the data collected should include quantitative data on existing services, economical activities, the presence of social investments, and the field research should involve people, local associations, schools, opinion leaders, local companies, politicians, sociologists, local organisations and experts. Due to the complexity of the investigation area and the impossibility to create a full and detailed description of all the resources and interests involved, at this stage the ability to abstract significant elements from investigation results is required. The data interpretation represent the starting point for formulating further research questions and defining the specific design guidelines (the *brief description*) that will orient the next steps of Action Research. This means that all the information collected (derived from literature, data, interviews, questionnaires, pictures, diaries, videos and other sources) has to be systematised and communicated among participants using face-to-face meetings, workshops or other forms of data sharing (including web-based tools). From a design perspective, the aim is to formulate a synthesis and a visualisation of the results in order to facilitate the participation of other stakeholders and share complex information among different practitioners enabling an active participation. In this case, tools such as storytelling, mapping and info-graphic visualisation are thus important elements in the design-research process. The capacity to visualise characterises designer knowledge and skills, so the designers/researchers have an important role in this phase to create the *enabling* conditions that allow people to understand the complex research process, and reflect on their own practices. The interpretative actions are a way to better examine one's own practice and use the research results to better planning the future actions and support the decision-making process. In the end, the data collection and their interpretation have to be correlated to the research objectives, and the planned results have to be useful to support or retract the research hypothesis. The analysing and interpreting phases deal with the time and the number of people involved. To make the research process sustainable and effective, a research plan (including scheduling, blueprinting, role descriptions, tasks and deliverables description) is needed to provide an overall strategy in terms of time consuming and resources involved in order to support the final research goal and set up the projecting and implementing phases.

Designing and implementing (action and knowledge sharing)

These stages set the transition from research to practice, since previous results cannot be considered as conclusive or absolute. Activities carried out during these phases aim at transforming the acquired knowledge in design products (material and immaterial). This means that the researchers/designers define the potential areas of intervention – the target scenarios – namely, identifying the macro-areas for design operations in keeping with the research hypothesis. This consists of formulating some *design scenarios* (Manzini, 2007) related to the research issues describing frameworks where project proposals will be developed and described. From a design point of view, this is related to the creative part of the process, describing the moment that marks the beginning of a specific design activity – the transition from theory to practice. During these phases, researchers/designers are required to formulate design hypotheses and transform them in design guidelines and procedures to be applied in the specific context. In other words, this is the part related to the description of the project *brief* and consequently to the identification of design concepts. Following the previous examples of designing new services for urban contexts through an Action Research process, we can image that the services ideas should consider specific issues emerged form analysis such as the connection between families and neighbourhood activities, the enhancement of local safety perception, the capacity to create new job opportunities for citizens, the ability to support multi-cultural communities in sharing their local culture and so on. Here, imagination and creative attitudes are needed for participants to imagine the design solutions, using a strategic vision guiding the possible changes to create better conditions for the context, the stakeholders and the people involved in the process and, at the same time, create new design knowledge. The action researcher has to act as *facilitator* of the design process and as practitioner and expert in the design field to allow people to have an active role in promoting the change and envision design solutions. As mentioned in previous paragraphs, a clear statement to be shared among participants is that the findings will not be possible to generalise in wider areas (economical aspects, social issues, context needs, communities are different), nevertheless the research through practitioners can advance practice and provide material for further activities and studies.

For Elliott (1991), action initiates reflection and it represents the moment of synthesis that is a central part of the solution-focused approach. The ideas that emerge are tested and implemented in the experimental phase, during which also the general research assumptions are validated. From a designer perspective, one way to involve different communities, skill-holders and practitioners in a participative design project is to set up participative sessions. Collaborative and participatory approaches can be used to generate design solutions that are the results of a knowledge and skill-sharing process. For instance, workshops, brainstorming and co-design sessions can be structured in order to enable the *design community* to participate in the design process. During the collaborative sessions all the actors involved participate in thinking up specific design concepts (also to be adopted in upcoming Action Research cycles) supported by designers in a step-by-step process aimed at identifying promising ideas responding to the research goals. The design concepts (related to products, environments, services, communication systems, processes, new tools) need to be described and visualised, as well as shared with other stakeholders involved in the research. The design concepts will consequently respond to different problems depending on the context; they could be referred to new enterprises, new businesses, new services, new fruition experiences, new products or communication systems and so on. As results of a participative process, the final outputs have to be representative of the different approaches and interests involved.

The design phase can lead to outcomes that will not necessarily mean implementing ultimate solutions (i.e. prototyping or product-service development or production), since several further research steps may be needed to achieve the final aim. The Action Research cycle considers a trial-and-error process implying the possibility of failure and/or refinement of the process and the tools used.

Also in designing and implementing phases, communication is very important. Sharing, communicating, socialising and visualising the design process, and describing the design solutions to all the stakeholders involved, are crucial steps. In order to make the design solutions visible and tangible, visualisation is one of the major issues that designers/researchers have to deal with in order to share complex information together with the capacity to manage the project of products/services. All the design tools adapted to developing or prototyping a concept can be used: sketch, storyboards, experience prototyping, maps, mock-up, etc. The selection of the final solutions to be implemented is also a negotiated process between the different stakeholders involved and also this choice depends on the context in terms of resources needed, time required to finalise the solutions, benefits for the participants and future impacts. When the solutions proposed do not answer all the research issues (including contexts, characteristics and communities/people's needs) further Action Research cycles have to be considered, planned and realised.

To conclude, another mark on the importance of monitoring and evaluation is needed. The step-by-step process needs to be constantly monitored using different techniques such as diaries, interviews and questionnaires (Cohen and Manion, 1984) in order to have feedback during both the research and action phases to be able to introduce modifications or adjustment in actions, tools and/or procedures. These activities also need to be designed and revised throughout the process allowing people to use the reflections on their own practice to improve and reinforce it.

Some remarks about the designer's role in the Action Research process

Swann (2002) considers Action Research to be an appropriate methodology for any design project where the final outcome is undefined. In the previous sections, Action Research has been described as a process useful to be adopted when designers have to face complex problems that involve collaborative decisions and practices related to specific contexts (i.e. enterprises, organisations, communities, neighbourhoods and cities). These are, for instance: small-scale projects where communities or users need to acquire an active role in promoting changes; large-scale projects where decision making is a collaborative process among a wider community of stakeholders; and projects where a design-driven approach might help people, institutions, companies and organisations in adopting design tools and design attitude in solving problems. In these areas, using Action Research can enable different design research issues such as new social networks, mutual help and solidarity, investments in learning processes, organisational processes, intellectual and social capital, active citizens, cultural activities, new businesses, long-term sustainable lifestyle and so on.

The principles and mechanisms of Action Research, as proposed in this chapter, are thus related to participatory and collaborative design processes (Kyng and Greenbaum, 1991; Ehn, 1992; Sangiorgi, 2011; Stappers and Sanders, 2003) that involve various stakeholders, encouraging a design approach based on collaboration and knowledge exchange, on participatory activities and on creative problem solving. The designer/researcher has to handle and monitor different levels of activity: theoretical, practical, organisational, decision making and communication. For designers, adopting the Action Research strategy should increase the ability to think and act in complex systems, by integrating observations, analysis, tests and design vision.

In this framework, further reflection on the role of the researcher/designer is in order. On the one hand, the designer can facilitate learning about design research and about professional practice for designers and people involved in design research. On the other hand, he/she can stimulate dialogue and foster relationships among different actors, playing the role of *broker*, *director* and *facilitator* (Pacenti, 2004; Maffei and Zurlo, 2000) while acting as *enabler* of a 'community' that actively participates in the design process (Maffei and Villari, 2004).

Action Research has been defined as an approach employed by practitioners to improve their practice participating in a continuous learning process. In some circumstances the designer/researcher can be considered a *dynamic element* in the process (a *catalyser*), for example, when his/her activity triggers the addition of new elements into a given context. In other respects, the designer/researcher has to have specific skills to analyse the context in depth (listening), to systematically analyse its significant elements and to propose design solutions that are coherent with the context analysed. Enabling design activities and enabling knowledge-sharing processes (Maffei and Villari, 2004; von Krogh et al., 2000) are thus ways to participate and to learn through cyclical interaction between research and design.

Researchers/designers, when involved in an Action Research processes, must reflect on professional practice, on theoretical and practical tools and on the production of new design knowledge. From a disciplinary perspective, different kinds of Action Research results can be outlined, shifting the attention from physical output to immaterial dimensions. For designers, doing Action Research means:

- giving shape to the relationships (community-building process) between those involved in the research process and proposing new ways to connect (to foster the communication among) individuals, companies, institutions, communities, places, etc.;
- giving shape to new ideas (design concepts and business ideas) and to design strategies so as to make immaterial elements like knowledge, values, know-how and identity tangible since these are also the connection elements among the various actors involved;
- giving shape to the artefacts that concretise the research output; namely, description and visualization of design scenarios, design concepts or final project solutions that are products, new services, distribution systems, communication systems, etc.

The Action Research output must be evaluated not only on its material aspects but also on the intangible nature of its findings, which include the strengthening of relationships, networks, knowledge and the organisational and communication skills acquired. All these elements put people first, at the centre of the research process, focusing on people's activities and on the 'communities' (of practitioners, of interest, of practice) where they operate and learn.

These elements are closely connected to the participatory approach used in design (user-centred design, participatory design, participatory planning and community design); they emphasise the collaborative and the emancipatory aspects, as well as the cyclical nature of the process considering design activities also related to organisational issues and strategies. Therefore, Action Research performed in the design field can enhance the processes of creative learning that means the enrichment, regeneration and propagation of knowledge, including practical knowledge. In this sense, an additional task for designers is to reinforce the methodological systematisation of Action Research to build a repertoire of experiences and *ad-hoc* tools useful for guiding and nourishing Action Research activities in the design field.

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25

STUDYING DESIGN COGNITION IN THE REAL WORLD USING THE ‘IN VIVO’ METHODOLOGY

Bo T. Christensen and Linden J. Ball

Introduction

Traditional research on design cognition typically employed artificial settings and quasi-realistic tasks. For example, Eastman’s (1970) pioneering studies focused on highly constrained space-planning problems in which the location of furniture items had to be optimised within a room of specified dimensions. Eastman’s approach arguably set the tone for design research over the next two decades, and although the tasks that researchers employed became more realistic, they mainly just ‘imitated’ key aspects of professional design problems (see Cross, 2001, for a review of this early literature). This restricted task focus meant that the situated and collaborative nature of design was omitted from the research agenda for many years. This was unfortunate given that factors associated with the social and cultural context of design seem paramount to understanding the authentic nature of design cognition. The past decade has witnessed a burgeoning of research on design cognition ‘in the wild’, focusing on expert designers and collaborative teams working on real tasks in natural environments. This move towards understanding design ‘in vivo’ is to be welcomed. Nonetheless, such research is associated with considerable complexity, which necessitates the selection and use of rigorous methods to achieve effective data collection and reliable data analysis. Here we tackle head-on the methodological challenges associated with studying real-world design cognition.

Studies examining individual designers have primarily employed questionnaires (e.g. Römer et al., 2001), qualitative interviews (e.g. Cross and Clayburn Cross, 1996) and diary self-reports (e.g. Ball et al., 1994; Pedgley, 2007). Such methodologies involve a major component of retrospective reporting, raising concerns about the reliability of findings given that retrospective reporting is highly susceptible to distortions that arise from forgetting and confabulation (Wilson, 2002). In other words, when asking designers to recall past events, the constructive and adaptive nature of memory means that it is unlikely that they will be able to provide accurate recollections of what truly transpired during instances of design problem solving. Furthermore, in the case of expert performance, people may never have had conscious access to key elements of their cognitive processing in the first place (Perkins, 1981). For example, research has shown that scientists’ reconstruction of the steps leading to discoveries do not include significant elements that were recorded by an observer who had been present during the original discovery process (Dunbar, 1997).

In sum, any methodology used to study design cognition should circumvent the memory distortions and omissions that limit the effectiveness of retrospective research methods. As such, we contend that the optimal approach to investigating design cognition is to make use of 'live' or 'online' research techniques. In fact, design research has used one online methodology extensively over the past 30 years, that is, the technique of protocol analysis, which involves participants 'thinking-aloud' while tackling a design problem (e.g. Craig, 2001; Cross, 2001; Cross et al., 1996). Ericsson and Simon (1999) developed the core theoretical framework and methodological guidelines associated with think-aloud protocol analysis, proposing that protocols report the current contents of short-term memory (i.e. the information that is being heeded or attended to at any moment in time). As such, the production of verbal protocols interferes minimally with ongoing task processing, yet they have the capacity to reveal important aspects of ongoing problem solving (see Ball et al., 1997 and Ormerod and Ball, 2007, for discussions of issues relating to the use of protocol analysis in design research).

Eastman (1970), in his studies of space planning and architecture, appears to have been the first to conduct a protocol analysis of design cognition, and subsequently protocol analysis has been used to study many design phenomena, such as goal analysis, design fixation and the role of sketching, opportunism and modal shifts in design (see Cross, 2001, for an informative review). It is also noteworthy that in 1994 a major workshop entitled 'Research in Design Thinking II: Analysing Design Activity' (Cross et al., 1996) was held in Delft, which focused exclusively on the use of protocol analysis in design studies. For this workshop a number of internationally esteemed design researchers were asked to analyse the same set of verbal protocols. This workshop gave protocol analysis a major boost as a respectable methodology within the design research community.

Despite the evident strengths of verbal protocol analysis it is not without limitations. In particular, protocol-based studies focus on single participants and require the reporting of everything that is being thought about during task performance, with reminders being given to 'please think aloud' whenever there is a brief period of silence. Research has shown that forcing subjects to verbalise during problem solving can interfere with performance and change cognitive behaviours (Davies, 1995; Lloyd et al., 1995). Schooler and Melcher (1995) also showed that enforced thinking-aloud may not only compromise accurate reporting but may also be detrimental to the creative process itself. For example, Schooler et al. (1993) showed that thinking-aloud 'overshadowed' the creative processes necessary for attaining solutions to insight problems. In sum, it seems that enforced verbalisation is problematic in the study of at least some types of cognition.

We also note that the typical protocol analysis method used in design research employs a laboratory set-up that relies on artificially constructed design tasks (Cross, 2001) requiring a short time-span for solution attainment (typically less than two hours) using participants (sometimes non-experts) working in isolation (see Ball and Ormerod, 2000a, 2000b, for critiques of this approach). These aforementioned factors contrast with real-world design, where tasks are usually complex and span weeks or months. Moreover, in real-world design, the contextual setting is typically social and team-based. Protocol analysis studies that explore team-based interactions often utilise strangers, depriving designers of their prevailing social network and normal interaction partners. In the real world, a designer will also normally work in a personally tuned environment (e.g. their own office or studio) with access to bespoke tools (Craig, 2001). This is unlike the laboratory set-up, where designers function in an unfamiliar and sterile environment. Since experts rely on external aids such as drawings and notes (Norman, 1988), it is important to incorporate these in the study of design cognition, rather than focusing on verbalisations alone (Chi, 1997). Furthermore, in experimental settings the experimenter frequently acts as ‘the client’, but interaction between the designer and the quasi-client is typically restricted to scripted and prefabricated responses to anticipated questions, thus prohibiting natural conversation and a meaningful image of a real client (Craig, 2001).

The experimental settings employed in typical protocol analysis studies of design cognition have been found to have a negative influence on protocol data (Cross et al., 1996) such that more ecologically valid methods are highly desirable. One way forward is to study the creative process ‘online’ in ways that avoid recourse to enforced thinking-aloud within the laboratory. Indeed, several theorists have argued that understanding situated behaviour is essential for framing cognitive research (Hutchins, 1995; Lave and Wenger, 1991; Suchman, 1987) such that it is paradoxical that research on design expertise has typically ignored the role of situational and social factors, instead focusing on laboratory investigations where such factors are controlled out. This paradox led Ball and Ormerod (2000a, 2000b) to call for more widespread use of ‘cognitive ethnography’ in studying design cognition. In essence, cognitive ethnography involves the adoption of a subset of the features of traditional ethnographic approaches, and the deliberate violation of other features, in the pursuit of cognitive research goals. Most importantly it involves observational specificity (as opposed to the sheer breadth and intensity of a prototypical ethnography) and it places a strong emphasis on validating observations across observers, datasets and research techniques. Below we extoll the virtues of one particularly important approach to utilising cognitive ethnography methods to study creative design processes as they occur online.

‘In vivo’ design research

Dunbar (e.g. 1995, 1997, 2000, 2001; Dunbar and Blanchette, 2001) developed a methodology for studying cognitive processes in science, called the ‘in vivo/in vitro’ method. The name is borrowed from the biological sciences where, for example, a virus can be examined both in the Petri dish (‘in vitro’) and when it infects a host organism (‘in vivo’). Similarly, the same cognitive processes can be examined both in the laboratory using controlled experiments *and* as they occur live in the real-world using ‘messy’ data (Chi, 1997), including verbalisations and observations of behaviours and gestures. This combined in vivo/in vitro approach allows the researcher to investigate cognitive phenomena in a naturalistic fashion, and then to go back into the laboratory to conduct controlled experiments on what has been identified. In this way, the methodology maintains a high degree of ecological validity (e.g. Neisser, 1976; Hutchins, 1995) whilst enabling the experimental rigour that is only possible in the laboratory.

The in vivo/in vitro approach has been used successfully in studying expertise in relation to the Mars Rover Mission (Chan et al., 2012) and in scientific domains such as physics, neuroimaging and astronomy (e.g. Trafton et al., 2005; Trickett and Trafton, 2002, 2007; Trickett et al., 2000). The methodology has also been transferred to studies of design expertise, being used to examine analogical reasoning, mental simulation and requirement handling in design teams (Ball and Christensen, 2009; Ball et al., 2010; Christensen and Schunn, 2007, 2009) and the co-evolution of problems and solutions in design creativity (Wiltschnig et al., 2013).

The in vivo component of the methodology involves eliciting qualitative data using ethnographic techniques, particularly audio-visual recording of dialogue, and subsequently running the data through a rigorous coding scheme involving both quantitative and qualitative analyses to inform theories of cognition. This approach entails several data-processing stages, including: transcribing all verbal utterances; segmenting verbalisations into particular grain sizes; developing a coding scheme; applying the coding scheme; quantifying resulting patterns, sequences and occurrences of coded behaviours; and conducting reliability and validity checks.

This kind of rigorous data-analysis approach has its origins in verbal protocol analysis (Ericsson and Simon, 1999), but extends protocol analysis to the handling of real-world discourse. As such, it utilises natural dialogue as the main unit of analysis, with no special instructions being provided to think-aloud. People simply work as normal and their activities and utterances are video/audio-recorded.

When using the in vivo method in design research, regular time points must be identified where design cognition occurs that involves natural dialogue. Dunbar (1995, 1997) discovered that in molecular biology a suitable time point related to the scheduled laboratory meetings that were held regularly between collaborating scientists. Lab meetings involved discussions between senior scientists and their postdoctoral researchers and PhD students, and Dunbar found that these meetings contained a range of cognitive activities, such as hypothesis generation, the proposal of new experiments and criticisms of existing ones and new concept development. He found that these meetings "provided a far more veridical and complete record of the evolution of ideas than other sources of information" (Dunbar, 2001, p. 120).

Analogous objects of study in professional design contexts are the small, team-based design or product-development meetings that regularly take place. For example, Christensen and Schunn (2007) report a study focused on the design of medical plastics, where a sub-group in a large product development project was followed over an eight-month period, with weekly sub-group meetings being recorded. The sub-group involved five core members (representing different disciplines) focused on producing novel features of the product. The activity at meetings was team-based and included a suitable number of people (typically four to six) to allow for meaningful interaction and the easy recording of dialogue. The observed design activity consisted of a broad cross-section of what characterises design thinking and reasoning.

The primary function of these product development meetings was observed to be the development of design artefacts through creative collaboration and problem solving. Activities included brainstorming, concept development, design problem solving, planning (e.g. for data collection and for the next design steps), evaluating mock-ups and prototypes, sketching, experimenting, and engaging in discussions and knowledge exchange about end-users, production methods and the like. In these meetings, 6 per cent of the time concerned off-task verbalisations (e.g. office gossip, jokes and banter), 3 per cent was spent summarising outcomes of past meetings (usually at the beginning of the meeting), 3 per cent was spent planning future meetings (typically at the end of the meeting), 10 per cent concerned planning future data collection or experiments and 78 per cent (i.e. the majority of activity) concerned design thinking and reasoning in the 'here-and-now'. These percentages are, of course, context specific, and will likely vary across organisational situations, design projects and phases of the design process. Nevertheless, they illustrate that the in vivo methodology is promising for analysing design cognition in that it seems to capture very little irrelevant data.

Data collection

In vivo research requires domain knowledge of the vocabulary and structure of tasks so that the researcher can understand what is taking place (Ball and Ormerod, 2000a). Prior to commencing data collection, it is advisable for the researcher to become familiar with the specific design domain, the intended product and the design organisation itself. Such familiarisation is typically achieved through interviews and pilot studies and by reading relevant documents. Before each group meeting the researcher should ideally interview one of the designers so as to understand the status of the project, the topic of the meeting, what is currently being worked on and the difficulties being experienced. A pre-meeting interview will also help ensure that information-loss arising between meetings is minimised.

The actual design meeting can then be video-taped and the conversation between designers audio-taped. When recording in vivo there is typically a trade-off between the quantity of data that can be collected and the invasiveness of the data-collection procedure, since many procedures can influence the process if designers become self-conscious or uneasy when being recorded. Audio-taping is a relatively non-invasive procedure, although it omits potentially important information about design objects, motor activities, gestures, emotional expressions and eye-gaze.

Collecting the latter data requires more invasive methods such as the deployment of multiple cameras to record the total room-view as well as desktops, the gestures of individual designers and details of note-taking and sketching. This approach is likely to influence designers' behaviour unless care is taken to hide recording equipment wherever possible and to allow for trial periods so that participants can adapt to the artificial feel of the situation. Much design activity can be captured using a single overhead camera located a short distance away from the table where the designers sit during a meeting – but zoomed in so that all objects, sketches and notes can be captured. This allows for all people to be in-frame and enables subsequent examination of who was talking at any time-point, which is useful if this cannot be identified from the audio-tape. Bodily gestures, facial expressions and gaze direction can also be discerned to some extent.

In terms of audio-recording an omnibus microphone recording from all directions can be placed at the centre of the table to enable discourse to be captured. No special instructions (e.g. to 'think-aloud') should be given to participants; they should simply be asked to proceed as normal. An observer can make written notes of any information not readily available in the video frame and can also gather copies of handouts or documents. Following each meeting, all design objects produced (e.g. sketches, mock-ups and prototypes) can be video-taped in close-up, sometimes with one of the designers explaining the function of objects in voice-over to provide additional information regarding the design objects referenced in the verbalisations arising during the actual meeting.

Data analysis

Following data collection, all verbalisations are transcribed and can be analysed as a series of statements using standard verbal protocol-analysis techniques (e.g. Ericsson and Simon, 1999). These statements can reveal considerable detail about the cognitive mechanisms operating during creative reasoning (e.g. Blanchette and Dunbar, 2000, 2001; Dunbar, 1997, 2001). Transcription is time-consuming and typically takes seven to ten hours per hour of video/audio. The transcribed data can be segmented into units according to a suitable grain size, with typical units being propositions, sentences or episodes (i.e. statements linked contemporaneously to a common theme or goal). For much design reasoning research, a useful grain size involves dividing the data in terms of 'complete thought' segments (e.g. Hughes and Parkes, 2003), which entails separating statements into segments containing verb phrases that reflect mental operations. Each segment will typically be either a single sentence or a fragment of a sentence, yielding hundreds of segments per hour of transcript. Each segment can be given a time stamp and additional non-verbal codes can be applied from the video data, if desirable (e.g. relating to eye-gaze, gestures or referenced objects).

Data reduction

Initially, the dataset might be reduced by applying preliminary codes that focus only on relevant parts of transcripts. For example, applying a code for 'off-task' as opposed to 'on-task' verbalisations can remove irrelevant passages where designers engage in office-related banter or personal gossip unrelated to the task. Another example is where transcripts are divided into episodes in the form of segments sharing a common theme (e.g. planning the next meeting or evaluating a prototype). Certain types of episodes can then be excluded from further coding insofar as they are irrelevant to the hypotheses being examined. However, care needs to be taken in selecting episodes for exclusion since this could raise doubts about whether the chosen subset of data is a valid reflection of the design process.

Coding schemes

To test theories of design thinking and reasoning, coding schemes have to be developed. Coding scheme development is difficult to convey in general terms since it depends heavily on the researcher's theoretical orientation, the hypotheses or questions being asked and the tasks and domain being researched (Chi, 1997). The reader is referred to Ericsson and Simon (1999) for further details regarding the development of effective coding schemes. However, a few concrete illustrations are provided below.

Coding schemes for cognitive processes: mental simulation

Creative processes can be captured using qualitative screening of sequences of segments. An illustrative example is the coding scheme for mental simulation developed by Trickett and Trafton (2002, 2007) for studying data analysis in science. The key feature in a mental simulation is that it involves a simulation 'run' that alters a mental representation or mental model of a situation, phenomenon or object so as to produce a change of state. This means that the simulation is not merely a question that is asked (e.g. changing features or functions of the design object); it also provides an answer (e.g. Will this design work? How should this design be produced?). In a design context such simulation allows the designer to reason about new possible states of the design object and its perceptual qualities, features and functionality, without actually having physically to change the object.

Mental simulation therefore involves a specific sequence of processing. This starts with the creation of an *initial representation*, then moves to *running* the representation, whereby it is modified by spatial transformations (i.e. elements or functions are extended, added or deleted), followed lastly by a *changed representation*. These three elements (initial representation, run and changed representation) are not mutually exclusive and can occur within the same segment, although frequently they cover several segments. The code for mental simulation has been applied in analysing in vivo design data (Ball and Christensen, 2009; Christensen and Schunn, 2009; Ball et al., 2010; Wiltschnig et al., 2013), with an example presented in Table 25.1.

The mental simulation code is a qualitative code, which makes it time-consuming to apply since there is no quick way to identify an occurrence and the coder needs to understand much of the context for each segment. Past research has yielded very high inter-rater reliability for this code, that is, two raters are able independently to code transcripts for simulation with a high degree of agreement.

Table 25.1 An example of a mental simulation

Initial representation	Could you add something so that you couldn't close this thing because there would be something in the way when you try to fold this way . . .
Run	But if this thing goes this way, then it is in a position to allow the ear to enter. . . . But then I just don't know how it should be folded . . . because if it is folded this way then it will come out here . . . then it should be folded unevenly somehow. . . . You should fold it oblique.
Changed representation	It wouldn't make any difference one way or the other. It would fold the same way, and come out on this side the same way.

Coding schemes for mental states: epistemic uncertainty

An example of a mental state of interest in design cognition is 'epistemic uncertainty', which arises when a designer refers to their subjective experience of lacking adequate knowledge or understanding. One way to code for epistemic uncertainty is to use a purely syntactical approach as employed by Trickett et al. (2005) in an analysis of expert meteorologists and neuroimaging researchers. Trickett et al. (2005) located segments displaying uncertainty by looking for hedge words such as 'probably', 'sort of', 'guess', 'maybe', 'possibly', 'don't know', '[don't] think', '[not] certain', 'believe' and so on. A code of 'uncertainty present' was applied if scrutiny of the segment confirmed that the hedge word related to uncertainty rather than, say, politeness. The coding of epistemic uncertainty has also been successfully implemented in design contexts (Christensen and Schunn, 2009; Ball and Christensen, 2009; Ball et al., 2010; Wiltschnig et al., 2013). Syntactical codes are relatively easy to apply (see Table 25.2 for examples), but are only suitable for a limited number of categories.

Coding schemes for episodes: co-evolution of problem and solution

An important idea in theorising about design cognition is that problems and solutions 'co-evolve' during the design process (Maher, 1994; Dorst and Cross, 2001). Under this view, design concepts develop iteratively, with the design problem and associated solutions influencing each other in a mutually adaptive manner. Wiltschnig et al. (2013) developed a code for identifying co-evolution episodes, which first entailed coding for 'requirement mentions'. This involved

Table 25.2 Examples of epistemic uncertainty coded syntactically using hedge words

Utterance	*Code*
Because I'm **not sure** whether you would fold it around the back.	Uncertainty present
I **think** so too, but before we get too cocky, let's make a model . . .	Uncertainty present
Well, I **guess** it's a combination of moist and heat isn't it? I **suppose** it has to be.	Uncertainty present
It has to push from the start.	Uncertainty absent
Yes, but the problem is that you can't hit it later . . . because it's too small.	Uncertainty absent
It . . . then we have . . . then we lose the possibility of folding it back.	Uncertainty absent

Table 25.3 An example of a co-evolution episode

A	. . . Could we make it so that it opens itself . . . so you do not actually need to go down and fiddle with the flap here?
B	Well there are some people who want to . . .
C	There are some people who want to bend the flap over backwards.
A	Yes . . . backwards . . . perhaps we should have a look at the hygiene around this flap.
B	Yes, but here we can write uhh.
A	Yes increased hygiene on uhh.
B	improvements . . . improved cleaning of the bottom flap or what?
D	There uh there an injection-moulded solution is again a good idea because it will be easier to wipe clean.

examining each segment to determine whether it contained an explicit reference to a design requirement and whether this requirement mention concerned: (a) adding a novel requirement; (b) interpreting or making revisions to an existing requirement; (c) bracketing a requirement (e.g. 'We're not going to be dealing with that here'); or (d) deleting a requirement. For co-evolution to be deemed to be present it was necessary for requirement mentions to be linked to a solution attempt within a five-minute transcript window.

Operationalising coding schemes

A theory-driven choice in relation to the construction of an a priori coding scheme may end up being too general for straightforward application to particular verbal data. What this means is that once a coding scheme has been developed, a decision then has to be made as to which verbalisations can be translated into particular codes (i.e. codes have to be *operationalised* in relation to the context and type of data at hand). For example, if one wants to study differences in 'analogical distance' for different analogies, it is one thing to have a general, theoretical distinction between 'local' analogies and 'distant' analogies, and quite another to know how to code for this distinction in the current dataset. In his research on molecular biologists, for example, Dunbar (1995, 1997) operationalised this local/distant distinction by creating three categories: 'within organism', 'between organism' and 'non-biological or distant' analogies. For the operationalisation of analogical distance in a design context see Christensen and Schunn (2007), Ahmed and Christensen (2009) and Ball and Christensen (2009).

Reliability and validity

Reliability is important for any methodology used to study design cognition, but is particularly important in relation to in vivo data because of the high degree of contextual variance that can arise, as opposed to the relative contextual stability in experimental settings. Inter-rater reliability checks of individual codes using independent coders can be conducted using Cohen's Kappa statistic, rather than mere percentage agreement as is sometimes reported. Percentage agreement makes reliability appear much higher than is warranted, especially for phenomena that are rare within a large dataset, which is an issue that often arises with in vivo data.

A satisfactory Kappa value depends on the number of codes applied and whether they are equiprobable. A general rule of thumb (Fleiss, 1981) is that < .40 reflects poor agreement, .40 to .75 reflects fair-to-good agreement and > .75 reflects excellent agreement (see Landis and Koch, 1977, for an alternative way to define agreement magnitude). Other types of reliabilities are also important. For example, whenever possible it is useful to recode the same hypotheses using different coding schemes and grain sizes to see if the results hold up (e.g. Chi, 1997). Reliability may also be demonstrated by splitting the dataset and showing that results are stable across the individual parts of the dataset.

The extensive coding required for in vivo research means that the method will typically involve analysis of only a few hours of recordings. For the same reasons, only a small number of different contexts are usually studied. The resulting limited data variance and data quantity can threaten the generalisability of results because of the increased risk of sampling errors. It is for these reasons that Dunbar recommends supplementing in vivo research with in vitro experiments that can better deal with sampling issues. These limitations aside, in vivo research remains particularly well-suited for tackling the lack of ecological validity in much research on design cognition.

Using the same dataset to answer different research questions

Because in vivo data are collected without an experimental set-up, the same dataset can be used to answer different research questions using alternative techniques such as discourse analysis or conversation analysis. This was evident in papers presented as part of the Seventh Design Thinking Research Symposium (DTRS7; McDonnell and Lloyd, 2009), where a single dataset of design dialogue was analysed by several independent research teams using distinct analytic approaches to investigate a range of unique research questions.

Conclusion

The in vivo methodology holds much promise as a way to address key limitations associated with traditional methodologies deployed in studying design cognition, such as interviews, surveys, experimentation and think-aloud protocol analysis. In vivo research studies design thinking and reasoning online as it arises in the real world. We have suggested that sub-group product development meetings may be suitable objects of study, with the evidence that we have presented indicating that the dialogue arising in such meetings reflects a broad cross-section of design activities, with a majority of verbalisations revealing a highly engaged process of design thinking and reasoning. By recording the verbalisations that arise in such meetings and subsequently transcribing, segmenting and coding the data, we have shown here that it is possible to test specific hypotheses about the authentic nature of design cognition.

In contrast to more traditional design research methodologies, the in vivo approach has some major advantages. First, the methodology captures design thinking and reasoning 'live', in contrast to many methodologies that focus on retrospective data, which are known to be biased and inaccurate. Furthermore, although in vivo research shares many features of think-aloud protocol analysis, it avoids problems that arise from having an enforced verbalisation requirement. Rather, in vivo research relies on *natural* dialogue arising spontaneously between designers. In addition, whilst a typical protocol-based study takes place in an experimental laboratory setting, in vivo research focuses on real-world design with expert designers working on their normal tasks, in their usual contexts, using their personalised tools, collaborating with their regular networks and teams and developing their ideas over extensive periods of time.

This ensures that in vivo design research has better ecological validity than standard experimental and protocol-based design research.

However, in vivo design research is not without some problems. Data analysis and coding can be labour-intensive and the approach is at risk of sampling errors if an overly restricted number of cases are analysed. To reduce this threat to generalisability it is recommended that in vivo research is supplemented with standard experimental studies that can add rigour by increasing the number of analysed cases.

We contend that all issues with the in vivo methodology are surmountable, especially if it is viewed as one of a set of techniques within a 'methodological triangulation' approach that focuses on clarifying the validity, generalisability and reliability of emerging findings. The burgeoning use of the in vivo methodology in investigating issues such as the roles of mental simulation, analogising, epistemic uncertainty and problem–solution co-evolution in creative design augurs well for its ongoing deployment in future design research. As experienced users of the in vivo approach ourselves, we commend the methodology to other design researchers who are committed to analysing the authentic nature of design cognition as it arises in real-world collaborative contexts.

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PART IV

How do we communicate design research?

Writing techniques; writing for your audience; publicising your research

The chapters in Part IV deal with how the outcomes of design research can be effectively communicated and disseminated for maximum impact. As such, Part IV includes contributions that present methods for writing up design research, communicating design research for particular audiences and how best to communicate and publicise the findings of design research in complex and collaborative scenarios. We start this part with three personal and reflective pieces. The opening chapter by McMullen, Banu and Adams presents their perspectives and experiences on how interdisciplinary collaboration can be encouraged and how research from different disciplines can be shared and understood across different fields. By investigating and dissecting their conversations around the design process, they expose the embedded (and often hidden) personal, social and environmental conditions of interdisciplinary critique and illustrate how collaborative interdisciplinary research unfolds over various times and places. In keeping with the part's theme on communicating design research, they have attempted to challenge the usual linear and singular communication of research by offering multiple narratives. They have accomplished this by presenting the text in an unconventional manner.

Likewise, Roxburgh's chapter draws on his personal experiences describing techniques that he has developed to help him apply a methodical approach to his writing. He recognises the frustration many creative practitioners have with bridging the gap between the 'making' and the 'writing' inherent in research projects and offers examples of how the act of writing can become an embodied exercise in design research rather than perceived as a separate practice from designing. He shares a range of diverse methods such as mapping, recursive note-taking and cut-up text composition. Macken continues this thread on the two modes of working – of writing and making. Her chapter, like Roxburgh's chapter, draws on her practice-based doctorate and she shares her approach to the relationships between the research question, the voice of the writer and the structure of the thesis, and its associated examination process. Through her doctoral work, which combines art practice with architecture theory, the form of an artist book is created as a vehicle to conceptualise the work, to realise its existence and as a way to appraise the work rather than simply to communicate the research.

The part then moves from the highly personal reflective pieces to the remaining chapters where the general theme is on how design research is communicated to an external audience within, between and beyond collaborative stakeholders. Fleming and Kelly's chapter describes an innovative service aimed at promoting knowledge and use of design principles for people living with dementia in care homes. They use this case study to outline certain understandings and processes necessary for successfully communicating design research to key stakeholders. The five conditions highlighted point to a general requirement not only for an awareness of key information but also an agreement on its value and a willingness to apply the information and enact real societal change. Gibson and Owens' chapter is a call-to-arms for design researchers to reach across disciplinary boundaries. Their chapter elegantly describes the growing intractability and rapid expansion of the scope and interconnectedness of real world social, economic and natural systems problems, as well as their corresponding demand to link diverse perspectives with innovative action and considered behaviours. Gibson and Owens suggest this contemporary crisis makes the need to overcome equally obstinate barriers to collaboration between design researchers and others all the more pressing. In an effort to alleviate these pressures, Gibson and Owens propose three methods to foster better understanding between investigators from inside and outside design that will lead to more effective collaborations. They suggest the three design-based investigative methods, 'conceptual mapping', 'conceptual prototyping', and 'utilising decision-tree diagramming processes to facilitate comparative analysis' can be used to place researchers from inside and outside design in conceptual and methodological proximity, which will provide them with the means necessary to identify and overcome both practical and philosophical obstacles to working effectively with each other. The final chapter in this part deals with how meaningful play research methods might contribute to new knowledge and understanding in design. Scott's chapter examines how 'playcentric' or 'playification' research methods are being used to understand, influence and validate design decisions. His work explores how a play-based approach to design research might complement other research methods such as participatory ethnography and persona creation in order to create holistic understandings of human behaviour, as well as communicate examples and benefits of inclusion into design processes. His 'playcentric' research methods include a framework of 22 playful experiences that has been developed to enable a deeper understanding of users and allow designers to develop more creative solutions.

26

INTERDISCIPLINARY DESIGN RESEARCH

Questions, conditions and interventions

Shannon McMullen, Lisa Banu and Robin Adams

The questions shaping this chapter and its eventual form began with the realisation that our individual scholarly activities in the disciplines of sociology and visual art, engineering education and philosophy may find a common expansive space in a shared focus on the social, critical and learning relationships expressed through the designed world. In other words, we began with the suspicion that when designers create things, they affirm or question the systems and contexts in which artificial things come to reside (i.e. political, social, economic, etc.).[1] When we as researchers ask questions about how material production unfolds as a learned social process, we are also investigating how designers shape social relations and cultural knowledge.

The standpoint presented in this chapter is an interdisciplinary one; rather than approaching design research from a singular disciplinary position, our aim is to explore and reveal the coincidence of disciplines related to design. In our local institutional context, design (our area of overlapping interest and expertise) is distributed across distinct colleges and departments. This isolation leaves little support for communication and collaboration across institutional boundaries. Design in the engineering context and design in the artistic context exist in parallel and as separate disciplines; the same could be said for design research. However, our own perspectives and experiences are interdisciplinary, focused on understandings of design that connect and pluralise knowledge. How can interdisciplinary collaboration be encouraged? How might scientific, technological and artistic strategies be combined through the design process? These two questions were implicit at the conceptualisation of this chapter and emerged more fully formed as research progressed.

The resulting outcomes described in the following pages are twofold: 1) an interdisciplinary collaborative design critique of a case of conversations around the design process; and 2) an exposure of the personal, social and environmental conditions of interdisciplinary critique embedded in our collaboration that remain otherwise latent and hidden (Figure 26.1). These two parallel and mutually informing outcomes resulted from a journey into our own interdisciplinary collaborative method and an emergent, shared analysis of instances of design conversations.

Representing interdisciplinary inquiry

As a result of our insistence upon retaining the messiness of multiple perspectives and disciplines, the chapter you are reading demonstrates a collaboratively crafted and performed work. The form and content is a product of collective conversations and analysis, writing, editing and revising. A defining moment occurred when the project transitioned from one of communicating features of interdisciplinary design research to translating the *process* of interdisciplinary design research into chapter content and form. A key method for visualizing and sharing this way of communicating was the creation of a design research timeline connecting the temporal and topical evolution of our collaboration to accompany this chapter. The timeline and its relationship to the chapter can be accessed at: www.gardensandmachines.com\McM_Banu_Adams_Chpt26_Timeline. Taken together, the timeline available online with the text and the figures in this chapter are intended to provide a demonstration of interdisciplinary collaborative research as it unfolded over time and place; and ideally to reveal that our analysis and outcomes were both textual and visual in nature. Furthermore, the timeline captures the interplay of social, environmental and personal conditions that enabled our interdisciplinary collaborative inquiry and describes the decisions that shaped the outcomes discussed in the following pages.

For the authors of this chapter, play, rather than work, became the operative mode – a way to encourage each participant to take risks, embrace ambiguity and trust the indeterminacy of outcomes. Play also came to mean that disciplinary expertise was de-emphasised; the act of continual and transformative learning was highlighted instead. Emergent practices like 'flocking'

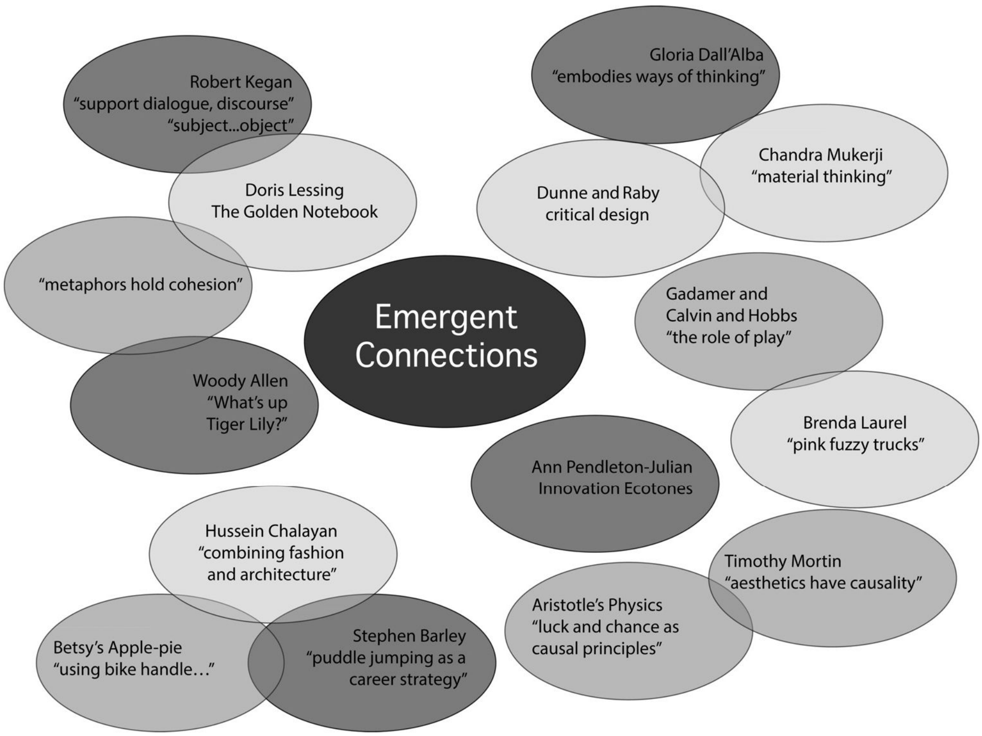

Figure 26.1 Interdisciplinary influences on conversations between points of convergence shown by overlapping ovals. Each shade of grey and accompanying text alignment (centre, left or right) represents a different voice – one combination for each of the three different authors

are a better metaphor for the process and method by which the project progressed. We converged through shared questioning and diverged in our perspectives. Our understanding of both the process of inquiry and object of inquiry did not develop through a linear causal logic. Rather, this exercise of collaborative learning developed in spurts and starts flocking around a set of ideas, and through eruptions of shared insight amidst a multidisciplinary confusion of the various voices we brought into our conversations (Figure 26.1). The diminished role of disciplinary 'rigour' permitted perspectives outside the normative constraints of categorical questions related to engineering education, sociology, visual arts and philosophy. Our hope is that readers will also recognise this chapter as a designed object and an invitation to join the conversation and experimentation.

Situating the experience

When we began this project, we purposefully did not read each other's work or the kinds of frameworks we used regarding collaboration and interdisciplinarity. We were concerned that starting with a literature review might distort the relationships we wanted to develop and sidestep a shared desire for a critical reflective journey on the nature of interdisciplinary collaborative inquiry. Rather, we pulled in previous research at the end of our process as a way to locate and communicate important features of our collective experience.

Such previous research has shown that practices and meanings of collaboration and interdisciplinarity vary. Motivations, methods and models are diverse and evolving. For this reason, we find it helpful to articulate our particular model formed around the formation of this chapter, before offering an alternative method for improving its conditions in the context of design research and pedagogy.

In his book *No More Teams!*, Michael Schrage (1995) characterises collaboration by the relationship between levels of 'technical' and 'conceptual' variation. In his definition, conceptual collaboration "occurs when people work together to devise concepts, ideas, themes, metaphors, analogies, and so on that frame the overarching goal of the collaboration" (55). In contrast,

> technical collaboration is not unlike the key that fits into the lock; it's the way people physically represent the conceptual aspects of the task at hand. . . . Technical collaboration involves people with complementary skills bringing them to bear on a specific task.
>
> *Schrage, 1995, pp. 55–56*

In Schrage's terms, the authors developed a relationship based on conceptual collaboration with high levels of shared communication and interest combined with overlapping levels of expertise.[2]

More recently, Harder, Burford and Hoover (2013, p. 45, Table 1) have offered a "typology of relationships of participation". These authors use participation rather than collaboration as the organising term, but their understanding of participation shares much with what other researchers have studied under the rubric of collaboration. Nevertheless, in this typology, the collaborators for this chapter worked in the modes described by Harder, Burford and Hoover as "learning together" and "learning as one" (ibid., p.44 and examples on p. 45, Table 1). The most significant difference between these two categories is the retention of individual responsibilities and authorship, as well as variations in power relationships: conditions where power might not be evenly distributed (Level 3) versus participation marked by consensus, shared common goals and no power differences in the decision-making process (Level 4); and interaction (Level 3) versus full partnership (Level 4). Within this typology, the authors' interdisciplinary collaboration shares characteristics of Level 3 and Level 4 with some shift over time.

Klein (1990, 2004) and Lattuca (2001) provide expansive definitions of interdisciplinarity and related concepts of multidisciplinarity and transdisciplinarity, as well as summaries of the ways thinking and working across disciplines can be marked by communication challenges and clashes in competing paradigms. These are synthesised in Table 26.1 in terms of differences in communication and collaboration structures problem orientation, modes of knowledge production and collaboration outcomes, and impacts on participants. Similar to the typology of relationships of participation, the authors locate most of our experiences within the interdisciplinarity collaboration column, with some examples of transdisciplinarity such as creating new language and logic to enable genuine dialogue, iterative problem setting responsive to emergent ideas, and knowledge fusion characterised by critical reflection.

Table 26.1 Summarising differences in multidisciplinary, interdisciplinary and transdisciplinary collaboration

Multidisciplinarity	*Interdisciplinarity*	*Transdisciplinarity*
• Joining together of disciplines to work on common problems • Divide and conquer approach, split apart when work is completed • Common ground assumed to exist	• Joining together of disciplines to work on or identify common problems • Close collaboration and development of common ground • Work to overcome problems created by disciplinary and paradigmatic differences	• Beyond interdisciplinary combinations to new understandings of relationships between science and society • Participatory, close and continuous dialogue • Elaboration of new language, logic and concepts that permit genuine dialogue
• Thematic projects where several disciplines contribute to a theme or expand an application of a framework	• Pragmatic problem solving or philosophical enterprise	• Problem setting and collectively formulating problems in highly heterogeneous environments including the experiences of affected persons
• Juxtaposition of perspectives as separate voices with emphasis on adding breadth without impacting status quo • No new knowledge across disciplines created	• Integrative synthesis, holistic mixing of perspectives and renegotiation of frameworks • Interaction generates new interdisciplinary knowledge	• Integrative and action-oriented transformation that transcends disciplinary views through an overarching synthesis • Knowledge fusion characterised by critical reflection
• Retain disciplinary identity	• Involves some learning of other discipline and critical reflection	• Beyond either/or thinking

Source: Adams et al., 2013

Instigation

The method of interdisciplinary collaboration co-evolved with a critique of design conversations within a case of learning/teaching context as presented in a national public television series. Airing three seasons from 2007 to 2011 with 36 episodes, *Design Squad* was a PBS[3] educational series devoted to promoting engineering to middle-school and high-school students.[4] The show was motivated by a perceived need in the US for positive role models in STEM (Science, Technology, Engineering and Math) fields and a clearer account of the role of engineering in society. According to the PBS website, *Design Squad* specifically aimed to increase students' knowledge of engineering and the design process, to improve the public image of engineering and to encourage further exploration.

Each episode in the original series was organised around an assigned engineering and design problem. The contestants were divided into two groups of four (season 1) or three (seasons 2 and 3) teenagers and given basic instructions in order to solve their tasks. A significant component of the early *Design Squad* was competition for a college scholarship. The competition aspect was designed to motivate participants, tie participation to material outcomes and create a sense of drama for viewers in the style of reality television (Cheng, 2008). The combination of hands-on demonstrations, engineering principles and interpersonal dynamics made the episodes both engaging and entertaining.

Gravitation to *Design Squad* as an object of study was motivated by a combination of qualities. Its pre-disciplinary focus on design in the engineering context was an opportunity to experience pre-college students learning what design means at the same time they were learning to do design. The use of engineering and design skills towards a multiplicity of diverse problems, instead of focused technical applications towards specific solutions, offered room for creativity, innovation and interdisciplinarity. Also, each episode involved a real client seeking help to address a particular need. We hypothesised that collaboration and communication as exercised in the series demonstrated creative practical solutions formed through debate, rather than repeated textbook single solutions.

Additionally, several design problems from the first two seasons reveal an interest in connecting engineering and aesthetic awareness on some level, as already implied by episode titles, such as: "Cardboard Furniture" (Episode 201), "Water Dancing" (Episode 205), "Blowin' in the Wind" (Episode 111), "Bodies Electric" (Episode 112) and "Functional Fashion" (Episode 108). This combination of an educational focus on engineering *and* artistic strategies was a good fit for our own combination of interdisciplinarity as researchers, and for the questions we wanted to investigate. Finally, as a publicly available instance of articulated and exposed design thinking, *Design Squad* as a case allows anyone reading this chapter to follow the process and engage with the same data discussed in the text.

Design Squad proved to be even more important than we anticipated. As Figures 26.2 and 26.3 illustrate, far beyond the content it provided, *Design Squad* became the research catalyst, as well as a pivot between reflection and critique. From the outset, we realised that our individual ideas of interdisciplinary work were so embodied in our actions that they would be difficult to articulate – to our audience, and even to ourselves. We needed a way to perform our interdisciplinarity in order to 'see' it, share it, and only then, derive a framework of analysis for a broader audience. The language of object, artifact and material culture connected us from the beginning and eventually led to the identification of an *elicitation object* – an artifact, a shared experience that could be used to reveal our individual perspectives, share and manipulate perspectives and explore a collective view – as a method. This idea of an elicitation object is similar to the photo elicitation technique (Harper, 2002) used in qualitative social science

Figure 26.2 The dual perspective coalescing around *Design Squad*

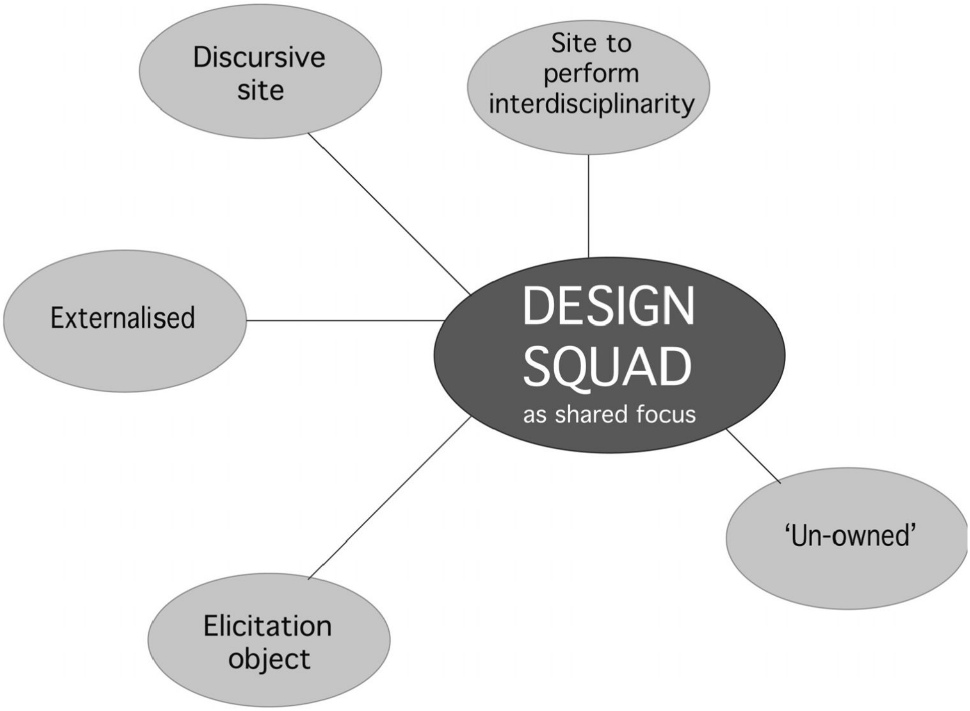

Figure 26.3 *Design Squad* provided a shared focus and was a multi-purpose object

research for investigating social phenomenon (Clark-Ibáñez, 2004), culture (Collier, 1967) and depicting experience (Carlsson, 2001).

Through continued engagement with the content and structure of *Design Squad*, our evolution in understanding the role of objects in creating the conditions for interdisciplinarity was a journey from communication (sharing our perspectives) to engagement (interrogating our perspectives) to discovery (naming collective perspectives) to transformation (synthesising perspectives).[5] Along the way, we also came to realise the value of using an external object that did not belong to any discipline or any individual collaborator. In our own words, we came to realise: "the artifact took the heat of any conflict – mediating the internal processes – it was an external object to us – allowed us to all look at it."

Further still, *Design Squad* was more than an artifact for eliciting perspectives. It became a location, a 'locus of our discussion', creating the conditions for a collective inquiry into the nature of interdisciplinary work: "a place to initiate questions – a way to emphasize the emergent nature of this work."

Short list and *Design Squad I*

This section highlights the tentative and collective conclusions we reached regarding interdisciplinary design research mediated by our own efforts to collaboratively critique a designed exercise in the form of a public media presentation on the subject of design.

Our intent was to focus on the collaborative and interdisciplinary aspects of a single episode in order to reveal exemplary and counterproductive moments of design discourse. We also took into account behind-the-scenes editing and production of the project, but limited our critique to what was made available on screen. We individually watched many many episodes then discussed six collectively identified candidates for further analysis. Thus, the first frameworks of observation were individual. Through discussion we settled on a particular episode, which we watched together. In this viewing we derived criteria and then had one final viewing in which we were able to describe the specific moments of potential interdisciplinary intervention and discovered a shared language for our observations. Much of our task of documentation revolved around translating, defining and categorising the conversations that took place.

We chose "Bodies Electric" (Episode 112) as our object of study based on what we individually perceived and collectively agreed as its high discursive potential related to its technologically multi-modal and aesthetically multi-sensory dimensions. In this episode, the client, a hip-hop dancer and choreographer, asked the *Design Squad* crews to create a sound and light show with an 'engineering twist'. The client taught the participants the choreography, and the hosts explained that the participants would use computer programming and sensor technology triggered by the 'moves and grooves' of the client's choreography. The sound sensor technology involved four sensors placed on the dance floor that when stepped on triggered one of four sound files that the teams also had to design. The light sensor technology involved sensors placed at different locations on a dancer's arms to control the intensity of six stage lights. Both crews were provided with access to a computer programmer to help program the sensors.

The intention was for the sound and light design to complement the choreography and contribute to the overall aesthetics of the performance through the creative combination and sequencing of the sensors. The winner of the competition would be selected based on the most creative sound and light show and be featured in the actual performance. A unique aspect of this episode is that participants used their bodies to both understand the technology and iteratively develop and test ideas. Being selected as the winner of this episode played a significant role in identifying the final two participants that would compete for the college scholarship in the next, and final, episode.

Collaborative inquiry and method

From the initial choice of the research subject as pedagogic demonstrations of design thinking, our task as interdisciplinary research collaborators doubled to include: a critique of our object of study, "Bodies Electric" and defining our own deliberative process that generated the criteria of judgement. Unlike discipline-focused design critiques, such as in an architectural studio, this critique of the *Design Squad* episode involved three different interdisciplinary approaches and as such, demanded agreement about necessary factors that would permit a shared critique.

While the research was not directed by a specific disciplinary methodology, it was informed by a shared investment in exceeding normative definitions of any particular discipline. Within our respective disciplines, or disciplinary combinations, we are motivated by discussions that address the indeterminacy of disciplinary practice despite disciplinary logic. The need to account for subjective and existential conditions as necessary, but not sufficient conditions of collaborative design research, arose out of the difficulty to apply any standard research methodology. The necessary lack of methodological determinism that risks being viewed as academic irresponsibility, we hoped, could be circumvented by our detailed and deliberate documentation of an emergent process of discovery. The documentation thus becomes a proxy for disciplinary standards of methodology that an interdisciplinary collaborative project must necessarily subvert in an effort to avoid the dominance of any single discipline.

Indeed, we are arguing against the application of disciplinary logic to collaborative projects as a necessary condition for an open exploration of divergent views in regards to a specific event or object. This argument has been informed by the ideas about interdisciplinarity and transdisciplinarity in Table 26.1 and contemporary discussions related to Actor Network Theory (Latour, 2007), Object Oriented Ontologies (Bogost, 2012; Bryant, 2011; Harman, 2005; Morton, 2013) and New Materialisms and Material Vitalism (Bennett, 2010). In particular, the new materialist concepts of imminence, emergence and transversality (Manuel DeLanda and Rosi Braidotti; see Dolphijn and Tuin, 2012) and Karen Barad's call for a "performative understanding, which shifts the focus from linguistic representations to discursive practices" were influential (Barad, 2003, p. 23). For example, in "Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter" Barad (2003) writes, "Material conditions matter, not because they 'support' particular discourses that are the actual generative factors in the formation of bodies but rather because matter comes to matter through the iterative intra-activity of the world and its becoming" (ibid.). This notion of iterative intra-activity as performative understanding shapes our methodology. In contrast to applying a linguistic representation of an abstracted pattern of understanding based on a given discipline, our discursive practice emerges out of shared questions. In this way there is no separation of theory and practice. As such, we articulate the personal, social and environmental conditions that generated this collaborative performance of learning and its resulting use in the critique of a *Design Squad* episode.

Through the sense of flocking towards understanding despite a series of oblique turns, we found three necessary conditions present during each instance of convergence and consequent interdisciplinary and collaborative inquiry as: personal, social and environmental (Table 26.2).[6]

Personal

A commitment to learning that permits and honours openness to conceptual failure and emergence defined the personal investment each participant brought to the project. Our conversations demonstrated individual flexibility to change definitions and parameters that hinder collaboration and co-existing frames of reference. Our learning process would have been truncated had we insisted on our own professional positions. The personal was significant in the way that it allowed our individual stories and struggles of trying to practice interdisciplinarity within institutional settings that often discourage such practices in a number of ways. Attending to the personal or individual also allowed us to express interdisciplinarity not as a certitude, but as an evolving identity, one that could become more clear through discursive engagement. Important to the scholarship here is the way that such conversation prevented unspoken

Table 26.2 Summarising the three necessary conditions present during each instance of convergence and consequent interdisciplinary and collaborative inquiry

Conditions for interdisciplinary collaborative inquiry		
Personal	*Social*	*Physical*
• Risk conceptual failure • Embrace ambiguity • Demonstrate intellectual courage • Explore the tension between disciplinarity and interdisciplinarity • Be open to emergence and experimentation	• Practice tolerance for what may seem arbitrary or divergent • Honour multiple perspectives and help them co-exist • Engage in translational work – continually	• Liberation from disciplinary and departmental space • Play space • Multi-functional and flexible space • Integration of personal and professional

assumptions and initiated a process of ongoing revision and the potential for transformative learning (Mezirow, 2000). The personal was not often attended to in *Design Squad* and we only saw the moments when interpersonal conflict could no longer be ignored and a crisis emerged. An essential aspect of our experience was ensuring each voice was heard and given equal space, particularly if there was conflict.

Social

We have a common understanding of design as a social process. Objects themselves are social and are an integral part of encountering and challenging disciplinary perspectives in creating shared meaning and ownership. Creating the social condition required a constant process of translation in which contributions from individual members were interrogated and subsequently reformulated until it made sense to each of us. Each instance of disciplinary jargon was distilled to a recognisable form for all of us. Seemingly random references and divergent views (see Figure 26.1) are actually representative of the translation process. The struggle for interdisciplinary communication is time-consuming, requires tolerance of ambiguity and an ongoing negotiation of responsibility. But, what might appear initially as fragmentation is actually the sweeping away of disciplinary assumptions and the materialisation of a collaborative project where multiple perspectives co-exist.

Environmental

Environment and context can enable or hinder conditions for collaborative conversation. Choosing informal spaces, unclaimed by any particular department, means strict disciplinary perspectives and rules can be avoided. The location of our conversations was not accidental, but rather represents the personal and professional investment in the project. We sought spaces conducive to conversation beyond campus, our offices or departments. These became learning environments that could evolve with the ever-changing nature of our experience.

Design Squad II

Once the above conditions for our own collaborative interdisciplinarity were recognised through interaction with one another and with the shared object of *Design Squad*, we were subsequently able to revisit the "Bodies Electric" episode utilising the conditions as a method of inquiry. Table 26.3 summarises the findings of our second collective viewing, which are discussed in more detail below. Simply stated, we were able to identify key moments and mechanisms that communicated a disciplinary, rather than an interdisciplinary, perspective. As a result, we were then able to articulate concrete sites for intervention.

Our recommendations for increasing interdisciplinary exchange in *Design Squad* encompass three major areas of intervention. First, we encourage a greater emphasis on *making* as inherently meaningful through defined deliberation. This immediate and documented engagement can counter assigned roles based on conception-production divisions resulting in separation between client, expert, teams, team members, competitors and coaches. Second, a parallel emphasis on technical and aesthetic strategies would articulate the interdependence of form, material, technology and function. And third, diminishing the urgency of competition would allow risk taking, failure, fruitful tangents and 'intentional serendipity'.[7] By inviting conflicting motivations (competitor, maker, user, teacher), competing methods (technological, aesthetic) and uncertain results, these interventions impart a critical and creative potential on design – beyond disciplinary, functional and teleological logic.

Co-emphasise technical and aesthetic strategies

Our first recommendation reinforces the emphasis on relations (instead of role-playing) whereby equivalent attention to aesthetic *and* functional issues is developed through demonstration and explanation. For example, in addition to technology, science or material animated videos there should also be aesthetic interjections that explain the functional implications of aesthetic strategies.[8] Another example of a critical intervention would be to articulate the question one team member asked regarding timed versus responsive effects of a light design for the interactive dancework developed in "Bodies Electric". "Why not have all the effects timed?" asked the participant. This same question directly relates to another comment about the potential for technology to give the dancer more control of the stage. A full exploration of these questions together would investigate not only the technological, but also the aesthetic logic of the piece.

The design squad exercise lacked clear communication of design intent and method. An understanding of technology and art with the common root of Heideggarian *techne* is lost in the separation of design intent and construction.[9] By articulating the way a tool or a shape emerges, we can tell a specific story of design practice fueled by immediate resolutions rather than universal ideals.

Emphasise making *and* meaning through deliberation and critique

Our second recommendation addresses the articulation of design motivation beyond the initial conceptualisation through conversation. We defined design as a process of meaningful, intentional, deliberate making that emerges out of shared practical and symbolic desire. Our efforts to communicate interdisciplinary and collaborative approaches to making aim to support the essential core of design as creative social agency. As such, we recommend exposing the relationships with clients, team members, experts, coaches and other teams as a condition of creative exploration that exceeds prescribed roles of production – one reinforced by the team

Table 26.3 Application of conditions and criteria to design conversations in *Design Squad*

Design Squad ("Bodies Electric") Final discussion			
Interventions	*Key moments*	*Significance*	*Recommendations*
Co-emphasise technical and aesthetic strategies	8:09 – Tech animations, but no equivalent explanation of implications for aesthetic choices. 11:03 – Tech expert in the room, but no one with musical, choreographic or new media art knowledge.	Aesthetic strategies are an integral part of the innovation process, not merely decorative.	1. Include technical and aesthetic experts in all phases of design. 2. Give equivalent attention to the implications of design choices in both areas.
Emphasise making *and* meaning	4:36 – Sound and light show to *accompany* dance 10:17 – "We're turning this dancer to control stage effect"	Articulate motivations intention of each aesthetic and technical decision as deliberate meaning construction.	Deliberate and critique with: – 'clients' – team members – other team – design coaches and experts
De-emphasise competition	6:47 – "How many sounds can we make?" 12:15 – "Even Playing Ground" 15:38 – "This is creative"	While it can be motivating for some, too much emphasis on competition can discourage experimentation and create the fear of failure.	1. Balance competition as individuals with collaboration as groups. 2. Push boundaries of disciplinary acceptability. 3. Make the *process* of designing itself an end goal.

metaphor. The division of labour model and assembly line processing follows a hierarchical logic that separates conceptualising and producing. Furthermore, it perpetuates the 'role' of aesthetics as decorative and supplemental. In order to subvert these marginalising tendencies we need critical conversation that ensures multiple competing perspectives.

For example, throughout the episode we find comments like "art with a technological twist" or identifying multiple technologies (electrical engineering and computer programming) as 'creative'.[10] We also witness moments where the participants begin to show awareness of the potential aesthetic empowerment technology can promote.[11] We found these moments saturated with deliberative potential that could share and voice design choices had it only been recognised.

De-emphasise competition

Our third recommendation aims to nurture the spirit of experimentation and reduce the fear of failure. The personal motivation to win and earn a college scholarship, we feel, may account for the cautious attitude of the teams. They seemed less willing to ask questions, follow curiosity or play with aesthetic choices or technological tools.[12] Of course we recognise the time constraint that artificially fuelled the urgency of the projects, however, in order to permit the convergence of collaborative conflict, there needs to be time and space for failure.[13] The need to recover from assigned incentives would prompt creative and critical reevaluation of motivations and assumptions. Providing more space (conceptual and structural) to explore solutions, the projects can balance the competition as individuals and collaboration as groups. By questioning assumptions the teams could push boundaries of disciplinary acceptability. Consistent with our first two recommendations of intentional meaning-making and creative practice, the third recommendation to de-emphasise competition aspires to make the *process* of making itself an end goal.

Debrief

Our assessment of the *Design Squad* episode "Bodies Electric" did not include a critique based on our derivation of personal, social and physical conditions for engaging in interdisciplinary and collaborative research. The structure of teamwork, personal achievement, client-focused problem-solving emphasised in the televised competition, we felt, did not meet the conditions of interdisciplinary and collaborative research defined by self-aware engagement with other experts that is as subjective as it is objective, as internal as it is external. In *Design Squad*, learning was measured by external objective criteria of clients, function and application of engineering principles. Hence the sore lack of aesthetic agency. Interdisciplinary and collaborative learning, we found, involved a willingness to encounter uncertainty, divergent interpretations and diminished ownership. Composing the interdisciplinary critique of *Design Squad* was easy compared to the challenge of sustaining our own collaborative learning throughout the process. The process required each of us to individually grapple with issues of pushing disciplinary boundaries, encouraging serendipity, discovering an enchanting depth of things and enduring the indeterminacy of collective action.

Our conceptualisation of 'conditions for interdisciplinary collaboration' emerged and took shape through this documented exploration, resulting in a shared framework for communicating our perspective on interdisciplinary design research. While we reject any claim that there could be a universal portable template for interdisciplinary design research – research methods will reflect the particularities of the interdisciplinary combination – we argue that our experience has yielded a learning process that can produce an interdisciplinary way of thinking and communicating that can serve as a starting point for others. What we offer is a provisional malleable method of collaborative inquiry for analysing communication moments and learning environments for their effectiveness in producing conditions for interdisciplinary design, and more importantly for their ability to create or hinder interdisciplinary design thinking or making more generally. To summarise and reiterate, the framework that we ultimately agreed upon was derived through two intimately linked processes:

1) A self-aware development of our own interdisciplinary collaboration in the pursuit of creating this chapter, which informed;
2) Our observation, interpretation and analysis of the model of design presented in the episode of *Design Squad* that we collectively viewed and treated as data.

At the risk of seemingly diminished disciplinary rigour and consequent disciplinary isolation, why engage in collaborative and interdisciplinary research? It is worth it precisely because interdisciplinary research involves academic, personal and social risk, failure, exposure and chance. When we confront uncertain questions collaboratively, we become willing to be ‘wrong’ together, to experiment, to translate, to subvert and to critically contradict comforts of normative discourse. Collaborative research gives us intellectual courage by investing in our peers as our creative critical collaborators, not our competitive rivals. The academic culture that rewards individual authorship at the expense of collaboration extinguishes the kind of curiosity able to exceed the comfort of incremental shifts. While this chapter has offered a critique of *Design Squad* as our object of study, it was more importantly a reminder of the forgotten joy of discovery possible in an academic community released by a shared jump into uncertain multidisciplinary terrain.

Notes

1 See, for example, the work of Anthony Dunne and Fiona Raby (see www.dunneandraby.co.uk/content/project; and also Dunne and Raby 2001, 2013) on critical design or the design events of Jerzsy Seymour (see www.jerszyseymour.com).

2 Zhang and Candy (2006) discuss how art and technology collaboration vary based on levels of shared communication, expertise and interest among art-technology collaborations at COSTART. This name, which derives from Computer Support for Artists, already points to the way collaboration is conceived by this organisation.

3 PBS stands for Public Broadcasting System, a network of public television stations across the US.

4 While *Design Squad* is no longer airing new episodes as a television show, the website (http://pbskids.org/designsquad/) and related facebook page (www.facebook.com/DesignSquadNation) are maintained. Beginning in January 2011, *Design Squad* was superseded by *Design Squad Nation*, which utilised a different format to address the same goals. *Design Squad Nation* ran one season for ten episodes.

5 An early indicator of the success of using objects to support personal and social learning is evident in the reflection shared by Lisa Banu on 25 January:

> process of explaining, I get more reflexive, more deliberate – as the quality that is really neat about interdisciplinary, collaborative work – clarify my terms, figure out what is at stake here. This is what I am about, I don’t get what you are doing . . . help me.

6 The structure has similarities with Felix Guattari’s mental, social and spatial spheres articulated as Ecosophy (Guattari, 2000).

7 Used to name the ways interdisciplinary professionals created the conditions for luck and chance in their ability to find collaborators in engineering education research. See Allendoerfer et al (2007) and Barley (2001).

8 At several points in the episode, the show producers interject explanatory animations that illuminate an engineering principle or engineering knowledge implied in design choices made by the participants.

However, at no point, are artistic strategies illuminated as such. The relationship between form and function is never explicitly addressed and effectively left unquestioned. Highlighting engineering as technology, while backgrounding engineering as a combination of technological and aesthetic strategies makes the latter seem incidental.

8:09 Tech animations, yet no animations explaining aesthetic implications
11:03 Technological expertise available yet no dancer in the room
13:22 No need for sound every step
17:59 Timed versus programmed light–sound effects

9 Martin Heidegger offers a poetic concept of *techne* in *The Question Concerning Technology* (1977) and *The Origin of the Work of Art* (197).

10 2:36 Jackson is introduced as a client aiming for "art with a technological twist" and 4:36 Sound and light show to *accompany* dance.

11 10:17 "We're turning this dancer to control stage effect".

12 6:47 "How many sounds can we make?"
12:15 "Even Playing Ground"
15:38 "This is creative"

13 For example in another PBS show, Fetch with Ruff Ruffman participants are given points for effort and creativity.

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27

DEPICTION AS THEORY AND WRITING BY PRACTICE

The design process of a written thesis

Mark Roxburgh

Introduction

Most design academics I have met, over my 20-year career in academia, could readily provide anecdotal accounts of the frustration they and their students feel in trying to reconcile their experience of their design practice and the academic requirements to write. I share those frustrations. During the past 15 to 20 years of my research I have frequently looked for concrete visual examples of techniques that would help reconcile the inclination to work visually with the process of writing, only to be disappointed that little existed. The majority of the growing body of published material, on the disjuncture between creative visual practices and writing, are predominantly text-based explications of the 'problem', its history and causes, strategies for resistance, or responses to harness and/or overcome it – sometimes with a few images thrown in for good measure. This literature is emblematic of the crucial yet nascent maturation of the design discipline within the academy and there is much that is good, rebellious, re-assuring or instructive contained within it. Although there is still resistance at the fringes there is a consensus emerging that writing is good for creative practitioners.

In this chapter I will first cover some of the existing literature concerning this topic then cover some of the techniques I have developed through my own research and practice to help me develop my writing. I should point out that I am not claiming my approach is the only way of tackling this issue. Rather I am offering it as an exemplar that might help others find their own way by adapting what resonates and ignoring what doesn't. It is also my intention, in providing these exemplars, to articulate the epistemological and ontological consequences of the kind of hybrid approach that emerged through my practice and is indicative of a broader trend in design research. The initial impetus for the work, that I will present, developed through my teaching but gathered momentum upon the commencement of my doctoral studies in 2004. What I discovered through the process is that by being methodical in developing my writing practice – in much the same way as I was already methodical in my design practice – producing my thesis (Roxburgh 2013a) became more like an embodied exercise in design than an alien and abstract exercise in writing.

But why do we have to write when we just wanna make stuff?

The literature exploring the vexed relationship between academic writing and creative arts and design practice covers two key areas. There is literature that problematises the relationship and sees it as a consequence of a lack of student interest or ability versus institutional requirements. Much of this literature either provides evidence of the extent or experience of the problem and/or articulates strategies for overcoming it (Bhagat and O'Neill 2009; Collinson 2005; Edwards 2004; Grow 1994; Hockey 2007; Lyon, 2009). Alongside this is literature that seeks to highlight the various personal, cultural, historical or institutional contexts and causes that have lead to the problem arising (Candlin 2000; Elkins 2004; Hockey 2007; Kill 2006; Melles and Lockheart 2012; Wood 1998).

The main theme that emerges throughout the literature is the almost universal frustration, at best, or resistance, at worst, that art and design students feel towards 'academic' writing. The key reason for this is that students who undertake tertiary studies in these fields privilege intuitive thinking and are poorly equipped with the kind of analytical thinking typically required for academic writing (Apps and Mamchur 2009). Although not consistently noted, there is some literature that suggests that this intuitive approach is a consequence of the visual learning styles of art and design students. Collinson notes this kind of learning is both emotional and intuitive (2005: 716–717); Lockheart et al. (2004: 97) discuss it in terms of visual-spatial learning styles as does Yee (2012: 471); Irwin calls it aesthetic knowing (2003: 63); McCannon calls it tacit knowledge (2011: 133); and Edwards and Woolf (2007: 55) and Grow (1994) refer to it as visual thinking. Without getting into a detailed discussion of the similarities and differences between the various terms used, in essence what they all have in common is the idea that learning of this sort occurs largely through doing and looking, rather than reading and listening and that visual-spatial learners "tend to think in pictures rather than words" (Yee 2012: 471). This is known as kinaesthetic learning within the field of constructivist learning theory. It is not surprising then that the vast majority of the available literature that deals with the challenges of teaching creative arts and design students how to write is focused on the explication and efficacy of techniques used to assist such students to develop appropriate writing skills.

A common feature of this literature is the success of taking a student-centred approach by using their studio practice as the starting point for research and writing, and finding or developing forms of writing that better parallel the creative process (Apps and Mamchur 2009; Edwards 2004; Kill 2006; Lyon 2009). In addition to this is literature that describes particular exercises or workshops that students undertake to develop the structure and content of their writing (Apps and Mamchur 2009; Bhagat and O'Neill 2009; Charlton 2008; Edwards 2004; Jones 2007; McCannon 2011; Roxburgh and Sweetapple 2007). There are certainly a number of published papers that include examples of experimental or hybrid visual/written texts (Bill 2010; Charlton 2008; Ingham 2012; Leahy 2009; Pollard et al. 2009; Speed 2007; Webb 2009; Yee 2012) but more often than not these are final outcomes of the process not examples of the specific techniques that lead to them. There are exceptions (Edwards 2004; Roxburgh and Sweetapple 2007; Yee 2003 and 2012) and these papers include graphics, diagrams, photographs, and/or text-based writing task briefs, all of which are concrete examples of techniques used to develop writing skills amongst visual practitioners. However, almost without exception the majority of the available literature relies heavily on narrative description of the techniques used and rarely do actual visual examples appear to any significant extent. Perhaps this in itself is a consequence of the need for researchers to conform to more conventional academic modes of communication in order to be published. Nonetheless it strikes me as paradoxical that the very thing that is being discussed in the literature, the use of visual techniques to help with academic writing, is not very prevalent.

Mapping the research process

Hockey (2007: 161–162) notes that there is considerable reluctance, amongst creative art and design students, to systematically document and reflect upon their research and creative processes when conducting higher degree research. Prior to my candidature, I had been developing the systematic use of mapping techniques to help design students conduct research for design concept and project development as well as to communicate research findings (Roxburgh and Bremner 1999 and 2001). These techniques were further developed – using the work of Buzan and Buzan (2000[1993]) and constructivist learning educators Hyerle (1996) and Sinatra (2000, Sinatra et al. 1990a and b) – to help design students analyse academic readings and construct written arguments in their theory studies (Roxburgh and Sweetapple 2007). So when I was advised in the early stages of my PhD studies that I needed to 'map my research' and insights, to keep track of it all, the concept of mapping resonated with me. This advice was of course metaphorical and could have as easily been 'make detailed notes' or 'keep good records' but the use of the mapping metaphor encouraged me to use my own studies to further develop the techniques I had been developing with my undergraduate students.

Many design academics are aware of and have used the mind-mapping techniques developed by Buzan and Buzan (2000[1993]). Edwards notes that mind-maps are popular in design education and typically get used in 'brainstorming' sessions as part of the design process (2004: 124). The purpose of such sessions is to get a large number of interrelated ideas down, in map form, for later reflection and refinement. Buzan and Buzan's work is also a feature of some of the literature concerning techniques to help creative art and design students write (Jones 2007; Lockheart et al. 2004; Roxburgh and Sweetapple 2007; Yee 2003). This is perhaps not surprising given the graphic, hands on, and apparently creative nature of this mapping process and its capacity to help with the analysis of ideas through reflection. In addition, their radiant structure facilitates the generation of related ideas in contrast to lists that Buzan and Buzan argue disassociate "each idea from its context" and "act in direct opposition to the associative nature of the brain" (2000[1993]: 86). The Buzan mind-mapping approach also seems attractive to help teach creative art and design students the skills of logical argumentation required in academic writing, given that their underlying structure is premised on hierarchy and categorisation. However, Kokotovitch argues the hierarchical structuring of these maps, whilst useful in the design process, proves problematic as they fail to describe the often "complex symbiotic relationships between issues" (2008: 55). Whilst Kokotovitch's argument is made within the context of their utility in the design process, and I concur with it, I am of the view that they are useful for conventional academic writing, more than other forms of written expression, given its hierarchical structure.

Alternatively both Hyerle (1996) and Sinatra (2000, Sinatra et al. 1990a and b) have developed various mapping techniques that not only parallel different cognitive processes – stream of consciousness, analytical thinking, hierarchical thinking etc. – but relate to different styles or genres of writing: for example, research report writing, creative composition, argumentative writing, comparative analysis, factual recounts, reviews, etc. In this regard they provide a wider range of techniques than the very singular approach of Buzan and Buzan. It is for this reason that, in my undergraduate teaching, I drew on all of these approaches, as my primary concern was to get design students to write in the first place, let alone write an academic essay. However, what Hyerle, Sinatra, and Buzan and Buzan share is a fairly prescriptive approach to the use of their various mapping techniques. In my undergraduate teaching I have advocated experimentation with, and adaptation of, the various methods, rather than adhering to set guidelines, including the use and/or analysis of images in map form (Roxburgh and Sweetapple 2007). Drawing upon this background then, I constructed 138 maps, during my candidature, which tracked various ideas, references, insights, creative projects, and photographic images. In doing this I did not follow any particular technique rigidly, rather I adapted aspects of the techniques I used with my students into the development of my own approach. In addition to creating these maps I also used a variety of mapping techniques to assist me in the drafting of my thesis, and the conception, execution, and reflection upon my practice-based research.

My desire not to be prescriptive in how I mapped was instinctive but Kokotovitch's research (2008) indicates that user-created, as opposed to the pre-determined structures typical of Buzans' mind-mapping, results in more complex relationships between issues emerging, whilst Yin et al. (2005) have demonstrated that they better reveal the users knowledge, or misunderstandings, of a topic area and related issues. In this vein Yee, for example, advocates a participatory process in developing literature maps and although she establishes the structural features and contextual links within them they are open to modification by other participants in order to "provide a more holistic view of the research inquiry" (2003: 8). Like Yin and Kokotovitch, Yee also argues that a less rigid and prescribed approach to mapping is more appropriate in the development of design knowledge (2012: 471–477). "Mapping knowledge", Yee argues, "through images, graphics and diagrams is essentially a way of envisaging information" that is ideally suited for the visual-spatial and intuitive manner in which designers learn and think (ibid.: 471). The apparent methodological flexibility, some might argue impurity, that these approaches exemplify is typical of research as a form of bricolage that has traction in the design research community. Louridas (1999), in drawing upon the work of Levi-Strauss, argues that design is a form of bricolage because of the pragmatic, contingent, adaptive, and pluralistic nature of its practice. Yee argues that research based upon the concept of bricolage allows researchers to "deploy available and established strategies and methods" but more significantly "grant them licence to create new tools and techniques" (2012: 464). Furthermore, she argues that the "multi-perspectival and interdisciplinary characteristics of bricolage lend itself well to the nature of design questions" (ibid.).

Louridas notes that the designer, as bricoluer, typically works through and with various forms of diagrams – "two-dimensional models, free-hand sketches, depictions of relationships, of flows, of structures" – and that such diagrams are *the* object of design that are eventually translated into a "real world object later on" (1999: 527–528). The mapping and visualisation strategies that I have used in developing my writing, and that is a feature of the relevant literature, parallel these processes. In design practice these visualisations form the basis of the designed object whereas in design writing the visualistaions form the basis of designed writing. The key point that needs to be made here is the manner in which the visual becomes the basis for the development of knowledge, even though words may be a part of the 'data' encompassed into such maps. This points to what Stafford (1997) calls a visual epistemology; the significance of which is not so much that the visual-spatial relationships that can be identified within such maps parallel the manner in which designers often think, nor that their use parallels their use in design practice. The key significance is that it points to design and design thinking being a fundamentally perceptual activity, rather than a problem solving one. I will revisit this issue in more detail a bit later but for now I will turn to an analysis of the specific techniques I developed through my research, all of which use some form of mapping.

Recursive writing

I have always preferred to learn through doing and looking. Reading academic texts and writing analytically, in essay form, has been a struggle for me. I have a hopeless recall of the content of academic texts that in turn makes it difficult to write about them. It wasn't until 2000, when I came across Gardner's (1983) concept of multiple intelligences – that includes bodily-kinaesthetic intelligence – and Kolb's (1984) learning style theory – that defines learning through feeling and doing as accommodating – that I understood that I had a preference for kinaesthetic learning. Given the scale of reading and writing that lay before me at the outset of my PhD, and knowing how poor my recall of academic texts was, I developed a somewhat convoluted strategy of note taking that was quite tactile and embodied. Over a period of 12 months I developed and refined this process, that I now call recursive writing. Recursion is a process of repeating things in a self-similar manner, usually ad-infinitum. In the context of my research, what this meant was that I manually wrote much of what I read, or my reflections upon it, in longhand form and then subsequently reworked my notes through a number of somewhat reductive iterations (Figure 27.1).

As slow as this was, I found that longhand helped my recall of what I read because I had the sense of 'doing' writing. This is not entirely unusual and there is some evidence that creative practitioners find that the tactile quality of making notes by hand reinforces the idea that handwriting is "a form of visual expression" (Preston and Thomassen 2010: 49). I deliberately avoided word-processing my initial notes, as this did not entail the same tactile experience as handwriting did. Nor did I use a pen scanner to record relevant quotes, as some of my peers were doing, for the same reason.

Initially my notes involved the paraphrasing or transcription of key themes in the literature relevant to my work. The almost rote learning that this largely mechanical approach entailed was not unlike what I have previously called the 'mimicry of action' which "can be equated to ones technical virtuosity in being able to mimic pre-existing styles" (Roxburgh and Bremner 2001: 67). Such mimicry is typical in the learning of novice designers and can be seen as an embodied way of learning how a variety of structural and stylistic aspects of a design do or do not work together. In the context of being a novice writer there are strong parallels to the structural and stylistic aspects of language that also can be understood through such mimicry. To make these notes more accessible for the word processing that writing my thesis would entail, I re-transcribed them into one single word processing document that would house my entire literature review. Again, this reinforced my understanding of the material. Much of this material existed in a state of 'raw data' not unlike that collected by novice design researchers in that there wasn't much evidence of my own critical thinking or insight. It was through a further stage of recursion, which entailed printing out each literature review and mapping it into an A2 sketchpad, that deeper insight into the material occurred.

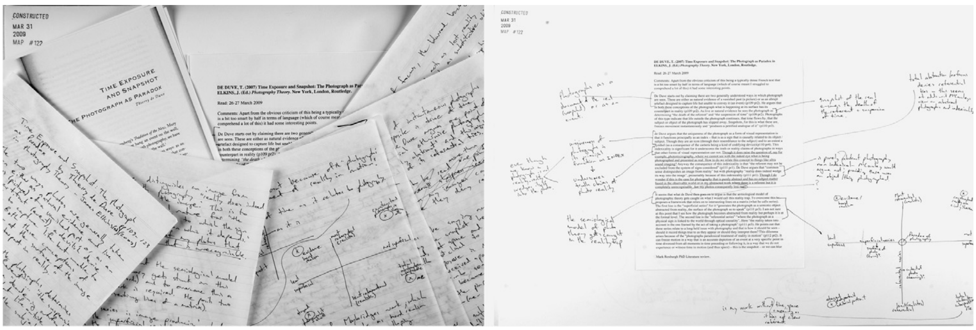


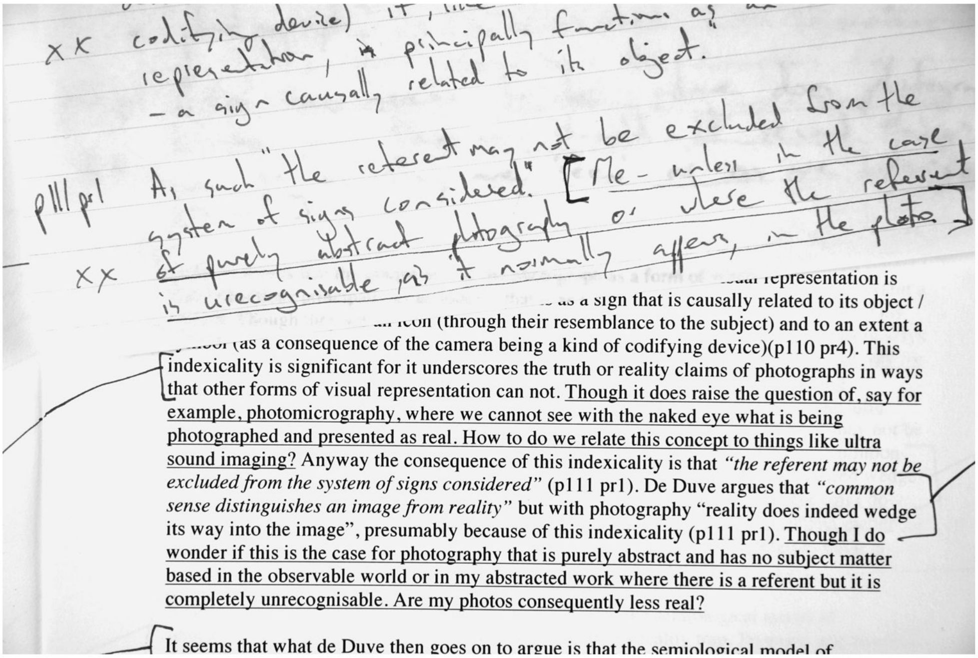
Figure 27.1 Reductive iterations (left) and 'conversation in action' with literature maps (right)

In mapping the literature reviews I re-read them and highlighted key ideas, questions, and insights, through a Schon-like reflective conversation in action (Figure 27.1). In many respects this last technique is a bit like mind-mapping but rather than mapping a series of interrelated key ideas drawn from an ill-defined and abstract (or wicked) design problem or situation, I was mapping ideas contained within the actual literature review and connecting it back to something quite concrete – the original article – even if the ideas explored were highly abstract. Spatial and contextual relationships between ideas within a paper began to emerge and as such more reviews were processed in this way, across a body of papers. The very tactile and visual process this mapping involved made it feel like I was committing key ideas and insights to a sort of 'muscle memory'. Producing these maps, as concrete manifestations of abstract ideas, appealed to me as it paralleled my experience of designing, moving from the concrete to the abstract and back again.

My approach to mapping the literature is somewhat at odds with that advocated by Yee who recommends starting with a clearly defined topic list, and the further classification of related topics under subject headings, as a starting point in structuring literature maps and hence the literature search (2003: 7). One might call this a top down approach in that the structure and topics guide the research. I was less clear about the topics that were relevant to my research and instead allowed my reading, and the insights I gained from it, to guide the development of the topics, as they emerged though my research, and the development of my literature maps. Such a bottom up approach is not unlike that taken by grounded theorists. Grounded theory was developed by constructivist social researchers and entails collecting and analysing and interpreting "data to build middle-range theoretical frameworks" in order to "focus further data collection" that in turn informs and refines the theoretical analysis (Charmaz 2003: 249–250). It is generally assumed that grounded theory privileges inductive reasoning, but Bryant and Charmaz (2007: 44–46) and Reichertz (2007: 214–228) demonstrate that abduction plays a more significant role than induction.

Irrespective of the starting point of top down or bottom up literature mapping, what these approaches have in common is: the refinement of the research topics through a reflective process of analysis and the consequential development of new insights; the spatial – as opposed to hierarchical – organisation of ideas; and an understanding that these ideas are "neither fixed nor definitive" but are signposts that enable the researcher "to navigate through mass amounts of ideas, concepts and methodologies encountered in the literature" (Yee 2003: 8). The reflective and indeterminate nature of both these approaches signals abductive inquiries and points to research as a form of bricolage. Abductive reasoning is privileged by designers, as is discussed in the relevant literature (Cross 2011; Kolko 2011; Lawson 2006[1980]; Louridas 1999). The use of various forms of mapping in design research, therefore, should be of no surprise to us given the parallels between the manner in which mapping helps generate knowledge abductively, and the abductive manner in which designers work.

The hand written and typed notes, as well as the A2 literature maps, that I developed through my research can be seen as a form of diary that existed in three cross-referenced forms. Preston and Thomassen note that "journals, sketchbooks and workbooks, all variations of the diary, figure prominently in art and design studies as the repository of emerging ideas and forms" (2010: 49). They argue that for art and design diaries to be rigorous reflections of the research material, coding the data and categorising it in relation to other material or experiences is essential (ibid.). Charmaz notes that memo writing, a form of reflective diary, is a key tool in the grounded theorists kit and that it "helps to spark our thinking and encourages us to look at our data and codes in new ways" (2003: 261). Furthermore, and perhaps more importantly, she argues that "through memo writing, we elaborate processes, assumptions and actions that are subsumed under our codes" (ibid.).


xx codifying device) it, like ... principally functions as a representation, – a sign causally related to its object.

p111 pr1 As such "the referent may not be excluded from the system of signs considered." [Me – unless in the case of purely abstract photography or where the referent is unrecognisable as it normally appears, in the photo]

xx

... representation is ... as a sign that is causally related to its object / ... icon (through their resemblance to the subject) and to an extent a ... (as a consequence of the camera being a kind of codifying device)(p110 pr4). This indexicality is significant for it underscores the truth or reality claims of photographs in ways that other forms of visual representation can not. Though it does raise the question of, say for example, photomicrography, where we cannot see with the naked eye what is being photographed and presented as real. How to do we relate this concept to things like ultra sound imaging? Anyway the consequence of this indexicality is that *"the referent may not be excluded from the system of signs considered"* (p111 pr1). De Duve argues that *"common sense distinguishes an image from reality"* but with photography "reality does indeed wedge its way into the image", presumably because of this indexicality (p111 pr1). Though I do wonder if this is the case for photography that is purely abstract and has no subject matter based in the observable world or in my abstracted work where there is a referent but it is completely unrecognisable. Are my photos consequently less real?

It seems that what de Duve then goes on to argue is that the semiological model of

Figure 27.2 Coding notes

The rigorous use of coding is both a pragmatic device essential to navigate through data and find ideas within the large volume of material, contained in both note and map form, and a framing device that reflects and shapes the theoretical construct of the research. For pragmatic purposes I developed several basic coding techniques through each note taking iteration and the eventual literature mapping that included: recording what page and paragraph an idea or quotation came from; and differentiating between quotations, the transcription of the ideas in the literature, and my own reflections upon them by underlining, highlighting, or changing the case of the text (Figure 27.2). When it came to coding the emergent concepts in the research I mapped the typed notes and extracted key ideas or insights (Figure 27.1). These key concepts were eventually re-mapped in what I call meta-maps (Figure 27.9) that I will discuss later. Each of the three forms that my literature review existed in was cross-referenced enabling me to move between a macro and complex overview (the original article or chapter) right down to a micro and reductive focus on very specific points (my maps of the literature review) (Figure 27.1). Because of the simple coding strategy I used I could locate an idea quickly within a map and trace it right back to the original paper via my notes. In addition I was able to clearly delineate between an author's ideas and words (crucial for correct attribution), my interpretation of that, and the ideas I had developed myself. Furthermore, by the time it came to writing my draft thesis I had a literature review of some 80,000 words contained in a single-text searchable document. This meant that many of the ideas I was exploring, the references I was making, and insights that I had, were already written in draft form. Writing the thesis involved a lot more editing and some rewriting rather than starting entirely from scratch.

Aside from the obvious benefits and pragmatics derived from coding the research material generated, in map or diary form, these approaches have profound epistemological consequences. For Preston and Thomassen (2010) and Yee (2012) such coding and rigour are the basis for the generation, and significantly, the explication of design knowledge. Through the reflective process of developing and refining the codes we ascribe to our 'data' we are building a kind of picture of the state of knowledge, as we perceive it to exist, at that moment. By definition, then, this means we perceive any gaps in knowledge that might exist as it relates to our inquiry. This is the epistemological consequence. As Charmaz indicates, the reflective use of memos in grounded theory reveals assumptions we have about the nature of knowledge, and indeed reality (Charmaz 2003: 261). The assumptions we have about reality are a direct consequence of perceiving the state of knowledge, as it exists, including the gaps that we perceive in that. By then addressing this knowledge gap we develop new knowledge and consequently change the world in some small way, be it theoretically or materially. This is the ontological consequence. Because, as designers, we often map and interpret our research data in some kind of visual form we in effect transform reality through the visual. As design knowledge so often gets used for designing things, and not just arriving at theoretical insight, then we actively transform the material dimension of our reality. Again this points to design as a perceptual activity as opposed to a problem solving activity. And once again I will defer a discussion about this until later.

Diagrammatic interpretation and development of concepts

It struck me early in my candidature that the conversations I was having about my research with my supervisors, at conferences, or with students were as instrumental in shaping my thinking as the reading I was engaged in. With that in mind I made rough maps, during these conversations, of the key ideas discussed and their relationships (Figure 27.3). These were then re-mapped into an A2 sketchpad with further insights and reflections inscribed. Like my literature review maps, these conversational maps were highly reductive but were a useful tool in facilitating my recall of the more complex ideas that emerged as well as actively constituting my growing knowledge of relevant material. Once again what was useful in doing this was that it gave a seemingly concrete, visual dimension to often complex and abstract ideas that unfolded through time and space via conversation. During the conversations with my supervisor we would often pass a piece of paper backwards and forwards and roughly sketch diagrams of very specific concepts to clarify our understanding of them (Figure 27.3). We were metaphorically trying to be on the same page whilst literally working on it. Designers typically use reflection in action as a kind of conversation with a design situation that draws upon the designer's experiential knowledge (Schon 1992) and, in a similar manner, grounded theorists use the reflective process of memo writing to encompass an understanding of the role of their subjectivity in the construction of knowledge (Charmaz 2003). As Yee demonstrates, both in her own work (Yee 2003) and numerous case studies (Yee 2012), the advantages of involving others in such reflective processes is to provide a shared understanding and more holistic overview of the material and encompass the interdisciplinary knowledge typically required in design research.

Where the tone of my supervisory interactions was conversational, much of the literature I was reading took on a more argumentative tone. Sometimes these arguments were so complex that I had to extend beyond my normal techniques of mapping and craft some of the key points I identified into a more diagrammatic form. This resulted in very structured diagrams of key concepts sitting alongside the mind-maps of the broader context these concepts sat within (Figure 27.4). This enabled me to more clearly see the relationships between the bits of the argument than a mind-map would allow me. Like my approach to mapping the literature, this approach to mapping conversations and arguments, and diagramming concepts enabled me to zoom in from a macro perspective down to a micro perspective and back again, all through a

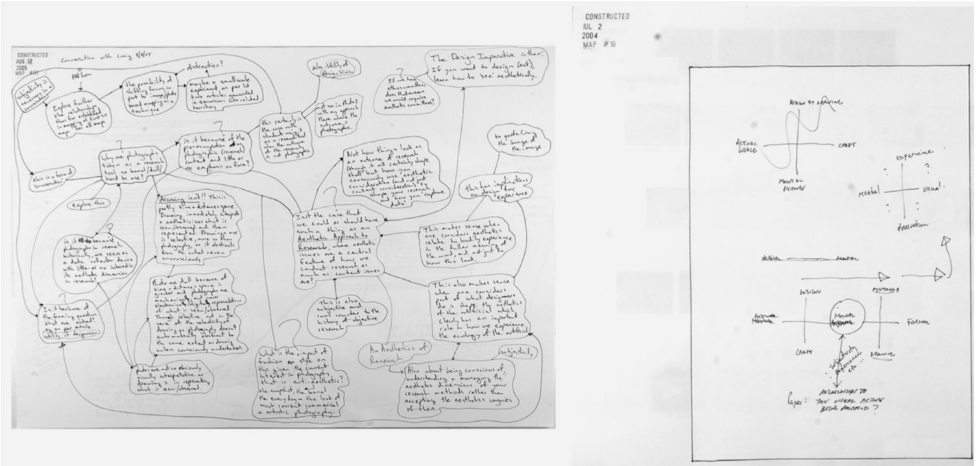


Figure 27.3 Conversation mapping (left) and collaborative concept mapping (right)

process that engaged some form of embodied interpretation and making. Preston and Thomassen's (2010: 51) review of the mind-mapping literature talks about them as being a form of diagram. However, whilst I concur with this as a generalisation, I am using the term diagram in the context of my work to refer to drawing simple diagrams of sets of relationships contained in very specific concepts exclusive of the broader context they sit within. Maps, on the other hand, I see as locating these concepts within these broader contexts.

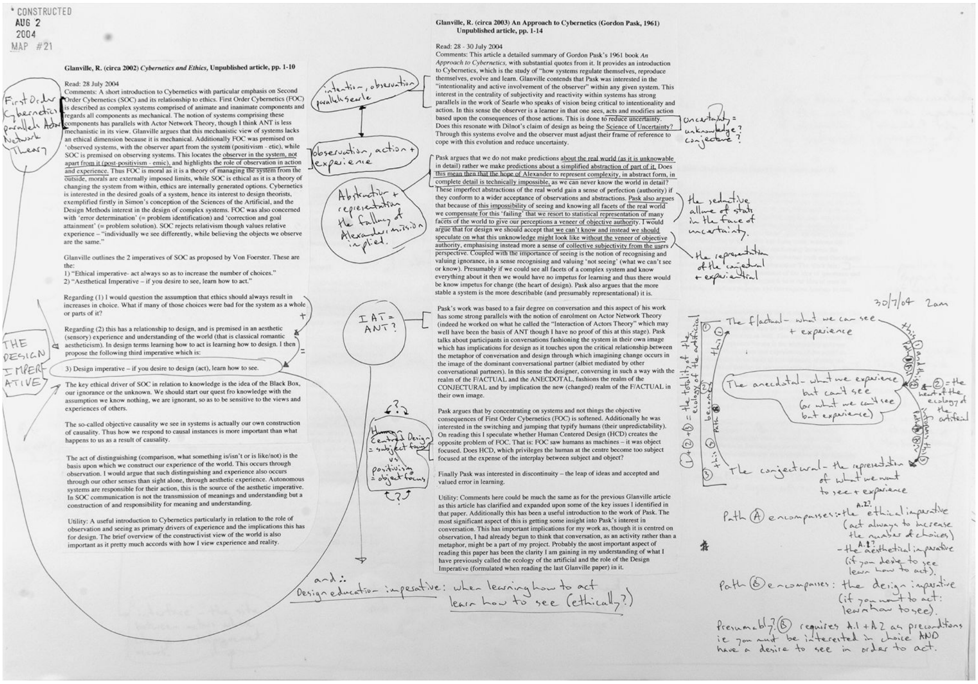


Figure 27.4 Contextual concept diagramming

Diagrams, Louridas (1999) argues, offer distinct advantages to designers "both in terms of information content and in terms of cognitive properties" (1999: 528). In relation to information, diagrams provide a simplified picture of rich and complex information and in terms of their cognitive properties "diagrams facilitate search and inference and allow lateral transformations without a premature freezing of concepts" (ibid.). Preston and Thomassen argue that "diagrams are known for their ability to order complex scenarios with an abstract and graphic clarity capable of conveying the essential nature of the subject at hand" (2010: 51). In this phase of my work I crafted complex concepts into various diagrams until I felt I had such clarity about the essential features of a particular concept irrespective of the broader argument it was embedded within (Figure 27.5). This in turn facilitated my understanding of those broader arguments. As a consequence of this experience I began to create diagrams of key concepts I was developing about, and through, my own research (Figure 27.5). In this regard it did not feel like I was writing theory, rather I felt like I was designing it. As a way of extending this approach to research, and to further refine my clarity about my research topic and its key concepts, I designed a predominantly diagrammatic, or visual, essay that functioned like a synopsis of these concepts (Roxburgh 2010). I say this because once again I was learning through designing, visualising and crafting these concepts into pictorial form. The key ideas that emerged through this became the framework for much of my eventual thesis and were some of the main points I wrote about in it.

Making pictures to explore arguments and concepts

My PhD was undertaken at the outset with the clear intention that my creative practice, photography, would play a key role in how I conducted my research. In this regard it conformed to the now well-established methodology of practice-based research. My research was critiquing prevailing attitudes towards, and assumptions about, the use of photo-observation in design research through my own photographic practice (Roxburgh 2013a). It was neither purposeful in the sense that it was addressing a specific design 'problem', or focusing on a group of users' 'needs'. My particular interest was in challenging the photographic orthodoxy of realism in the pursuit of design knowledge, and the production of the designed world, through an exploration of abstract photography. As such it could be characterised as a form of critical design practice, as it was using a practice, and its artefacts, to interrogate and critique prevailing norms (Dunne and Raby 2001). To that end I used my practice to ask questions similar to those I was asking through my review of the literature.

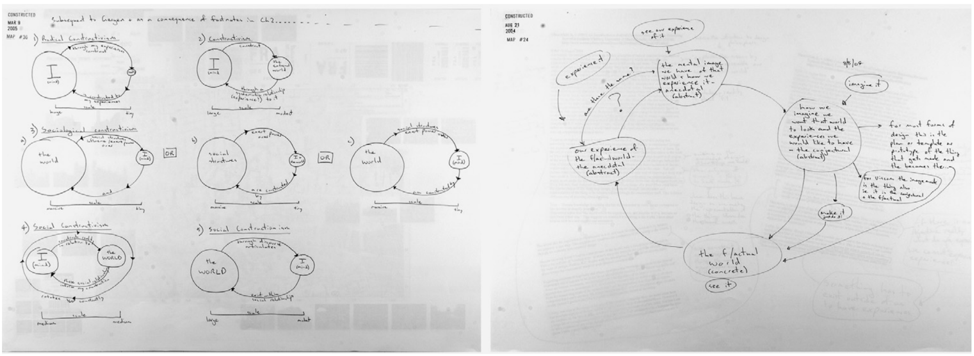


Figure 27.5 Concept diagramming 1 (left) and concept diagramming 2 (right)

With this in mind I engaged my practice quite early on in my studies. Although I had no clear idea what those questions were going to be I knew that by working intuitively, and trusting that, they would eventually become apparent – again something of a grounded theory or bricoluer approach. It was also a relief and an escape to disappear into my practice without too structured or analytic an approach when analysis was the main basis upon which I was conducting my reading. This is hardly surprising and conforms to the experience of creative art and design research students as noted by Hockey (2007: 163). Inevitably the ideas that emerged through my reading and its mapping began to emerge in the kinds of photographs I was taking and the kinds of questions I was asking of and through my photographs. This experience of my practice in turn began to inform not only the material I was reading, but also how I was interpreting that material and the questions I was asking of it. Once again I used mapping to document the various photographic exercises I was engaged in. Sometimes these consisted of nothing more than a series of photographs I had taken, stuck in my A2 sketchpad in between A2 pages that mapped my readings (Figure 27.6). At other times these maps were reflective of the ideas I was exploring, not only in my photography but also in what I was reading and writing. This form of mapping revealed connections to me between theories in the literature and theories emerging through my practice, connections not apparent to me in any other form. Insight was revealed through the reflection in action this approach to mapping entailed.

After several years of working in this manner, in which my research topic had become substantially clearer, I began to set myself a series of quite specific photographic project briefs (Figure 27.7). These briefs enabled me to interrogate my creative work through a series of public, and in one case participatory, exhibitions (Figure 27.7). Once again the process of mapping was used to document this process but also to explore fresh relationships and insights between my photographs, what I was reading and writing, and the feedback I received from participants and audiences of these shows. What I discovered through this stage of my work was that, up to a point, the more removed from realist depiction a photograph became the greater the interpretive and imaginative space of the viewer became in responding to it. Beyond a certain point of abstraction, however, the photograph became something in and of itself and the space of imagination and interpretation began to close down as the photograph became less obviously connected to the perceived world. In essence, my work was dealing the relationship between the abstract and the concrete, two ideas central to design.

My practice-based work culminated in an exhibition that chronicled my entire research process and creative and written output prior to completing my first thesis draft (Figure 27.8). I used the logic of mapping as the basis for the exhibition design in that the work was curated and installed in such a way that it led the viewer through the various stages and outputs of my research process. The timing of this exhibition with the writing stage I was at was largely coincidental but the experience was revelatory. I say this because it was the first time I could see all of my work in one location and trace all of the key ideas and moments of insight through it. In essence I had designed an exhibition of my 'thesis' and the research journey that got me there and this informed the very basis of the structure and content of my thesis.

The design of a written thesis

From my final exhibition I had a strong sense of not only designing the conceptual structure of my argument but it felt like I had an embodied experience of it because I had to make and install the exhibition. This sense flowed into the manner in which I was 'writing' my thesis. As I outlined earlier I had a literature review of about 80,000 words towards the end of my studies.

Figure 27.6 Photographs exploring preliminary research concepts

Figure 27.7 Photographic briefs and exhibition image mapping as Research methods (left) and exhibition image mapping as research method (right)

Figure 27.8 Process and outcome exhibition

In addition, along the way, I had written several conference papers, journal articles, and book chapters about my research. All of this work had been developed through the techniques I have already outlined so writing the thesis was much more a case of reshaping, or editing, parts of that material. So arriving at the base of the mountain that writing a draft PhD thesis appears to be (my final thesis clocked in at about 75,000 words) was not as daunting as it might otherwise have been for I had been meticulous and methodical in my preparation. Furthermore I had done so through a variety of designerly methods, as well as through my own creative practice, and consequently I felt like I was a part of the work, or it was part of me. This feeling of belonging didn't happen overnight but was the result of an ongoing process of making, thinking, reading, writing, and reflection.

In order to keep an overview of the vast amount of information, both visual and written, that I had generated throughout my studies I made sure that at semi-regular intervals I reviewed the contents of all my maps to date and re-mapped the key concepts, references, ideas, creative work, etc. that appeared in them. These maps were meta-maps (Figure 27.9). This allowed me to better see and evaluate how my ideas had developed as well as what the key ideas were and the relationships between them. As outlined previously, Yee (2003) generated literature maps to overview and guide her research. In this instance I was using my research to generate overview maps that in turn guided my research. Despite the apparent differences between these approaches, both demonstrate the kind of abductive and reflective reasoning typical of design research and practice that help the designer, or design researcher, determine an appropriate course of action with the contingencies of the circumstances in which they work (Louridas 1999: 531–534). As such my meta-mapping provided me with an overview of my research in a way that enabled me to burrow into the specifics of the material I had created, if and when I needed to, but specifically helped me to shape the structure of the thesis and its contents.

When it came to the actual task of writing the draft thesis I again used a kind of mapping, as I had done with the various papers I had created throughout my studies. The technique I used was a bit like the cut-up techniques the Dadaists used to write poetry. Using my meta-maps I identified the relevant sections of my literature review, and the original sources they related to, as well as the relevant points in my publications that related to the specific concepts each section of the thesis was dealing with. I printed out the sections of this material I had identified, cut them up, and physically arranged the bits into the structure that I had envisaged for them (Figure 27.9). This process was very dynamic so the various bits of paper could not be stuck down in case I needed to move a section around. As a result I did this on a dedicated pin-board in my office. This process paralleled the manner in which I work as a designer and although I was working with a large amount of written material I was in a sense looking at the relationship between content and structure and doing a lot of cutting and pasting. By working with what I called 'essay walls' I could easily locate particular sections of a chapter and consider

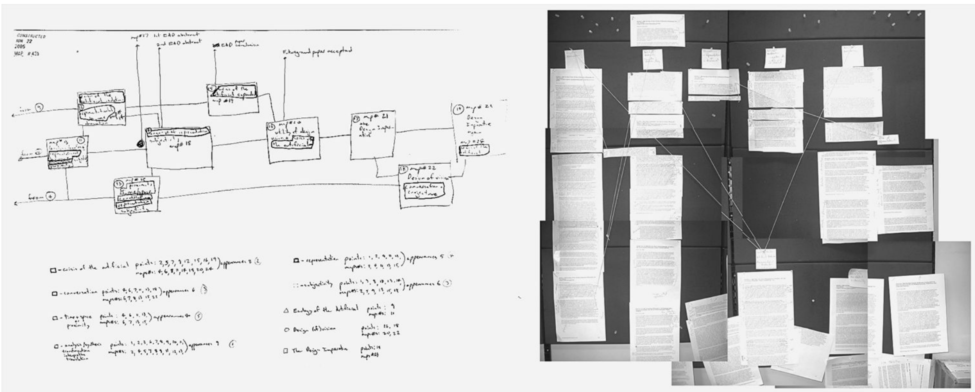


Figure 27.9 Meta-maps (left) and mapping the thesis (right)

them in relation to other sections within that chapter but also within the overall thesis. If I was unhappy with the juxtaposition of one section against another I knew I either had to move it, delete it, re-write it, or write a proper segue between them. This didn't just involve reading but was very much based upon an embodied sense of observation as well as a very physical approach to editing. It is a process that reminds me a lot of the manner in which art directors, such as Alexy Brodovitch, work with scale mock-ups of the magazines they are designing to see how they work as a whole. In more contemporary design practices, such as interaction design and human computer interface design, designers commonly use what Youille calls forensic walls to "develop assemblages of their design research, thinking and production" (2012: 134). Such walls "become materials to think with, think through, and perform what it is that researchers are thinking about" (Nafus and Anderson 2009: 137). Not only are they used to produce designed artefacts but they produce social relations through what Nafus and Andserson regard as a form of writing that involves a "process of moving between text, visual materiality, and orality" (ibid.).

Although the essay walls that I used to craft my final thesis were largely text based, the underlying logic of the forensic wall was at play within them, as it was when I was developing my work for exhibition. The 138 A2 maps that I produced throughout my research more closely resembled Youille's forensic walls but for the sake of practicality I had to keep these reasonably compact. Notwithstanding this my maps, diagrams, and essay walls were all a "stage for designerly conversation" that allowed me "to manage ambiguity while designing" (Youille 2012: 137). Importantly these techniques also enabled me to manage ambiguity while writing.

Knowledge of things and things of knowledge

I stated at the outset of this chapter that there was a growing body of literature that discussed the issues of writing, and specifically academic writing, for creative art and design students in the university sector. In this regard much of what I have described in this chapter may be familiar to those involved in it. However, it has been my experience that little of this research presents much in the way of the very visual and designerly techniques used to facilitate such writing. This presents a paradox for those seeking exemplars of such techniques, for what they find is predominantly written accounts of those techniques that potentially perpetuate the very issue they seek to address; getting visual thinkers, or kinaesthetic learners, to engage in some level of analytical reading and writing. It is partly with this in mind that I have produced this chapter to provide a few more exemplars of what these, or at least my, techniques look like. In doing so I am not making the claim that these techniques are definitive, nor will their use produce similar results for others, for they are not like the steps in a controlled scientific lab experiment. Unlike lab experiments, design diaries – or in this case, maps – do not lead to "verifiable research outputs" rather they are "forms of media" that construct a reality in order to evaluate that reality (Preston and Thomassen 2010: 51). To that I would add that the approaches to visualising design research that I have covered, and as discussed in the literature I have mentioned, do not simply evaluate reality but inevitably result in some form of conceptual and material transformation of reality. These processes are the explicit evidence of the worldmaking dimension of design, to use Goodman's term (1978). This brings me back to a point I have deferred addressing twice within this chapter, and that is my contention that design is not simply a problem solving or even problem setting activity. It is my contention that the problem solving paradigm of design is simply a frame that we use to better understand and, more importantly from the instrumentalist perspective, manage design.

It is generally acknowledged in the design thinking/problem solving literature that the visual representation of complex information in a variety of forms is a central feature of design activity

(Cross 2011; Kolko 2011; Lawson 2006[1980]; Louridas 1999; Schon 1992; Simon 1969; the list goes on). In a phenomenological sense the concept of the visible image as a mere representation of reality does not accord with the significant role it plays in our embodied perception of the world. As Merleau-Ponty (1964) argues, the visible image is not simply a copy, or representation, of the world, nor separate to our embodied perception of it. Perception, in a classical sense, sees "our relation to the world" as "that of a thinker to an object of thought" (ibid.: 12), hence classically speaking we can see the visible image as a representational object separate to the reality it purports to represent. However, Merleau-Ponty contends that as a perceived thing can exist "only in so far as someone can perceive it", its existence is contingent entirely upon our perception (ibid.: 16). As a consequence any perceived thing, be it a visible image of a material object or the material object itself, is not a stable entity but is transformed as the circumstances of our perception change. As the image in this understanding constitutes a part of our sense of reality, and is a part of the horizon upon which we perceive reality, then each visible image we create also transforms reality (Merleau-Ponty, 1964). Merleau-Ponty calls this the "image sensitising itself" (2010: 153).

This is the ontological consequence of thinking through the image. Interestingly Schon himself recognises as much for he argued that not only do designers "construct the meanings of their situations, materials and messages, but also the ontologies on which these meanings depend" (1992: 9).

Perception, Merleau-Ponty argues, does not reveal truths but presences. Our ability to constitute "the unity of perceived objects" from the revelation of its various presences is what he calls "perceptual synthesis" (Merleau-Ponty, 1964: 16). It is for this reason that I argue that the dependence of design upon the transformation of the world through the visible image, in whatever form that may take, is fundamentally a perceptual activity. Furthermore I would argue, as I have done in more detail elsewhere (Roxburgh 2013a and b), the only inevitability arising from this is the ongoing imaginative transformation of the world. Conceptually and materially speaking this is what I was doing through my research. On a conceptual level I was constructing an understanding of design and its relationship to reality, whilst transforming that reality through the material production of my maps. In conventional research terms I made knowledge of things and in design terms I made things of knowledge.

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28

THE BOOK AS SITE

Alternative modes of representing and documenting architecture

Marian Macken

Any practice-based doctorate, at some point, needs to be submitted for examination. At this culmination two modes of working – of writing and making – combine to constitute a single thesis or argument, and hence, new knowledge. Within the fields of art and design, this relationship is inherently ambiguous with no one clear model. The topicality of practice-based research is evidenced by discussions, and hence writing, concerning the notion of art and design as a way of inquiring, of producing knowledge and as a way of researching, different from traditional fields of research such as science and the humanities. The particularities of practice-based theses have been less discussed, in regard to the relationship between the written and studio components of the thesis. This chapter articulates an approach to the relationships between the research question, the voice of the writer and the structure of the thesis, and its associated examination process. Using as case study the author's doctorate, which migrates between disciplinary boundaries, it is argued that these relationships, and the methodology of working between them, are the core component that defines the practice-based doctorate.

In this discussion about the relationship between the text and material evidence, the term thesis refers to the work produced as a whole, that is, the final examined work. This thesis is made up of two parts: the written text, referred to as the dissertation, and creative work, or studio work.

Exordia: the research question

The doctoral thesis 'The Book as Site: Alternative Modes of Representing and Documenting Architecture' combines art practice with architectural theory. A natural route for an investigation into architectural drawing would be within an architectural institution. Jonathan Hill writes that sometimes a building is not the best way to explore an architectural idea (Hill, 2007: 166); equally, sometimes an architecture school is not the best place to explore an architectural idea. The doctorate was undertaken at Sydney College of the Arts (SCA), the visual arts faculty of the University of Sydney, jointly supervised by professors from the Faculties of Visual Art and Architecture, Design and Planning. This institution allowed for a breadth of practice, to draw on architectural ways of knowing, yet not be defined by them.

Each doctoral student approaches the combination of text and studio work differently, depending on their research question and method of working, and the institutional expectations and requirements of their programme. According to SCA, for a PhD by thesis and creative work, students must submit "a thesis comprising a substantial body of creative work plus a written text examining the histories and theoretical underpinnings of the creative work, both of which demonstrate an original contribution to knowledge" (University of Sydney, 2013). The dissertation, expected to be in the vicinity of 40,000 to 50,000 words, should include a full visual documentary record and catalogue of exhibited work. The examination comprises an oral examination and exhibition.

'The Book as Site' begins with the premise that architectural space is usually documented in the form of orthographic projections, that is, plan, section and elevation drawings, with perspective and three-dimensional models. These render the space in a particular way and, hence, have limitations and specificity. The artist's book – that is, a book made as an original work of art, with an artist or architect as author – is a different format from the usual way of presenting architectural space. Due to its qualities and characteristics, it is conducive to a particular reading of drawings and of representation. Taking Ulises Carrión's description of the page as a site, and the collection of these pages as "a sequence of spaces" (Carrión, 1985: 27), the artist's book may be seen as a space of potential beyond that of bound drawings and photographs. This thesis examines the results of housing architectural drawings within the format of the artist's book and the possibilities for documenting space within the book. Through an examination of the relationship between the drawing, the building and the book, and various case studies, the potential of the book as a site for architecture is examined.

Parallel to this is an interest in the notion of *post factum* documentation, that is, when the 'designerly' drawings have supposedly stopped. Architectural representation is predominantly concerned with architectural space yet to be materialised. Drawings are produced to picture an imagined building, to assist in 'getting to' the building. These drawings initially take the form of sketch or conceptual drawings which develop into scaled orthographic projections. These sets of drawings are referred to as 'documentation'. However, the word 'document' refers to a record or evidence of events. It implies a chronological sequence: the document comes after the event, that is, it is *post factum*. Within architecture, though, the dominant practice is in producing drawings whereby the subject-matter exists after the drawing, not before it (Evans, 1997: 165). This leads to a predominance of one form of drawing, producing and, therefore, thinking within design education.

Giving a presence to the under-examined realm of *post factum* documentation questions the hierarchy of certain activities within the design process: by including that which is seen to exist separate from and outside the design process brings the notion of reflection to reside within the design process. For example, representing an existing space, as a precedent, is *post factum* documentation. This documentation is not neutral representation that merely documents a presence; instead it is able to be interpretive and, therefore, exploratory and generative. This view of representation elongates the representational lineage, and continues it past the building of a project. Similarly, the thesis proposes the artist's book as a complementary, three-dimensional architectural representation with a generational and propositional role within the design process. This repositions books within an expanded notion of the design process, displacing the built object as the endpoint of this process, and investigates the critical facility of artists' books.

The dissertation was driven by the original research question: What is the possible role of artists' books within architectural representation and architectural teaching? Subsidiary and associated questions concerned the representation of aspects of architecture that fall through the cracks of conventional documentation, such as the body in the space of architecture; the role of hybrid representation within architecture; the role of *post factum* documentation of architecture within the design process; and the advantages of including works with book-like structures and techniques – what might be referred to as 'folded models' – to the representation of architecture.

The dissertation concentrates on three main areas of potentiality of artists' books as documentation of architectural representation, which align with the latter three chapters of the dissertation. It is within these three chapters that the studio works operate as case studies, addressing aspects of the architectural content that is omitted from conventional representation (Figures 28.1 to 28.4). As the dissertation developed, the main stylistic decision in regard to the writing was not to refer to the studio work within the dissertation. The writer's voice was not one of the maker.

Conjugation: the structure of the thesis

The approach of this thesis was to give equal weight to the material outcomes of practice and the discussion of the knowledge. In this model of working, the dissertation acts as a repository of research that informs the art or design practice, and the scholarship of the text is positioned so that it supports and guides the reading of the studio work. In his essay, 'A method of search for reality', Timothy Emlyn Jones describes four categories of submission, as used by Glasgow School of Art (Jones, 2005: 30). According to Jones, the submission category whereby equal weight being given to both parts of the thesis is suited to those instances where the knowledge is intelligible only when considered in the context of what is written, often text of a theoretical character (ibid.).

With this model of the relationship between making and writing, there is one research question. Brad Buckley, Professor of Contemporary Art and Culture at SCA, has written of this as his preferred model. He notes that this situation allows the different models of knowledge "to illuminate and inform both the text and the creative or studio work, thus producing a genuinely integrated thesis" (Buckley, 2009: 82). In 'The Book as Site', the scholarly and creative components aim to fuse in their intentions to explore the book as a complementary medium for architectural representation.

While discussions within the field of design research are most often concerned with the notion of art and design as research activity, the more specific question of communication and the role of the dissertation within the practice-based PhD is addressed less often. James Elkins has written on this topic, and suggests three ways in which this relationship may be approached: the dissertation is research that informs the art practice; the dissertation is equal to the artwork; and the dissertation is the artwork and vice versa (Elkins, 2005: 8–17). Within these configurations, he proposes eight sub-categories. Elkins' terminology of the dissertation being research that informs the art practice implies a relationship between the writing and making as one of support. In this instance, the thesis describes the intentions and process, interprets the studio work and may be chronologically structured. Elkins' third category is particularly interesting, however, as he notes that there are few examples of this fusion of text into creative work (ibid.: 28). It is the second category, in which the dissertation is equal to the artwork, which is most closely aligned with this case study.

A methodology of reflection

In 'The Book as Site', it could be said that the structure of the dissertation is influenced by the studio work: the three latter chapters came about through the making of three main works. Equally, it could be said that the unfolding dissertation shaped the themes and direction of the studio work. The important point being that in reading the dissertation and viewing the studio work neither is dominant: one can come to either first, which makes encountering the other richer. This relieves the dissertation from a support role. The dissertation is not documentation, an account, a description or a record of a process. Instead, the text offers a context within which to view the studio work and frames its production. Equally, the studio work is not the sole embodiment or lodgement of the knowledge that the thesis bears (Jones, 2005: 31). Rather, the studio work exemplifies that which is expounded in the dissertation.

For example, the studio work *Mies van der Rohe: Built Houses* (2009) uses the technique of removal to draw Ludwig Mies van der Rohe's 15 built houses over the 50-year span from 1906 to 1956. The plans at 1:100 are cut out of the page, using a laser cutter. The first page begins with the Riehl House (1906–7) cut out; on the second page, the Riehl House and the Perls House (1911) are both cut out. Each subsequent page has the cumulative cut out of the next chronological plan. At page 15, all the house plans are cut out of the page. From page 16 onwards, each chronological plan is removed from the cutting process, starting with the first house, until the last page, which shows only the Morris Greenwald House (1951–6) (Figure 28.1).

Through the technique of cutting out the plans, the drawings in *Mies van der Rohe: Built Houses* interact with the page edge. By page seven, the wall, as it extends into the landscape, runs to the edge of the page, disrupting the page as frame. During the reading of the book, the page is eaten away by the laying down of each subsequent house plan, and then returns with the final pages. These lines cannot be undone. In this work, the actual page is not merely a site upon which the ink is applied, nor are the edges only those which are held in one's hands. The page is no longer a frame, but rather is integral to the reading of the drawing.

The text component of the book mirrors the production of the drawings within each page. There is an embedding of the text within the page, through the process of blind letterpress printing, just as there is an embedding of the plan within the page. As each house plan appears on multiple pages, so too does its name and date (Figure 28.2). By an additive printing process, each house title has a similar range of depth of printing.

This studio work, which presents the *post factum* documentation of the work of one designer, acts as a silent case study within the dissertation chapter examining the line within architectural representation and drawing within the book (Figure 28.3).

Architecture presents itself through the economy and apparatus of the line: its boundaries and capacities are defined by the workings of orthogonality, or the 'right-angledness' of the line (Ingraham, 1991: 66). Exploring architectural drawings housed within artists' books allows for an examination of the line within architectural drawing that has a different nature. *Mies van der Rohe: Built Houses*, as a case study, demonstrates that the book presents the *page* as the site for the drawing as strongly as the drawing itself (Figure 28.4).

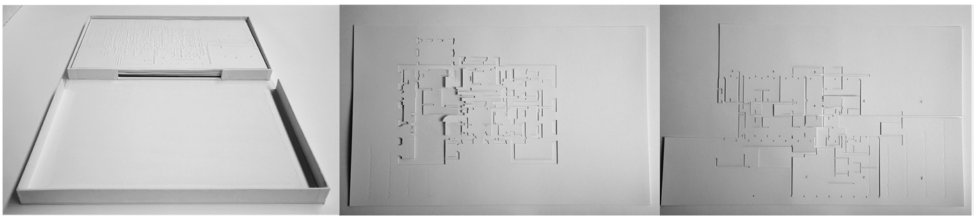

Figure 28.1 Marian Macken, *Mies van der Rohe: Built Houses*, 2009

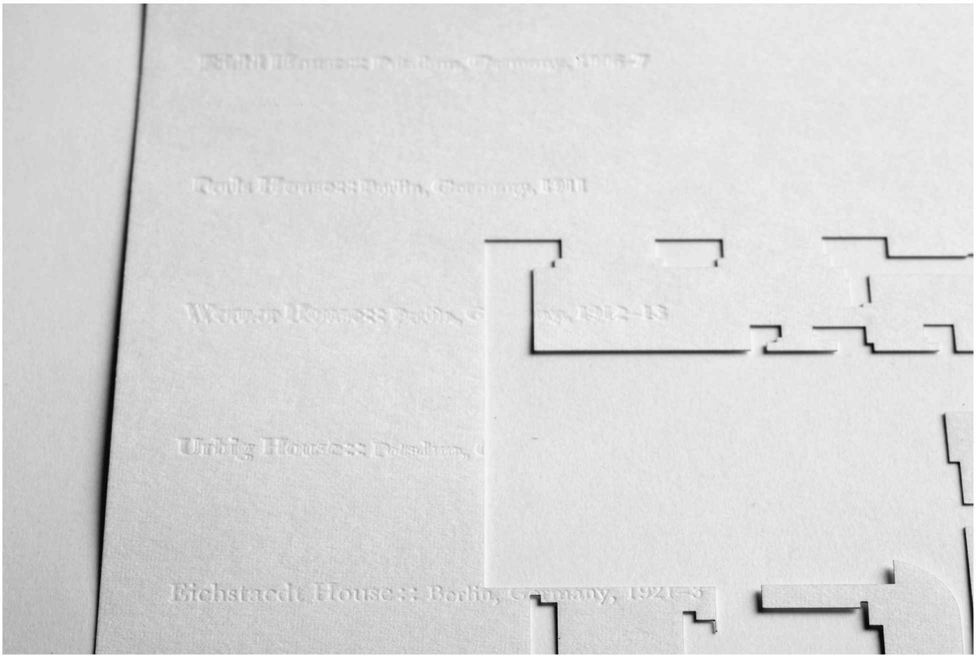

Figure 28.2 Marian Macken, *Mies van der Rohe: Built Houses*, 2009 (detail)

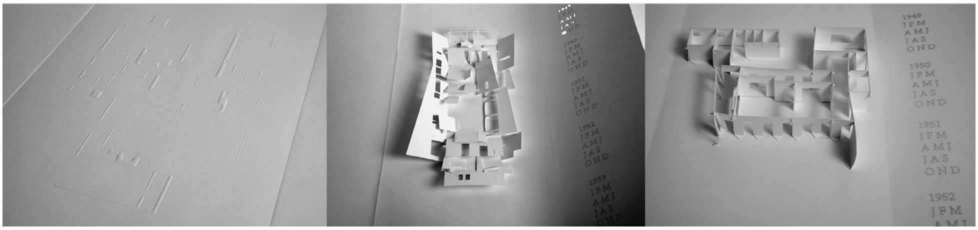

Figure 28.3 Marian Macken, *$1.45¢: Houses in the Museum Garden: Biography of an Exhibition*, 2011; details: embossing, *okoshi-ezu* of Marcel Breuer's 'House in the Museum Garden', *okoshi-ezu* of Junzō Yoshimura's 'Japanese Exhibition House'

Due to this quality, the method of drawing is as important as the final work. The method of presenting drawings and the technique of drawing is different from the usual way of presenting architectural drawings, that is, black line on film, trace or paper. These drawings may be drawn without the magnitude of the presence of the black ink line, but rather by other techniques such as embossing, cutting or scoring. This embeds the drawing within the page in a particular way, forming a relationship between the drawing and its paper. This technique gives conceptual character to the line, by the altered reading of the actual page as a three-dimensional space. Reading both the dissertation chapter and the studio work together demonstrates the presence of the drawings beyond that of referent for a proposed building: the drawing is not cast as a two-dimensional proxy for the manipulation of a three-dimensional world (Wood, 2002).

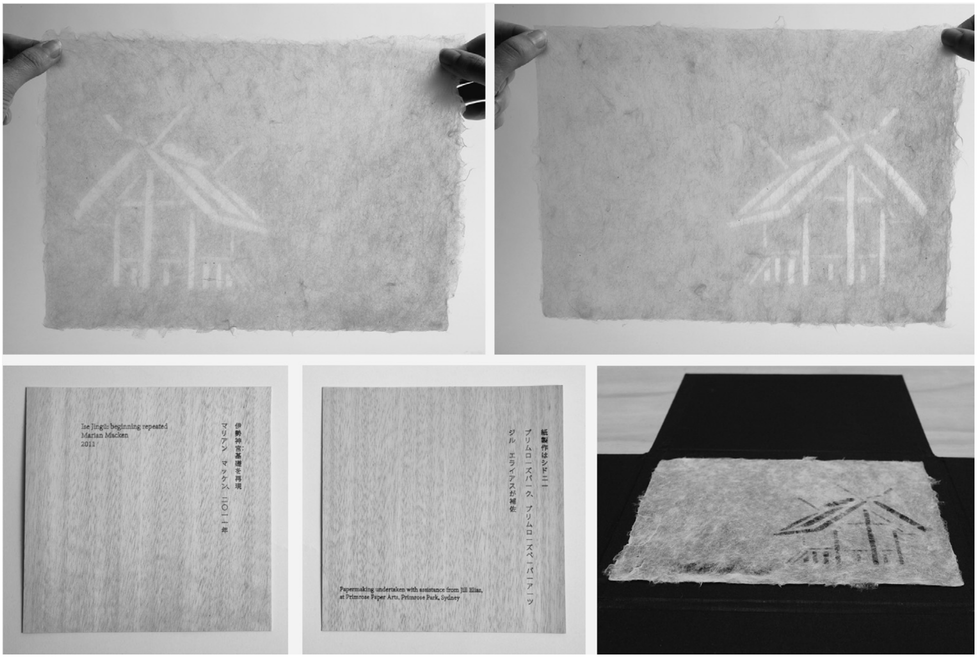

Figure 28.4 Marian Macken, *Ise Jingū: Beginning Repeated*, 2011; pages with left and right hand image, Mountain Ash veneer endpaper, with laser scored text and page within cover

Returning to Elkins' model in which the dissertation is equal to the artwork, he proposes two sub-categories: the research and artwork comprise a new interdisciplinary configuration, and that the research and artwork are understood as wholly separate projects (Elkins, 2005: 15). Rather than testing the finiteness of Elkins' suggested sub-categories, it is more valuable to note his comment of the advantages of this model: "freeing the scholarship from its ultimately informational or supportive role, and potentially making the scholarship equal to the artwork" (Elkins, 2004: 26). This is in opposition to his category of research that informs the art practice, with the dissertation being art history, philosophy or art criticism, which makes the "common assumption that self-reflexivity is an unexceptionable good" (ibid.: 27). According to Elkins, the idea that "self-awareness is a desideratum needs to be treated as a problematic assumption, not as a guiding principle" (ibid.: 25). This raises the notion of reflection within the practice-based doctorate. It is often assumed that reflection and self-consciousness are core components of theses within these fields. For a higher degree, it is appropriate that the retrospective gaze and reflective evaluation be present within the thesis. However, reflection may take various forms, and need not be entirely dependent upon words.

Since research and art and design are activities, not simply bodies of knowledge, the knowledge of how to do these is fundamentally learnt, rather than taught: we gain experience in how to do these through researching, designing and making artwork (Downton, 2003: 9). Peter Downton writes that this learning is ongoing, and the knowing is embodied in the doing (ibid.). The process of research through art and design involves both immersion within the act of making, and analysis. This way of working asks the student to delve inside their area of inquiry while also maintaining a critical distance from it: the student is asked to hover between production and reflection (Gibson, 2008: 32). This hovering then manifests itself in the submitted thesis.

Since the making of studio work is an inherently recursive and reflective process, it is often deemed appropriate that the retrospective gaze be present within the dissertation. In these more narrative-driven theses, the researcher is presented as the subject of the research (Mäkelä, 2006: 78–79). Taking the assumption that "reflective, critical approaches are woven through quality designing and constantly inform design decisions" (Downton, 2003: 128), the decision was made during the writing of 'The Book as Site' that there was no need to further state this. As Ranulph Glanville writes, almost everything we research, "which involves us doing and thinking about what we do and think, is, at heart, recursive" (Glanville, 2003: 258). In this case study, the artefacts of the studio process are the holders and embodiment of reflection. The act of making places the studio works under constant interrogation. Hence, the studio works reveal and become active agents in producing ideas (Heylighen et al., 1999: 219). They are the manifestation of the iterative (one-sided) conversation the designer has with the (partial) propositions, of the constant evaluation of what has happened and what has been suggested or revealed (Downton, 2003: 101).

This case study embodies reflection in another way. The summation of 'The Book as Site' is that the qualities and characteristics of the artist's book, coupled with the content of *post factum* architectural documentation, coalesce to form a mode of three-dimensional architectural representation. In this way, the book forges a relationship between architectural ideas and projects and the vehicles of their dissemination, beyond mere documentation, reportage or observation, to continue to be the site of architectural innovation. The book is seen as the vehicle to conceptualise the artwork, think it into existence and appraise the work, not just to disseminate information. The book is seen as a translation of drawings and built form. This act of translation is not the transference, reproduction or image of an original, but rather is the transition between forms. This role of the book as analytic method makes it a potent vehicle for creative criticism. The doctorate offers new territory, then, for the relationships between *post factum* architectural documentation, art practice and critique.

Another location for the retrospective gaze is during the process of the *viva voce*, if present within the examination process. This offers the opportunity for candidates to detail their enquiries, share their knowledge and make the process public (Downton, 2003: 128). The examination at SCA included the space for a verbal narrative of the process and hermeneutical discussion. This retroactive approach collected the cumulative knowledge from the process, offered interpretation and future applications of thinking. The outcomes and conclusion of the thesis offered an application to pedagogy, a further way in which reflection resides within the practice-based PhD.

Christopher Frayling writes of three kinds of research in art and design: 'into', 'through' and 'for' (Frayling, 1991). This raises the issue of the oft-seen clumping together of the fields of art and design, in order to set them apart from other fields of research. While art and design do share an interest in the role of experience in knowledge generation and the assumption that the knowledge base in some way includes either the artefacts themselves or the knowledge that is embodied in them (Biggs, 2006: 182, 186), the terms are not interchangeable. The disciplines have access to different content, deep knowledge and, hence, different traditions as to the nature of research inquiries. Nigel Cross writes of the different aspects of education across the areas of science, the humanities and design. Education in each of these 'cultures' entails: the transmission of knowledge about a phenomenon of study; a training in appropriate methods of enquiry; and an initiation into the belief systems and values of the culture (Cross, 2007: 2). This case study demonstrates an interdisciplinarity between art and design. Undertaking the doctorate at an art school – outside the author's usual disciplines' visual training and core knowledge gained from architecture and landscape architecture – allowed for a freedom to probe the inconsistencies of architectural discourse outside an architectural institution, yet make the work applicable to the discipline. The "processes, imaginings, representing and testing which make up designing" (Heath, 2010: 454) were utilised to produce the studio artworks.

To use Frayling's terms, this case study demonstrates research *through art* but could also be termed research *into design* and research *for design*. The interdisciplinary nature of the thesis allows the opportunity for specificity and distinction: the maker is trained in design; the objects are designed artefacts, and read as artworks; the postgraduate context is both design and art and the thesis was examined as such. Downton writes that the transformational process of designing:

> enables what the designer knows, what has become available by research *for* design and the design knowing brought to the task and enriched *through* its doing, to be made manifest in the external physical world as a drawing, a model or an object.
>
> *Downton, 2003: 107*

Downton interprets research for design, or as he alternatively names it, "research to enable design", as that which helps the immediate design process (ibid.: 17). 'The Book as Site' examines the book as an alternative, three-dimensional representation and speculates on its potential role within architecture. It expands the term 'research for design' as research influencing future design processes, not just those of the individual.

Another phrasing using similar terminology is offered by Turkka Keinonen: 'art contributing to research' and 'research contributing to art'. According to Keinonen, *art contributing to research* is: "actions of research in the field of research are preceded and motivated by actions of art in the field of art" (Keinonen, 2006: 49), and *research contributing to art* is: "actions of art in the field of art are preceded and motivated by actions of research in the field of research" (ibid.: 50). As mentioned earlier, the dissertation of 'The Book as Site' was influenced by the process of making the studio works, and the direction of the studio works were influenced by the textual research and the act of writing. In this way, the thesis demonstrates both of Keinonen's definitions, with some adjustment: it is both art contributing to research *and* research contributing to design. The studio works both elaborate and extend the text, and the dissertation, rather than exposing and reflecting on results, places the studio work in a conceptual and historical framework. Rather than seeing Keinonen's terms as polar, but instead taking them as a necessary couple, refers to the oscillation of modes of working within the practice-based PhD.

It could be reasoned that within art and design, each discipline also has further differences. One such difference is the doctoral relationship between the research question, the voice of the writer and the structure of the thesis, and its associated examination process. To apprehend the relationship between these components is the core task for the doctoral student. To undertake a practice-based PhD, then, is to be interested in the relationships *between* things rather than finished works, that is, the interaction between the ongoing making and the evolving knowing. It could be reasoned that the practice-based PhD is a complex system; it is not constituted merely by the sum of its components – by the dissertation and the studio work – but also by the intricate *relationships* between those components (Cilliers, 1998: 1–2). In complex systems, these relationships shift and change, and rely on the system's capacity to store information concerning the environment for future use, writes Paul Cilliers; and "it must be able to adapt its structure when necessary" (ibid.: 10). This is an analogy of working; mapping these changing relationships, however, does not necessarily need to be a part of the dissertation.

Cover, page, cover: reading architecture

This chapter outlines a doctoral thesis that examines an expanded form of architectural practice. It explores the qualities and characteristics of architectural drawing within the book as a speculative practice rather than as purely instrumental. Incorporating a praxis of bookmaking within architecture relates to architecture's history of appropriating techniques outside its field. The thesis examines how the form of the book affects how the architectural work is conceived, constructed and read. The book, then, is seen as the vehicle to conceptualise the work, think it into existence and appraise the work, not just to disseminate information. The seeming conventionality of the book has the capacity to be reinvented anew, through creative practice, to take on a role of critical enquiry and to be the site of architectural innovation.

Through a discussion of the doctoral components of the research question, the structure of the thesis and the voice of the writer, the relationship between these is seen as crucial. Adrian Snodgrass and Richard Coyne write that the "design process is an uncovering of *tacit* understanding, which is not something fixed, crystalline or frozen. It is processual, fluid, in incessant flux . . . Understanding is always in process" (Snodgrass and Coyne, 2006: 52–53). This could be seen as analogous to the shifting, mutable relationships between the doctoral components. There is no one path or blueprint of navigation amongst the research question, the thesis structure or the voice of the dissertation. Instead, this path of interaction between the doctoral components could be described as 'organised indeterminancy' (Gibson, 2008). The participant needs to generate a methodology between these mutable components which is aligned with the core of each one. Rather than the relation between the textual dissertation and the studio works within a practice-based PhD being seen as a dilemma which can be addressed quantitatively, it should instead be seen as a core conceptual and structural relationship that needs examination by the postgraduate student, and in its addressing lies the crux of the practice-based doctorate.

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29

COMMUNICATING DESIGN RESEARCH

Improving the design of environments for people with dementia

Richard Fleming and Fiona Kelly

Introduction

There is unequivocal recognition of the relationship between the buildings we live, work, learn and relax in, and how we feel and act (Eberhard, 2006), with growing recognition of the importance of good care home design for promoting a positive experience for those who live, visit and work there (Innes et al., 2011). There is increasing recognition that care homes should not be medical institutions (Anderzhon et al., 2012), although there of course will be a need for medical supports as those who live there become more frail. However, the concept of home means so many things (to individuals, for communities and society) and the challenge for designers is how to create a space that serves multiple purposes; home for those who live there, workplace for care staff and a community within a community. Anderzhon et al. (2012), in their very useful book detailing 26 exemplars of design to meet the needs of older people, note two overarching principles that link these 26 exemplars: first that the physical environment is integral to the care being delivered and second that the design fosters a sense of belonging; a sense of feeling at home. Zeisel (2006: 74) highlights the importance of 'multidisciplinary professional cooperation' for the translation of complex concepts into designing places for people to live, work and play in and that are better suited to their needs:

> Cooperation enables people who work together to achieve more than the sum of each working separately. Even when people are through working together to solve shared problems, something remains: a knowledge of the other's discipline and point of view; new ways to define problems; an improved knowledge of how to cooperate with others.
>
> *Zeisel, 2006: 74*

In a practical approach to facilitate cooperation between stakeholders, we describe an innovative service established in Australia aimed at promoting knowledge and use of evidence-based design principles for people with dementia living in care homes. This service was established following recognition that the quality of care home design was influenced by the extent of knowledge held by the care home manager and the relationship between management and architects, thus highlighting the importance of a shared knowledge and vision of good dementia design.

First we will describe the key features of dementia and highlight important global projections of the numbers of people who will live with dementia. Second we will consider key elements of the design of care homes that are seen as important for a positive living experience for those who live there. Finally we will describe the rationale for and preliminary outcomes of the Australian knowledge transfer service before outlining the elements we consider are necessary for successfully communicating design research to key stakeholders.

Characteristics of dementia

Dementia is an umbrella term for a large number of progressive brain conditions that affect cognitive functions such as memory and reasoning. Alzheimer's disease is the most common form and accounts for between 50 and 70 per cent of dementias. The second most common form of dementia, resulting from small strokes, is vascular dementia. Other types of dementia include Lewy body dementia, alcohol related dementia and fronto-temporal dementia. Symptoms have been broadly classified by Burns (2001) as:

1 **Cognitive Impairment**: This is associated with problems with memory (amnesia), speech or understanding of language (aphasia), difficulty with carrying out physical tasks despite having intact motor function (apraxia), and difficulty with recognising objects or people despite having knowledge of their characteristics (agnosia).
2 **Behavioural and Psychological Symptoms (BPSD)**: The cognitive impairment may be accompanied by symptoms such as depression, delusions, hallucinations (visual and auditory) and behaviours such as 'wandering', incessant walking or agitation. It is important to understand that these symptoms may be due to the physical or social circumstances of the person with dementia rather than the dementia itself.
3 **Difficulties with Activities of Daily Living (ADL)**: In the moderate stages of dementia these can include difficulties with shopping, driving or handling money. In the later stages more basic tasks are affected such as dressing, eating and bathing.

While the levels of cognitive impairment and the difficulties with activities of daily living increase as the dementia progresses, the prevalence of behavioural and psychological symptoms (with the exception of passivity) tends to peak in the middle stages (Lövheim et al., 2008). The median survival from initial diagnosis has been estimated as 4.2 years for men and 5.7 years for women (Larson et al., 2004), although with people being diagnosed earlier in their condition this is likely to increase.

Dementia mainly affects older people with its prevalence increasing steadily as age advances. It has been estimated that the prevalence doubles every 5.1 years after the age of 65 (Jorm et al., 1987; Alzheimer's Disease International, 2009) (ADI). As Table 29.1 shows, people below the age of 65 can also develop dementia (known as early onset dementia).

Table 29.1 Prevalence of dementia

Rate (%)			
Age	*Males*	*Females*	*Persons*
0–64	0.1	0.1	0.1
65–74	3.1	3.4	3.2
75–84	8.8	10.4	9.7
85+	24.4	32.3	29.5
65+	7.1	10.3	8.8

Source: Australian Institute of Health and Welfare, 2012

Dementia is not restricted to developed countries. In 2005 it was estimated that 60 per cent of people with dementia lived in developing countries, with this number rising to 71 per cent by 2040 (Ferri et al., 2005).

Globally, declining fertility rates and increases in longevity mean that the proportion of people over 60 is rising and by 2050 it is projected that there will be two older people for every child (United Nations Population Division, 2003). For example, in Australia in 1970–71 the proportion of the population over the age of 65 was 8 per cent, in 2001–2 it was 13 per cent and it is anticipated that it will reach 25 per cent by 2045 (Australian Government, 2004). The combination of an increasing proportion of older people, the fact that dementia more often occurs in older people and improvements in diagnosis of dementia is resulting in a rapid increase in the number of people with dementia (ADI, 2009). ADI (2009) estimates that, worldwide, there were 16 million people with dementia in 2010, with this number expected to almost double every 20 years, requiring huge efforts on the parts of governments and society to meet their, often complex, needs.

The projected increase in the numbers of people with dementia is often referred to in the popular press as an 'epidemic' of dementia. This is somewhat misleading as dementia is not an infectious disease. The word epidemic portrays the sense of fear that many have as they contemplate the steadily increasing demand for resources that will occur as care is provided to those with dementia. This is well understood by governments and has resulted in the development of national strategies to meet the growing need to support this growing population (for example, Norwegian Ministry of Health and Care Services, 2008; Republique Francaise, 2008; Department of Health, 2009; Productivity Commission, 2011).

The Australian Institute of Health and Welfare (2012) (AIHW) estimated that 30 per cent of people with dementia live in accommodation in which care is provided, and the demand for residential places for people with dementia is estimated to grow at 4 per cent per annum between now and 2029 (Access Economics, 2009). The Norwegian Ministry of Health and Care Services (2008) recognise that despite the fact that nearly 80 per cent of people living in care homes have some form of dementia, many care homes are not built or adapted to meet their needs. In the UK, increasing understanding of the importance of good design in promoting well-being of people with dementia has resulted in a drive to redesign existing care settings and hospitals to make them 'dementia friendly' (The King's Fund, 2013).

There has been a substantial amount of empirical research into those aspects of the physical environment that can assist people with dementia by reducing confusion, agitation and depression while improving social interaction and engagement with activities of everyday living (Day et al., 2000; Calkins, 2009; Fleming and Purandare, 2010). This research has been used to develop a set of principles that inform the design of residential and care homes for people with dementia (Fleming and Bowles, 1987; Marshall, 2001; Fleming et al., 2003; Topo et al., 2012). The ten principles used in the work we report on in this chapter are:

- **Unobtrusively reduce risks**
  People with dementia require an internal and external environment that is safe, secure and easy to move around if they are to make the best of their remaining abilities. However, obvious safety features and barriers may lead to frustration, agitation and anger so potential risks need to be reduced unobtrusively.
- **Provide a human scale**
  The scale of a building will have an effect on the behaviour and feelings of a person with dementia. The experience of scale is determined by three factors: the number of people that the person encounters, the overall size of the building and the size of the individual components, such as doors, rooms and corridors. A person should not be intimidated by the size of the surroundings or confronted with a multitude of interactions and choices. Rather, the scale should help the person feel in control.

- **Allow people to see and be seen**
  The provision of an easily understood environment will help to minimise confusion. It is particularly important for people with dementia to be able to recognise where they are, where they have come from and what they will find if they head in a certain direction. When they can see key places, such as a lounge room, dining room, their bedroom, kitchen and an outdoor area, they are more able to make choices and find their way to where they want to go. Buildings that provide these opportunities are said to have good visual access. Good visual access opens up opportunities for engagement and gives the person with dementia the confidence to explore their environment. It can also enable staff to see residents from where they spend most of their time. This reduces their anxiety and the anxiety of the residents.
- **Reduce unhelpful stimulation**
  Because dementia reduces the ability to filter stimulation and attend to only those things that are important, a person with dementia may become stressed by prolonged exposure to large amounts of stimulation. The environment should be designed to minimise exposure to stimuli that are not helpful. The full range of senses must be considered. Too much visual stimulation is as stressful as too much auditory stimulation.
- **Optimise helpful stimulation**
  Enabling the person with dementia to see, hear and smell things that give them cues about where they are and what they can do can help to minimise their confusion and uncertainty. Consideration needs to be given to providing redundant cueing, for example providing a number of cues to the same thing, recognising that what is meaningful to one person will not necessarily be meaningful to another. A person may recognise their bedroom, for example, because of a view, the presence of furniture, the colour of the walls, the light fitting and/or the bedspread. Cues need to be carefully designed so that they do not add to unhelpful stimulation.
- **Support movement and engagement**
  Aimless walking can be minimised by providing a well-defined pathway, free of obstacles and complex decision points, that guides people past points of interest and provides opportunities to engage in activities or social interaction. The pathway should be both internal and external, providing an opportunity and reason to go outside when the weather permits.
- **Create a familiar space**
  The person with dementia is more likely to use and enjoy spaces and objects that were familiar to them in their early life. The environment should afford them the opportunity to maintain their competence through the use of familiar building design (internal and external), furniture, fittings and colours. This will involve an understanding of the personal background of the people living in the environment. The involvement of the person with dementia in personalising the environment with their familiar objects should be encouraged.
- **Provide opportunities to be alone or with others**
  People with dementia need to be able to choose to be on their own or spend time with others. This requires the provision of a variety of spaces, some for quiet conversation with one or two others and some for larger groups, as well as spaces where people can be by themselves. These internal and external spaces should provide a variety of opportunities, for example a place for reading, looking out of the window or talking, to cue the person to what is available and to stimulate different emotional responses.
- **Provide links to the community**
  Without constant reminders of who they were, a person with dementia is at risk of losing their sense of social identity. Frequent interaction with friends and relatives can help to

maintain that identity. This is made easier when the person is living in a care setting within or close to their own community, as friends and relatives are able to drop in easily.

The environment must include spaces that the resident and their visitors can use, both within the unit and in its immediate surrounds. These need to be attractive and comfortable to encourage visitors to come and spend time with the person with dementia. Stigma remains a problem for people with dementia so the unit should be designed to blend with the existing buildings and not stand out as a 'special' unit. Where possible a 'bridge' should be built between the unit and the community by providing a space that is used by both the community and people with dementia. Where the unit is a part of a larger site, there should be easy access around the site so people with dementia, their families and friends can interact with other people who live there.

- **Respond to a vision for way of life**
  The environment should support the person with dementia to lead a life that has meaning and value to them. The choice of this life style, or philosophy of care, will vary between care homes. Some will choose to focus on engagement with the ordinary activities of daily living and have fully functioning kitchens. Others will focus on the ideas of full service and recreation, while still others will emphasise a healthy life style or, perhaps, spiritual reflection. The way of life offered needs to be clearly stated and the building designed both to support it and to make it evident to the residents and staff. The building becomes the embodiment of the philosophy of care, constantly reminding the staff of the values and practices that are required, while providing them with the tools they need to do their job well.

While the information that underpins these principles, and those developed by others, has been available for a considerable time and in many instances is backed by high quality research (Fleming and Purandare, 2010), it is not always used in the design of care settings for people with dementia. The situation in the UK is captured in this quotation:

> The vast majority of care home residents in the UK have a form of dementia. More than a third of these residents are not staying in facilities specifically designed for their needs. Many homes have been adapting existing environments that are not up to date with current thinking in the field. As a result, poor care facilities are making it more difficult for carers to deliver a good level of person centred care.
>
> *Timlin and Rysenbry, 2010: 6*

While there are examples of good design to be found in care homes, the results of an audit of 56 care homes in Sydney, Australia showed that many have been designed in a way that does not reflect the application of evidence-based principles (Smith et al., 2012). Van Hoof and Kort (2009) identify how meanings of concepts and terminology differ between disciplines, with, for example, different meanings given by health professionals and those in technological sciences to the 'physical environment' indicating the need for clarity when communicating such concepts. The conceptual gap between the actual design of dwellings that people with dementia live in, whether their own home, care homes or supported accommodation, and the evidence base highlights a problem in the translation of dementia design knowledge into practice.

Design for dementia: translation of knowledge into practice

There is no universally acknowledged model of knowledge translation (KT) (Graham et al., 2006), indeed it has been reported that there are more than 90 terms used to describe the process

(Straus et al., 2009). The translation of evidence into practice, particularly in the health sector, is extremely challenging (Armstrong and Kendall, 2010), with problems including a time delay between innovation or knowledge creation and its uptake in practice, differing definitions of evidence held by different stakeholders and the need to develop a critical mass for evidence to be embedded into practice. In a review of KT literature, Ward et al. (2009) identified 28 different models, which explained all or part of the KT process. Five common components emerged:

1 problem identification and communication;
2 knowledge/research development and selection;
3 analysis of context;
4 knowledge transfer activities or interventions;
5 knowledge/research utilisation.

Of the models we have reviewed, the trans-theoretical model (Prochaska and Velicer, 1997) looks at change at the level of the individual, and suggests that health behaviour change involves progress through six stages of change: pre-contemplation, contemplation, preparation, action, maintenance, and termination, although Rogers (2003), looking at the broader picture, conceptualised these as stages in the decision-innovation process. Graham et al. (2006) describe their knowledge-to-action framework as a dynamic and iterative process, with the following seven steps: identify problem; adapt knowledge to local context; assess barriers to knowledge use; select, tailor and implement interventions; monitor knowledge use; evaluate outcomes; and sustain knowledge use. In their very influential paper, Pathman et al. (1996) provided a useful, four-stage framework for exploring the issues around knowledge translation on a large scale. They suggest that if knowledge is to be translated into practice, the potential knowledge users must first become aware of the existence of the evidence, for example, by reading an article or a conference presentation. In the second stage, Pathman et al. suggest that the user must evaluate the new knowledge and come to the conclusion that it is credible and that they agree with it. In the third stage, the knowledge must be adopted into practice and in the fourth stage, adherence, the new application becomes business as usual, often as the result of the development of regulations to ensure compliance with accepted good practice.

The idea that knowledge translation in the area of the development of medical services is a simple linear process has, however, come under criticism. Newell et al. (2003) have drawn attention to the role of 'process knowledge' as a facilitator in the transfer and application of 'product knowledge'. This approach recognises that the characteristics of the relationships within a project team will have a profound impact on the uptake of the available knowledge. McDonnell (2009) has investigated this in the area of client–architect relationships and, while not using the language of knowledge transfer, has come to similar conclusions. Analysing conversations between architects and building users, she describes the interchanges in a collaborative planning meeting and reports that "a priori designations of the roles of building user, client, designer . . . are also to some extent continually negotiated during conversation" (McDonnell, 2009: 49). McDonnell goes on to suggest that in the context of such negotiations, it is important not to "overprivilege nor to under-rate expertise" but rather to acknowledge the expertise of others and their right to assert their expertise when the situation demands as "a practical way to get things done . . . a consensual act without implying power inequality" (ibid.).

The Pathman's model of knowledge translation, informed by the insights of Newell et al. (2003) and McDonnell (2009) has been used in a study investigating the reasons for the lack of application of the evidence base that we have identified (Fleming et al., 2012). The study involved five care facilities for older people in Tasmania and five in New South Wales (NSW), Australia. In Tasmania, a convenience sample of facilities that had been either built or renovated within the last five years was accessed. The NSW sample was selected to ensure that the facilities had been built within the last two years. The study involved undertaking an audit of each facility using the Environmental Audit Tool (EAT) (Fleming et al., 2003). This tool measures the extent to which the building complies with the ten principles of design outlined above. The data gathered were used in the production of a report that highlighted the gaps between the design of the facility and the optimum design as defined by the principles underpinning the EAT. This report was provided to the representatives of the care facilities who had been involved in the design process and to the architects. The care facility managers and the architects were then interviewed separately using a semi-structured interview schedule designed to guide them through a discussion of their awareness, acceptance and adoption of the principles of design that underpinned the audit.

Five of the care facility managers clearly described an awareness of the principles contained in the report provided to them. All of the managers who were aware of the principles stated that they agreed with them. One of the architects expressed only partial awareness of and partial agreement with the principles, the remainder described themselves as being aware of the principles and agreeing with them.

The mean EAT scores of the facilities where the manager was aware of the principles was 73.96; significantly higher (t test, sig. 0.01) than the mean EAT score of 61.82 for those facilities where the managers described themselves as unaware or only partially aware of the principles. As the architects were aware of the principles this suggests that it is the manager's awareness of the design principles that makes the difference. It appears that the architect's knowledge is overridden by the manager's, as they write the brief that the architect follows. This conclusion was reinforced by the finding that the building refurbished by the architect with only partial awareness of the principles was amongst the sample of higher scoring buildings, because the manager had provided the knowledge. There was no problem in the agreement phase of Pathman's model as everyone who was aware of the principles agreed with them. The adoption of the principles into practice followed on directly from the agreement.

It is unreasonable to place all of the responsibility for the application of evidence-based design principles on the managers of care facilities for older people. The lack of influence of architects, who claimed awareness of the principles, must raise questions about the willingness of architects to take on an active role as educator and professional guide. The data suggest that on at least three projects there was the opportunity for the architects to raise the awareness of the managers. If they tried they were not successful and followed the directions of inadequately informed managers. The data also showed that there was tension in 50 per cent of the relationships between architect and client.

The qualitative interview data suggested that the fundamental problem does not lie with either the managers or the architects but with their combined failure to establish an effective project team. Newell et al. (2003) have highlighted the vital role that the exchange of knowledge within the project team plays in achieving best practice outcomes. Successful project teams are characterised by a willingness to interact, debate and go through a process of sense making in which the members try on the perspectives of the others involved in the process. The presence of tension between architects and managers in 50 per cent of the projects described here may well be an indication of the difficulty of establishing a successful team and the resultant problems in realising 'a practical way to get things done'.

The relatively poor outcomes in the five homes where the managers were not fully aware of the principles of dementia friendly design may therefore be explained in two ways. The first is a failure in stage one of Pathman's model: the existing evidence-based information had not been brought to the attention of the managers, they were simply not aware of it. Second, the tensions between the architects and the clients are probably an indication of the failure to establish a cohesive team characterised by mutual respect and the ability to hear other points of view, negating the availability of the knowledge from the architects.

Disseminating design research

The NSW/ACT Dementia Training Study Centre provides a Department of Health and Ageing funded service to encourage care providers planning refurbishments to take advantage of the available research information. This service usually involves a one-day site visit by an expert in the design of environments for people with dementia. The service will only be provided when two conditions are met; the full design team, including managers and architects, will be present and the project is at a stage where the provision of advice can make an immediate difference to the design of the refurbished care home. The day begins with a presentation of the ten dementia friendly design principles and a discussion of their application in the context of the philosophy of the care home.

This is followed by an evaluation, using the EAT (Fleming et al., 2003; Fleming, 2011; Smith et al., 2012), of that part of the care home that is to be refurbished. This evaluation is conducted in collaboration with key staff from the care home. The results of the audit are processed immediately and presented to the project team in the form of a graph, see Figure 29.1, that

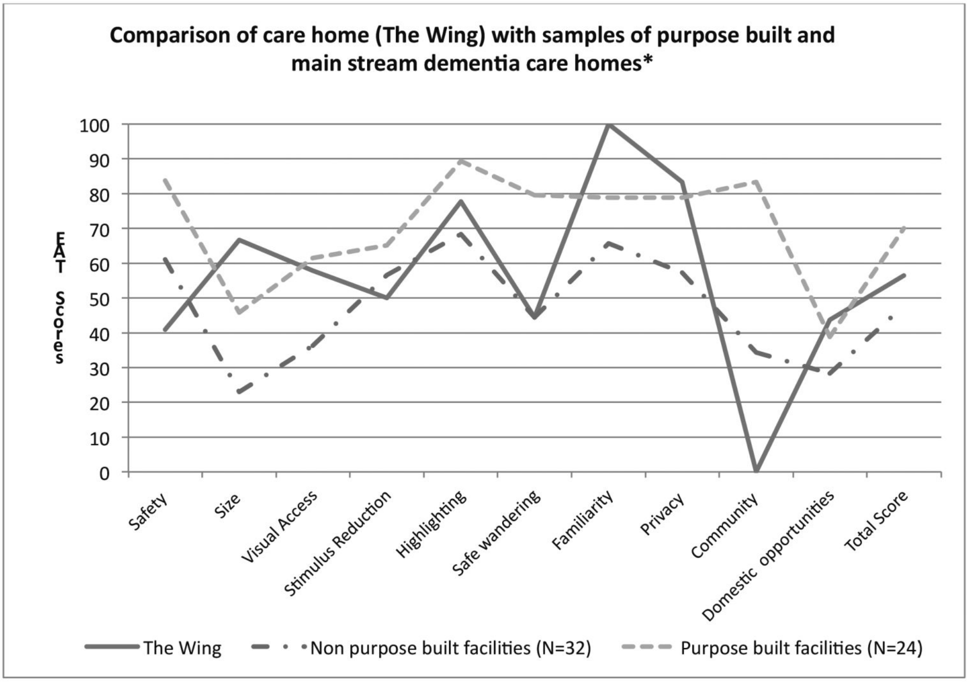

Figure 29.1 Comparison of EAT Scores

Note: *Comparative data drawn from Smith et al., 2012 compares their care home with a sample of purpose built dementia care homes and a sample of main stream dementia care homes. Higher scores indicate closer adherences to the design principles.

The afternoon begins with a discussion of the strengths and weaknesses of the care home as shown by the graphical comparison with other care homes. This leads on to a detailed discussion of the items in the audit tool that have identified where the greatest room for improvement lies. This discussion is systematised by ranking the EAT items by their Room for Improvement score (possible score – actual score) and discussing each item in turn. This service has been delivered to more than 100 care homes in NSW, Victoria, Tasmania, Queensland, South Australia and Western Australia since it commenced in mid-2011. It is the subject of a systematic evaluation of the extent to which it results in the transfer of information and the application of the information in practice. This involves pre- and post survey of knowledge of design principles and a six-month email and telephone follow up to identify changes brought about by the service. Preliminary results strongly suggest the need for provision of information to the whole of the design team at critical time points in the design process. This contrasts with the more usual route of knowledge translation that involves one or two members of the project team in collecting information via conference attendance and reading, both of which are likely to be ad hoc processes and do not address the issues of making the information available to the team in a way that maximises their awareness, canvasses their agreement and sets up a readiness for adoption.

This service is clearly labour intensive and it may seem that it is therefore impractical to use it to bring about a large scale change in the quality of physical environments for people with dementia. This problem may not be as large as it appears at first glance. While it would be wonderful to mandate the refurbishment of the unsatisfactory portion of the current care home stock, this is highly unlikely to happen. In reality that stock is refurbished as and when resources and opportunities allow. A survey of 289 randomly selected care homes in NSW was undertaken to find those that had been refurbished or had new wings or units added in the previous two years (Fleming et al., 2012). Thirteen facilities met these criteria giving rise to an estimate that 4.5 care homes per 100 facilities undergo refurbishments per year, providing an opportunity for the provision of information and support that will improve the quality of the building for people with dementia. There are approximately 3,000 care homes for older people in Australia; thus in order to ensure that all of the refurbishments are carried out with an awareness of evidence-based design principles, the service will need to identify and consult with 135 care homes per year. This level of activity is achievable within the resources of the centre.

Conclusion and learning points

In this chapter, we have identified the importance of good design for positive experience and have introduced design principles to guide the design and use of spaces in which people with dementia live. We have emphasised the role of design in supporting independence, safety, links with the community and privacy. It is clear, however, that translating such design knowledge into practice not only depends on the acquisition of relevant knowledge and information, it also requires close cooperation with key stakeholders at critical time points. Van Hoof and Kort (2009: 310), in their development of a demonstration home care environment, summarise the process as follows:

> Because in dementia all aspects of the home environment need to be in harmony with each other, the design of such buildings calls for a 'Gesamtkunstwerk' approach, in

> which all disciplines work and design together to come to a single end-product. The word 'Kunst', meaning art, should be combined with evidence-based practice derived from scientific research in order to come to an end-product that does not only possess certain aesthetic qualities, but also functions as a supportive entity.
>
> *Van Hoof and Kort 2009: 310*

We have described an innovative service delivered by the NSW/ACT Dementia Training Study Centre and funded by the Department of Health and Ageing, aimed at encouraging care providers planning refurbishments to care homes to take advantage of the available research information on dementia design. This service aims to close the theory/practice gap by using Pathman's model of knowledge translation. Findings from a preliminary evaluation of the service indicate the need for certain understandings and processes to occur for multidisciplinary professional cooperation (Zeisel, 2006). Specifically, there needs to be:

- a common level of awareness of key information to successfully communicate design research;
- agreement between the team members on the value of the information is required;
- a willingness to apply the information to the current situation, whether it is refurbishment or a new build;
- the development of a conversation between the managers and architects on 'a practical way to get things done';
- a willingness to make substantial changes in the plans, if required, to bring them in line with evidence-based principles.

We suggest that there is only a small window of opportunity for knowledge translation to occur in the design process. Attempts at knowledge translation via conference presentations, for example, will rarely be timely and may well lead to frustration as the holder of the new knowledge may not have the opportunity to put it into practice. Knowledge that is gained while the design is being implemented may also lead to frustration if the new knowledge holder is aware of problems in the design but unable to do anything about them. It is the provision of critical information to critical people at the critical time that will result in efficient knowledge translation and improve the quality of life of the burgeoning number of people with dementia who live in care homes.

While the example of knowledge translation explored here has involved the design of buildings, it is suggested that a deliberate effort to identify the critical period during which a team needs new and relevant information, and to follow through with the provision of a timely service that supplies that knowledge, will result in more efficient knowledge translation in most settings.

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30

MAKING MEANING HAPPEN BETWEEN 'US' AND 'THEM'

Strategies for bridging gaps in understanding between researchers who possess design knowledge and those working in disciplines outside design

Michael R. Gibson and Keith M. Owens

A call for design researchers to reach across disciplinary boundaries

Investigators who use knowledge from design to gain insight into current existence, as well as to invent future alternatives to it, often do so as a means to generate research yields that include knowledge *and* effect – that is, bounded but measurable actions informed by contextualised understanding. Likewise, investigators from outside design, in particular the sciences, also possess the capacity to generate and validate new knowledge that can form the basis for understanding and action, although their endeavours often emphasise the former over the latter. And so, while investigators from within and outside design both possess knowledge of the *necessary* theories, methods and tools to allow them to gain insight and foment effective change, neither group, working alone, may have the *sufficient* capacity to achieve larger transformative ends. Changing conditions within which researchers find themselves, and the natural limitations of specialised inquiry, have made this lack increasingly pronounced.

Today, investigators from outside design seek to improve conditions in areas as diverse as global development, education, social innovation, natural resource management, health-care, public policy and the socio-economic 'livability' of communities. That their focus is drawn to these significant human endeavours is not surprising, or new. What is new, however, is the fact that these investigators are increasingly being challenged to validate their understandings to more of the people who may be affected by their endeavours and more who are asking to actively participate in many of the research processes that yield results which affect them. The desire by stakeholders to plan active roles in determining the criteria by which research outcomes will be developed and assessed is one of the primary drives for this type of participatory research paradigm (Crishna 2007: 217–219; Muller 2002: 1053–1057). While this push to involve stakeholders in the creation of knowledge and provide them ownership to its tangible outcomes is not as novel to design – calls for design investigators to generate and use knowledge in this way can be traced back to the 1960s, notably in the work of Alexander, Rittel, Papanek, Cross, Archer, Simon and Jones – design has not entirely or successfully come to grips with this reality either.

Moreover, the inherently narrow disciplinary focus of traditional research in any field, design or otherwise, limits its potential to address situations that involve diverse communities and their wildly varying expectations (Fischer 2004: 152–161). Societies are now evolving in a world where the social, technological, environmental and political challenges confronting them are increasingly too large, too complex and too interdependent for amelioration that is too myopically informed. As Rittel and Webber suggest, the relatively 'easy' problems confronting society have been addressed: "The streets have been paved, and roads now connect all places; houses shelter virtually everyone; the dread diseases are virtually gone" (Rittel and Webber 1971: 156). Replacing these are so-called 'wicked' problems: ill-defined breakdowns in the social and natural fabric that resist clear definition, for which there is no ultimate 'good solution', and which are shot through with contentious perspectives concerning equity – what 'ought' to be, rather than what *is*. Logically, then, the growing intractability and rapid expansion of the scope and interconnectedness of real world social, economic and natural systems problems, as well as their corresponding demand to link diverse perspectives with innovative action and considered behaviour, makes the need to overcome equally obstinate barriers to collaboration between designers with research expertise and other investigators all the more pressing. Ideally, these efforts could guide interdisciplinary opportunities that have the potential not only to transform how diverse investigators work to better understand our world, but to also yield outcomes that spark and sustain transformations within it that will help make the future more livable for more people.

While the need appears pressing and the potential benefits promising, collaborative research activity across disciplines or among diverse constituencies is generally not in common practice. Nor does it often occur organically absent of purposive action by diverse investigators and/or stakeholders. The failure to involve researchers who possess design knowledge in research initiatives that require contributions from diverse communities and multiple disciplines means that these initiatives are deprived of understandings that come from the unique knowledge space occupied by design, which is not constrained by tightly defined, paradigmatic boundaries. As articulated by Harder, Burford and Hoover, "Its transcendence above paradigm boundaries gives design a privileged perspective, and provides fertile ground for building up a framework of knowledge" (2013: 43). Failing to operate this type of collaborative research also denies researchers from outside design the knowledge designers can bring to research processes that guide manufacturing and distribution, the dissemination of messages, new ways of doing, or new ways of processing information.

In what follows, some of the barriers to these types of collaborations are examined descriptively as well as from a particular, normative vantage point. It is the central premise of this chapter that productive collaboration in and around research – interdisciplinary approaches to methodically guided investigation, analysis and action – requires bilateral understanding resulting from critical dialogue, that is *communication*, and is fueled by action rather than contemplation, that is *agency*. From this premise, it is logical to suggest that design research, in possession of its array of communicative, dialogic and action-fuelled tools, can and should become more proactive in its efforts to overcome the stubborn barriers thwarting collaboration between design researchers and other investigators and stakeholders from outside design.

Identifying and overcoming barriers to collaboration

If collaboration among investigators is one of the more viable means to engage contemporary world problems, and design researchers possess the capabilities to foster such exchanges, why aren't these types of partnerships more prevalent? In one sense, such collaborations do exist, but are often more narrowly construed and tend to occur in near-field disciplines. This is true of partnerships that call upon multiple *scientific* intelligences to inform their operability, such as nanobiology, bioinformatics and quantum information processing. This is also true of partnerships that rely on similar investigative methods despite addressing more synoptic topics of study, such as material culture or queer studies. However, forging partnerships between disciplines that are more inherently diverse, or that attempt to span entire domains of inquiry – the sciences and humanities – is more difficult. Disciplines like design that derive significant knowledge from examining conceptual foundations and propositions expressed in subjective, qualitative narratives often find themselves at odds with disciplines like agricultural management and disease prevention that rely more on quantitative measures to create the kind of knowledge they value and utilise. These instances of difference exemplify the types of significant barriers that exist which often hinder the creation and cultivation of more diversely populated research partnerships. Individually and collectively, these hurdles form impediments to the collaborations designers and other groups need to overcome if they are to work together to understand the world in new ways and bring positive transformations into it.

Initially and importantly, design researchers and researchers from other disciplines must dispel a number of disciplinarily fuelled biases about each other. Those from the world outside design need to understand that designing has evolved beyond the creation of embodied aesthetics to the invention of outcomes and affordances that build value, empathy and storytelling (Kolko 2013). Conversely, those from the world of design need to seek understandings of – rather than merely about —how investigators who employ scientific procedures utilise theories to frame and operationalise methods, account for variables as they test concepts and claims for validity, and document and share their processes and results. Both sides must realise that these misperceptions underpin the construction of the bulwarks that impede attempts to foster meaningful dialogue, common understandings and the productive collaborations necessary to engage with the types of ill-defined problems spawned by an ever more complex, intensely mediated and interconnected world.

Beyond these basic perceptual hurdles, however, other equally obstinate impediments exist that can and do hamper meaningful research exchange and action. Any schema of these stumbling blocks would include the following:

- The variances between the animating principles of design research and other purposive human endeavours, disciplines or modes of inquiry. For example, design research might be undertaken to achieve pre-determined ends rather than be employed as an open-ended method of knowledge acquisition.
- The difference in temporal orientation between design and other forms of research. That is, the difference between a focus on understanding what exists at present – e.g., gravitational attraction over distance, and a focus on inventing a future outcome not yet in existence – e.g., an empowering social arrangement that would benefit elderly shut-ins.
- The contrasting views held by those who engage in research informed by design and those who engage in research informed by other disciplines about the legitimate participation of researchers in their systematic inquiries. That is, a differing view over the necessary level of remove between researcher and subject.
- The well-recognised general impediments to interdisciplinary collaborations (Jacobs and Frickel 2009: 60). For instance, the privileging of disciplinary theoretical knowledge over interdisciplinary problem-based knowledge, the existence of institutionalised disciplinary bias and the belief that interdisciplinarity is inherently parasitical — that is, it draws upon disciplinary competence in a non-reciprocal fashion.

Each of these four areas is briefly examined below.

When collaborating with others in order to achieve a common end, partners naturally consider their common goals and the best means to attain them. Treading silently alongside, however, are the normalised preconceptions, dispositions and first principles colouring the worldview of all involved. These shaping conceptions are diverse and, at times, may seem incommensurate. Owen neatly captures this reality in his explication of the needs, values and measures of design thinking when compared with those of science, art, law and medicine (Owen 2007: 17–18). One sample comparison can illuminate the synoptic differences between science and design and their respective needs.

Archer echoes this same dynamic when articulating the differences between traditions in scientific research and those common to the humanities, the former being animated by the need to explain, the latter by a desire to evaluate and at times foment change (Archer 1995: 6–7). Elsewhere on the same topic, Archer suggests that while design shares sensibilities with the sciences and the humanities, it enjoys a level of autonomy by virtue of its interest in and ability to actively shape the material world. The fact that design often straddles numeracy and literacy while uniquely contributing to the practical and ethical application of these forms of knowledge places the discipline at a juncture that is both central and at times frustratingly indeterminate.

For example, the nature of generalisability and notions about researcher involvement are two elements common to but viewed differently by these two traditions. Scientific research characteristically values generalisability: "explanations that remain valid when tested in wider and wider fields of application, and which therefore offer some powers of prediction" (Archer 1995: 8). Design research, however, is typically pursued through action, in particular real-world situations – thus it is highly specific and therefore generalisable only to a very limited degree. Moreover, most scientific research is conducted to ensure objectivity and is observationally remote: ideally, the investigator should not interfere or be personally reflected in the phenomenon or the forces at work within it. Conversely, much design research purposefully immerses the investigator in the phenomenon under study, often with the explicit desire to change some aspect of it from an existing to a preferred state (Simon 1981: 126). In a less obvious but nonetheless critical difference, while researchers from outside design may also adopt immersive postures, especially those in the natural sciences, these investigators may not be seeking to function as situated change agents in the way that many design researchers do. Rather, they may view their immersion as a function of experiential discovery and validation rather than normative transformation. As Friedman posits, "Design is both a making discipline and an integrated frame of reflection and inquiry. This means that design inquiry seeks explanations as well as immediate results" (Friedman 1997: 60).

Table 30.1 Owen's (2007) needs, values and measures of design thinking

	Needs	*Values*	*Measures*
Science	understanding	correctness thoroughness testability	true/false provable/un-provable
Design	form	cultural fit appropriateness effectiveness	work/doesn't work better/worse

A second barrier that impedes the development of mutual understanding between those who place the word 'design' ahead of the word 'research' and those who place words such as 'science', 'market', 'social' and 'medical' ahead of 'research' is that these latter constructions "articulate [that which] has worked so far [whereas] design articulates constructions that might work in the future – but not without human intervention" (Krippendorff 2007: 79). Many from outside design who have learned to engage in research to fuel knowledge are not as familiar with utilising research to envision *both* the construction of new knowledge (articulated as theories) *and* to yield applied results (articulated as new processes and procedures, or new ways of facilitating services, or new inventions).

Apart from differing temporal orientations, design practice and research that make concerted efforts to involve end users and subjects of study in significant, constructivist ways during the operation of solution-seeking or research processes also find themselves at odds with other disciplines that privilege 'expert' knowledge and with those who possess and wield it. In a sense, the disciplines with which design researchers wish to engage characteristically function as closed expert systems resistant to accepting knowledge generated by external sources. Thus, they may suspect methods that involve non-experts in the creation of insights and new knowledge that is difficult to measure using traditional or more widely accepted 'scientific' means. Design practice and research, on the other hand, often operate as open expert systems involving laypersons and the production of contextually derived but unquantifiable tacit or experiential bases of knowledge. Sanders (2008: 13–17) explores this user-centric, open paradigm in her systematic efforts to map meta-trends in design practice and research. Her investigations reveal that design-led, expert mindset forms of practice have been joined and are now perhaps being supplanted by participatory, research-led modalities. Examples include making use of generative tools, co-creative practices, participatory design and lead-user innovation. Bowen strikes the same participatory chord in his research into critical theory and the ways in which critical artifacts – objects or models that prompt user-driven critical reflection and co-creative solutions – can be used as "tools for exploring problem contexts and generating needs-focused product ideas" (Bowen 2007: 14), or better answers that can take the form of new knowledge as well as effective solutions.

Finally, although the world and its problems have fuelled "heightened demands for problem solving . . . [and] fostered greater interest in collaboration and the ability to work with multiple sources of knowledge" (Klein 2006), endeavours by investigators to work across disciplines – be it design researchers or others – confront now highly codified disciplines surrounded by strict boundaries. Their inherent theoretical or paradigmatic homogeneity can make them hostile to alternative conceptual approaches, and to knowledge that is not supported by their preferred modes of validation and basic notions of what counts as 'knowing' or 'truth' or fallibility. Moreover, disciplines can be suspect of any effort that appears to draw from their respective stores of knowledge without a clear sense of reciprocity. Or, more broadly, that inter-disciplinarity "is a sink in the intellectual systems while the traditional disciplines are sources" (Hansson 1999: 340). These highly institutionalised approaches to understanding the world and the corresponding perspectives on knowledge creation and its management can continue to yield deep insights and robust predictive power. Nonetheless, they can also be resistant to the growing need for shared attempts at wider problem setting, meaning making and solution finding.

No doubt, differing approaches to systematic inquiry, data collection and validation and bias about the legitimisation of expertise often stymie efforts by design researchers seeking common ground with those from outside the discipline – be it interdisciplinary opportunities with other investigators or collaborative exchanges with external partners. However intransigent these obstacles may appear to be, examples of more broad-based synergistic efforts have begun to emerge. For example, academic collaborations between designers and anthropologists in the early 2000s have resulted in the inception of Design Anthropology and Design Ethnography as academic degree programmes or course concentrations in several western European, Australian and American universities. This is also reflected in the relatively recent rise in requests for proposals from the American National Science Foundation (NSF) that have called for contributions from design researchers, and that call to advance design research and education. In the United Kingdom, the Arts and Humanities Research Council (AHRC) of the Research Councils UK regularly solicits proposals from interdisciplinary teams of researchers, including those who possess design knowledge in particular. However, these examples remain the exception rather than the rule. More often than not, it remains the case that research of varying types employ different means, hold different values and have markedly different ends – seeking to negotiate with reality rather than hypothesise about it, or seeking to change the world rather than know more about it (Frayling 1993/4: 4).

Nonetheless, design research and other forms of inquiry or problem solving are not so dissimilar in process that their respective investigative approaches and solution-seeking methods preclude collaborative working modes and shared enabling artifacts. In fact, design researchers (and some designers) already employ methods that could easily be adapted to the task. Key among them are those that enable iterative testing approaches and feedback loops, explicate conceptual frameworks or theoretical principles, support decision making and visualise equivalencies, systems, relationships or correlations. In order to support this assertion, the final section of this chapter examines a series of specific design research methods and their respective ability to reduce barriers to common understanding.

Three methods to foster understanding and guide effective collaboration between investigators from inside and outside design

Conceptual mapping

Concept maps rely on utilising diagrammatic processes to visually depict the relationships that exist between the various types of conditional factors, circumstantial issues, actors and the various networks they combine to constitute a particular situation (Figure 30.1). These four variables, or 'concepts', are described as follows:

- Factors encompass socio-economic, political, technological and environmental conditions that can be cited as having broad causal or correlational influence. Examples include regular access to electricity and the Internet, amount of rainfall per year and the type of government in power in a given region.
- Issues are qualified as having more direct, micro-level types of influence on the evolution of a particular situation. Examples include how particular groups choose to signify social class distinctions or aspirations, political beliefs or sexual attitudes by possessing and operating specific types of material goods or utilising specific types of services, and how these choices affect perceptions and patterns of consumption in given areas among certain populations.
- Actors are represented in concept maps by personas whose behaviours are hypothetically guided by particular sets of social, cultural, economic and political beliefs. Given their respective biases, the manner in which they act within specific kinds of situations can be accounted for visually within a given concept map's structure.

- Networks can be constituted in a concept map wherever the map creators deem it necessary to organise a given group or groups of factors, issues or actors together so that their collective influence on other networks or individual factors, issues and actors can be more effectively understood.

Both the collaborative, iterative process that informs the creation of a concept map and the artifact that results affords research team members opportunities to "see both the forest and the individual trees" (Dubberly 2010). Relationships between details within specific areas of the map may be understood as they are also understood within the context of the entire system.

Used interdisciplinarily, concept maps can help diversely populated research teams examine problems that call for contributions from researchers who have cultivated different types of knowledge from distinct backgrounds, approach their work from divergent perspectives and possess various types of expertise. These types of problems tend to require the merging and expansion, and eventually the transcendence, of disciplinary understandings. They will require the creation and utilisation of knowledge that is informed by integrating methods and concepts from individual disciplines to effectively investigate and explain new and complex phenomena (Olson 2013). Samples of these include:

- How should oceanfront communities around the world prepare for the climatic changes and rise in sea level that will affect them by the latter half of the twenty-first century (or sooner) as a result of the alteration of the earth's atmosphere?
- How can the complex combination of social, environmental, political and biological factors that appear to be contributing to a rise in obesity rates in several populations around the world be better understood?

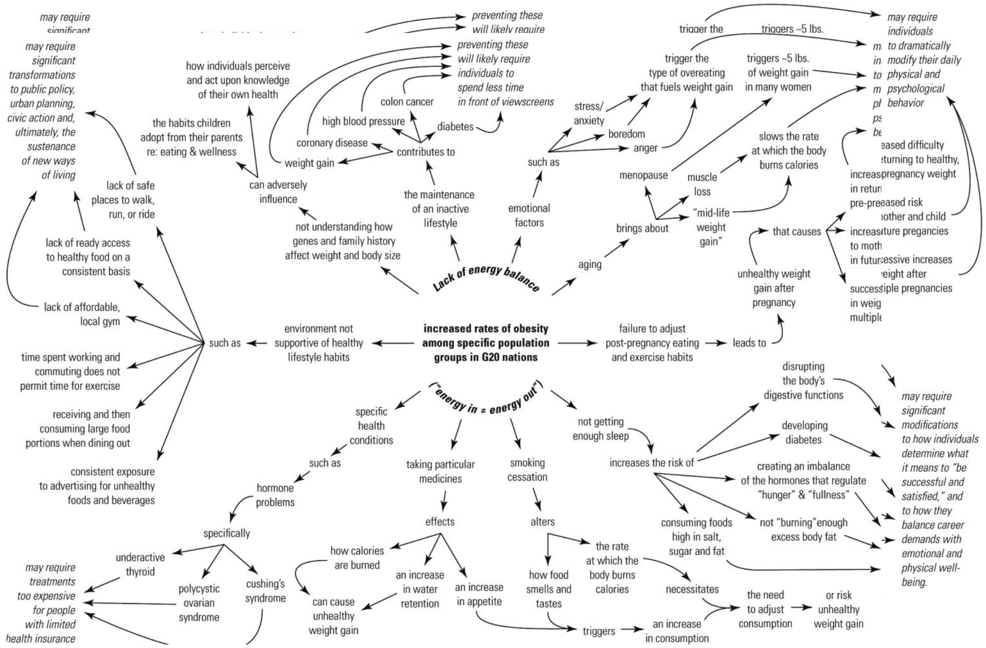

Figure 30.1 This type of concept map provides interdisciplinary research teams with a means to work together to depict how they understand the interactions between the complex sets of factors, issues, actors and networks that are affecting or that could affect a particular situation

- How can human populations alter extant or invent new means for producing the energy necessary to meet the needs of modern societies without simultaneously dooming the future livability of the earth?

Concept maps are structurally neither hierarchical nor linear. They can be dynamically used to analyse multiple clusters of inter-related ideas in ways that can help construct meaning and facilitate sense-making. They exist to represent collectively how complex arrangements of factors, issues, actors and networks affect each other within complex systems. It is the discussion between researchers from design and those from other disciplines during the configuring and re-configuring of concept maps that can yield increased understanding between them. This occurs as members of each camp attempt to explain how the operation of specific linkages between given factors, issues, actors and networks positively or negatively affect the living or working experiences of those who occupy the situation depicted in the concept map.

Conceptual prototyping

As described here, this collaborative, cyclic process fosters and documents an ongoing series of interactions between three broadly defined groups: 1) stakeholders who may or will be affected by the implementation of a given procedure or system of operations, the performance of a tool or set of tools, or interactions with various features of a built environment or computerised interface; 2) researchers, often based in design, whose methods tend to yield applied means to improve how given conditions affect the situations within which the first group lives and works; and 3) other researchers, often based in the social sciences, information science, education, environmental science and business, whose methods tend to yield theoretical knowledge, or validation, or predictions of the future based on the analysis of past events.

Conceptual prototyping is an iterative, heuristically informed critical design process intended to result in situational transformation rather than an affirmative one intended merely to augment, reinforce or make more efficient that which already exists. The critical processes that guide the making and re-making of roughly articulated prototypes allow members from each aforementioned group to use dialogic exchanges to elucidate particular ideological viewpoints and specific cultural, social, economic or political biases. Prototypes can be crudely realised sketches or layouts of computer interfaces, wayfinding systems or paginated materials. They can also consist of simple three-dimensional mock-ups of products, packages or environments. Experiences – the process of applying for health insurance online for Americans who were uninsured when the American Affordable Care Act went into effect in late 2013, or learning to read and write in the midst of a socially unstable, economically unpredictable or physically unsafe environment – can also be coarsely modelled with minimal props, simple role-playing and basic diagrams to help improve a given group's ability to engage in a specific activity or set of activities.

Conceptual prototyping differs from other prototyping processes in that its primary intent is *not* to guide the development of new products, systems or communities. Rather, the dialogic exchanges that occur during the evolution of these processes are primarily intended to foster empathy building and understanding between diverse groups of stakeholders and researchers. As events that involve the operation of the prototype advance within a given situation, distinct viewpoints can be articulated regarding how these events trigger particular emotional responses, or shape socio-cultural perceptions, or disrupt ingrained habits of use. Discussions that surround the iterative development of a given prototype allow individuals who would otherwise rely mostly on already formed experiential knowledge to frame their questioning and commentary differently. This can lead to a re-imagining of extant ideas about how things, environments and processes must 'work' in certain situations to meet known needs or aspirations. In this way, these things, environments and processes can be virtually placed in different or new situations to meet *future* needs or aspirations.

In his research into user-centric product design, Simon Bowen employs conceptual prototyping – in the form of what he refers to as critical artifacts or cultural probes – as a means to enable users to "articulate what they need if they don't know what they can have" (Bowen 2007: 6). These reflexive, iterative prototypes are not final solutions to a problem *per se*. Rather, they are interim level artifacts that exist on the path towards a solution but are shaped by earlier dialogue undertaken to reveal abstract, high-level notions, values or fears expressed by targeted users. In practice, they are 'conversation starters' for ongoing reflexive dialogue between user and designer. For a scoping study on design and aging in the home, for example, Bowen and his team developed conceptual prototypes that engaged with and accounted for concepts such as clutter – *the Prioritizer* (Figure 30.2): a shelf system that allowed users to spatially rank order

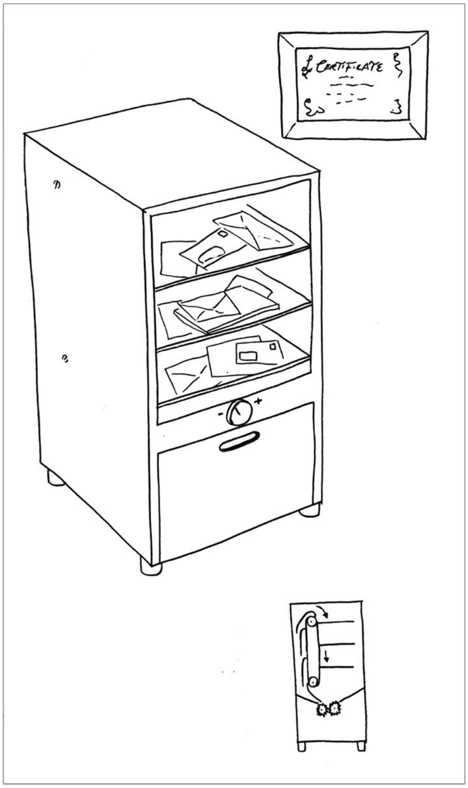

Figure 30.2 The Prioritizer was developed by Simon Bowen's research team in response to a need voiced by groups of stakeholders they were working with to more effectively organise and process the paper-based correspondence they had to deal with in their offices every day

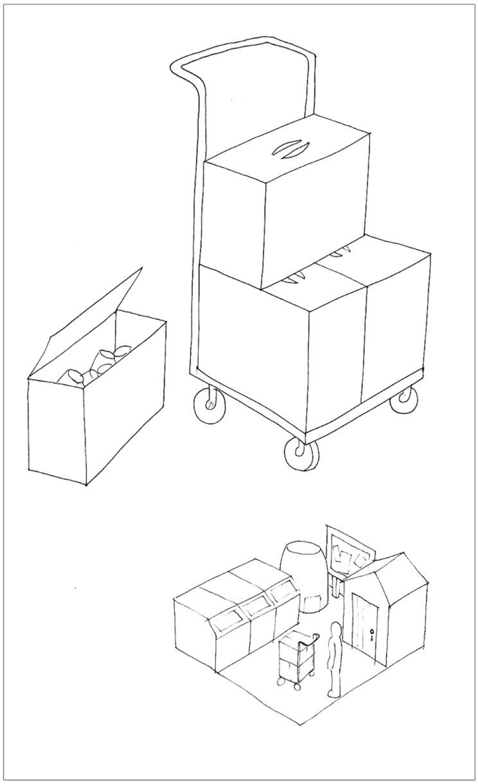

Figure 30.3 Communicycle was developed as an outgrowth of the understandings that Bowen's research team learned from their interactions with the aging people whose input helped guide the development of the *Communitools* tool-sharing programme. This programme arose as a response to the need to facilitate the regular collection, sorting and proper storage of recyclable items within the community

and then discard the paperwork of life; and to support the idea of independence and community dependence – *CommuniTools*: a collection of hand tools shared by the community. In turn, CommuniTool prototypes generated further dialogue and prototype exploration into product-based ways to increase social interactions among neighbourhoods of aging populations through shared recycling. The result was the *CommuniCycles* (Figure 30.3) – communal rolling mini-recycling stations.

Utilising decision-tree diagramming processes to facilitate comparative analysis

Decision-tree diagrams are an effective means to facilitate decision-analysis processes, so that rationales for select individual decisions and sets of decisions within a given scenario of use or experience can be either supported or rejected. Their visual and logical utility, combined with the fact that their evidence structures are readily available for analysis and evaluation, make these diagrams methodologically useful for bridging gaps in understanding between researchers informed by design and those informed by other disciplines.

The process of iteratively creating a decision-tree diagram is a tangible modelling process that reveals how particular factors influence given decisions *made by a select individual or group within a specific sequence or cycle of events*. It functions as a kind of a map through which personas representing *different* individuals living or working in the same situation or scenario can be hypothetically made to navigate. Analysing how they do this makes this hypothetical activity valuable to different types of researchers who need to determine how specific influences affect the decision-making processes of distinct personas. A persona can be made to navigate through a course within a decision-tree diagram in ways that account for how known (i.e. observed and documented) influences, such as emotional or socio-cultural biases and political beliefs, will affect its decision-making at given junctures in the sequence of decisions articulated in the map. In this scheme, the map itself, as a configuration of visually depicted pathways and junctures (also known as *nodes*), is not alterable; only the routes taken through it by the personas are.

Operating a decision-tree diagram in this manner can allow for reasonably accurate predictability and replication, but it is less useful as a method that could yield insights regarding how a given transformation within a decision sequence might yield benefits to that persona. Nonetheless, decision-tree diagrams are effective even if very little hard, verifiable data exists to fuel its instantiation, because they still provide a means to develop revelatory insights into how a diverse array of logistical probabilities, social, economic and political biases and personal preferences affect how given situations evolve.

Faculty and student research teams comprised of individuals who possess backgrounds from inside and outside design recently worked within the *Design Research Center* at the University of North Texas to operate a set of decision-tree diagrams as a means to inform the development of a complex, web-based system of communications (Figure 30.4 and Figure 30.5). This 'digital system of care' was being designed to improve awareness about and access to mental health resources for children in a large suburban area of north Texas. The four primary audiences and user groups who will utilise this comprehensive website have a broad array of informational needs, which are affected by a heterogeneous amalgam of emotional, legal, social, cultural and economic biases. To develop an information architecture that could effectively describe how this website's functionalities should operate in light of these factors, understandings gleaned from both types of decision-tree diagrams were used to guide the planning process. The faculty and student teams created decision-tree diagrams that accounted for how multiple influences could influence user behaviour, as well as decision-tree diagrams that accounted for what would occur if a distinct persona entered the website seeking to fulfill a very specific need (i.e. to

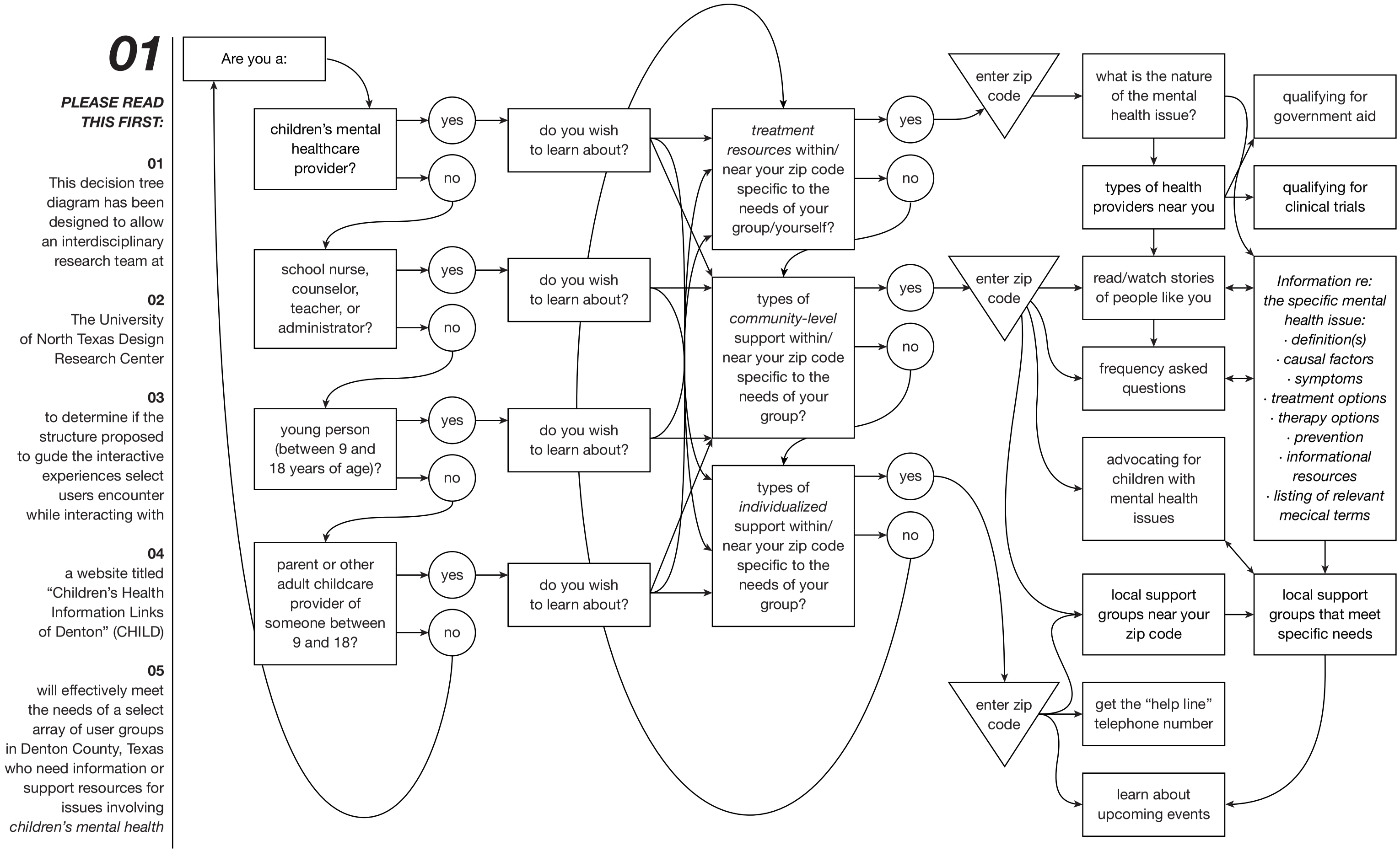

Figure 30.4 The decision-tree diagram depicted here is an iteration of several of these used by an interdisciplinary team of researchers at the University of North Texas' (UNT) Design Research Center. It allowed them to work together to strategically and tactically plan a website that tailors its functionalities to meet the needs of different types of users who are seeking information or assistance with children's mental health issues. An early iteration of a webpage from this site that was informed by this method appears in Figure 30.5

Figure 30.5 The information the UNT Design Research Center team derived from the decision-tree diagram (and others like it) depicted in Figure 30.4 was used to inform the user-experience design and user-interface design of this website

ascertain the location of local children's mental health clinics, or to determine how to join local support groups for people dealing with particular children's mental health issues). Comparing our analyses of how distinct personas – local public school teachers and counsellors, children, their family members and local children's mental health professionals – navigated specific paths through both types of decision-tree diagrams helped the faculty and student teams make more well-informed decisions about how to design particular features of the website to meet individual needs.

Finding common ground between disciplinary barriers

These three design-based investigative methods (among others) can be used to place researchers from inside and outside design in conceptual and methodological proximity, and can also provide them with the means necessary to identify and overcome both practical and philosophical obstacles to working effectively with each other. If design researchers and their collaborators from outside design can address potentially contentious issues as they initiate projects together, they can actually operationalise an idea espoused by Dr Lisa Campbell, a social scientist working in the area of Marine Affairs and Policy at Duke University. Dr Campbell has extensive experience working on interdisciplinary research teams, and writes that "challenges to deeply held, sometimes unquestioned beliefs can be opportunities for growth. This can be one of the most rewarding aspects of interdisciplinary research" (Campbell 2005: 575).

Along with Dr Campbell, the authors of this chapter have learned that it is advisable to address philosophical and practical differences at the outset of a collaborative endeavour rather than at the time when project outputs are due. The authors have learned that it is best to identify and then discuss challenges to deeply held beliefs about framing, operating, analysing and reporting research during its initial phases. Facilitating this identification and discussion process using the methods associated with conceptual mapping, conceptual prototyping and decision-tree diagramming can allow differently informed researchers and research subjects diverse opportunities to simultaneously 'see' and address the multitude of issues that affect the interactions within a group.

Many of the practical issues that become contentious or challenging, or both, during interdisciplinary research endeavours involve issues such as publishing protocols and how project funding may be sought and disseminated once it has been secured. Additionally, researchers from different disciplines often approach given endeavours differently from theoretical and methodological perspectives. Sets of beliefs that are so standard for personnel who possess design backgrounds that they go unquestioned by designers and design researchers may require deeply probative and broadly informed inquiry from those outside design, and vice versa. Key to dealing with all of these issues is (again) the need to acknowledge them by depicting and describing them early in the process so that they can be effectively minimised and managed. All of the researchers from within and outside design who may commit themselves to work together on a specific research project need to be involved in its initial planning.

Cultivating a collaborative research atmosphere is not easy. It requires concerted effort. Nonetheless, the complex contemporary issues and problems facing investigators from every discipline clearly demarcate the need to overcome barriers to interdisciplinary partnerships. Increasingly, true, durable solutions to the world's problems will spring up from along the shared boundaries between disciplines, not from within their respective central cores. No one discipline possesses the synoptic theory, methodology or social means to tackle the contested, ill-defined problems vexing contemporary society. Possessing unique tools and methods to facilitate cooperative investigation, design researchers should recognise their contributory responsibility and take it upon themselves to find common ground between their discipline and others. Design, more so than other disciplines, is in a unique position to build bridges of communication and action outward rather than waiting for external interdisciplinary spans to reach it. One means that design can call upon is its ability to create situations where researchers and stakeholders of all types are invited to create physical artifacts – e.g. conceptual maps and prototyping, and decision-tree diagrams – depicting complex power relationships and interdependencies, be they physical, social, cultural or technological. These creative acts not only explicate new ways of understanding reality in and between all involved, but, as importantly, become the catalysts for critical dialogue: the active exchange of information that requires not only recognition and understanding by participants of each other's unique insights, but also the reflexive engagement necessary to create common understandings and departure points for effective action.

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31

MEANINGFUL PLAY

How playcentric research methods are contributing to new understanding and opportunities for design

Aaron Scott

Introduction

Play as it relates to human behaviour has recently made resurgence into design conversations. Current discussions address its importance and value as a tool for providing product category differentiation and the application of gamification, or game related elements, intended to improve usability and extend application; but play is more than that.

> At its core, play is not about any tool or object, a toy or game, but about (an) ability to reframe one's attention around a voluntarily chosen, self-defined activity, goal, challenge, story, in which one may experience, freedom – to either master it or creatively explore its potential.
>
> *Deterding, 2011: 89*

Play enables a way for people to understand and deal with the unexpected aspects of the world around them. True play is creative; it gives the player a sense of control, and is a result of the experience. It is the satisfaction of learning and the value of effort exerted towards achieving objectives.

The main difference between play based research methods and other methods is the focus. Playcentric methods are created to seek out where the playful elements in every human activity are hidden, and then focuses on how to pull them out in order to better utilise these elements of play. When this is done a product or system becomes more engaging and valuable to the user.

In *Rules of Play* Salen and Zimmerman established a loose definition of play. They identified three categories: game play, ludic activities, and being playful (Salen & Zimmerman, 2003: 302–304). Game play and ludic activities fall within the defined area for being playful. Think of these areas as nested within the others. As one travels outward from game play in the middle through ludic activities into the outer area of being playful, the rules and structure begin to fade away leaving being playful or playfulness. "A playful approach can be applied to even the most serious or difficult subjects because playfulness is a state of mind rather than an action" (Fullerton, 2008: 92). "In most cases, this enjoyment arises from doing everyday activities in a way that is different from how they are usually performed" (Lucero & Arrasvuori, 2010: 37). Ludic activity is bound by a loose set of rules and structure. It may, but does not have to, have a goal or quantifiable outcome. Being playful for these purposes is defined as manipulating or altering the normal structure or system in order to obtain a different more engaging or enjoyable effect. Being playful can be thought of as a less constrained way to alter activity or behaviour for the purpose of bringing enjoyment.

An illustration of this could be as follows. A child is walking home from school. To occupy the time and make it more enjoyable, the child may incorporate these three areas. For the incorporation of game play, she creates a simple game based around kicking a can. For this game, she develops a scoring system and rules that are self-imposed and regulated. This provides the structure, a starting and end point, and defines how the activity or game is won. In the situation of this child walking home, a ludic activity would be the creation of an activity for getting the can around obstacles along the path. This has many of the same game elements but the child's actions are not restricted by concerns with score or winning, and vary by the level of defined structure and rules. It is a more open expressive type of play. The activity of kicking the can down a road is a ludic activity because it enhances enjoyment while still being constrained by semi-ridged structures with governing boundaries. When kicked, the can has limited possible outcomes. It will not indefinitely fly away; its response is based upon its inherent physical properties, natural forces such as gravity, environmental constraints like curbs and trees, and the physical ability of the person kicking. So, ludic activities test the limits and boundaries of the activity or system and allow movement within these structures. Finally, an example of being playful or playfulness would be independent of game creation; it may simply be the altering of the steps or pace by including a hop, possibly whistling a tune while walking, or allowing oneself to get lost in daydreams. The enhanced enjoyment found is a result of doing normal activities in a different manner than they are usually conducted. All three category situations are examples of engaging in activities that incorporate varying levels of play and allow the passage of time to be more enjoyable. There is fullness in the moment of play. This is possible because play exists within the gaps of "more rigid (established) structures", and allows freedom of activity and exploration of concepts and ideas (Fullerton, 2008: 91). "Designing for playfulness would then involve designing for minor actions that people can perform impulsively and with little effort" (Lucero & Arrasvuori, 2010: 37).

We will explore how playcentric research methods are being used to understand, influence, and validate design decisions. This will enable further discussion on the inclusion of playification and how this will operate with other research methods, such as participatory ethnography and persona creation, in order to create a holistic understanding of the human behaviour, as well as communicate examples and benefits of inclusion into design processes. Principles of play are also being used by products and software that provide and promote physical activity, healthy lifestyles, learning, and choices that contribute to improved consumer behaviours (see Zamzee later in this chapter). As a result of this resurgence new areas for design and design theory are developing. "The aim of designing for playfulness is to create objects that elicit a playful approach in the user and provide enjoyable experiences from using them" (Lucero & Arrasvuori, 2010: 37). In order to more effectively elicit playful approaches, products, systems, and experiences, designers must design with this understanding and value of the intent to utilise play to its full capabilities.

Background information

Playification

Playification is defined as using engaging play based interaction in situation and non-play contexts to make a product, service, activity, or application more engaging, enjoyable, and motivational. Playification is a method used to imbue an activity or task with a psychological, emotional, social, or physical reward and then evaluate the levels of extrinsic and intrinsic motivational forces. This term began to appear in the early 2000s and gained a more accepted usage in 2011 when Deterding and others further established the definition of "gamification"(Deterding et al., 2011: 9–15). Playification seemed the next likely to be established. Yet to date no one clear definition can be found. This material provides an introduction to the term, and seeks to contribute and establish a refined definition.

Let's look at how this understanding is being developed. Playification has a broader focus than games or gamification, both of which fall within the boundaries of play. Play deals with usability, interaction, enjoyment, and engagement. Play allows the creation of narratives that tie into feelings and behavioural motivations. "Potentially any activity can be approached and performed in a playful manner" (Lucero & Arrasvuori, 2010: 37). Playcentric research allows the researcher to identify areas where play is being used and where it can be implemented. It may also have the objective to make the process of conducting the research less of a compulsory task and more enjoyable. "Sometimes, (playfulness) is equated broadly with any 'pleasurable experience' or 'fun', or indeed every interaction that goes beyond utilitarian work and task contexts" (Deterding et al., 2011: 10).

'Clocky' created by Gauri Nanda is an alarm clock that's intended to improve the way people wake up by incorporating more lifelike interaction and simulated personality. Figure 31.1 illustrates what happens when the alarm goes off; Clocky rolls or falls away forcing the sleeper to wake up and chase it down in order to turn off the alarm. In a personal interview, Gauri Nanda stated that "it's intended to be a fun product that will make people laugh". She

Figure 31.1 Clocky diving off the nightstand

Source: Nanda, 2007 (personal communication)

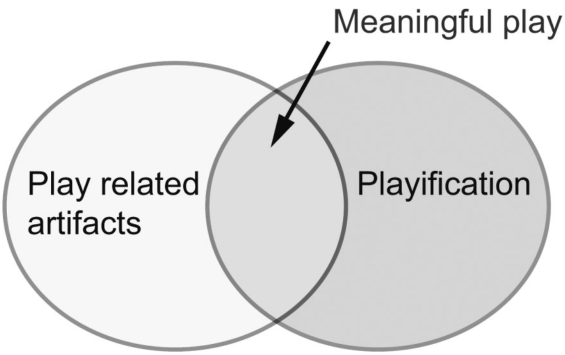

Figure 31.2 Meaningful play activity location

Source: Scott, 2012

continued, "it's sort of playing a game of hide and seek with the user" and "poking fun at an everyday situation. Clocky evokes emotions and playful experiences that people want to share" (Nanda, G. personal interview, 22 November 2013).

Meaningful play

"All meaningful activity begins with the activity characterized in play, and with the structure that results from such a playful activity" (Hans, 1981: 7). For the purpose of this research, meaningful play will be defined as follows: meaningful play is play with an objective for the user to learn and explore content or ideas in a fun or enjoyable way. Meaningful play is intended to be activity or action driven with emphasis on the experience rather than the object or game. An example of this in the health related tracking devices is when challenges or objectives are matched to the users' requirements or needs with the purpose of helping them accomplish an overall goal of improving their health and well-being in an enjoyable way. Meaningful play takes place in the overlapping area where playification and play related artifacts come together to form a system (Figure 31.2).

Meaningful play allows the participant to understand and learn from the relationship between events. It enables optimal experiences and the ability to achieve purpose. In order for meaning to be created, clear rules for action and a way to concentrate and become involved must be established. The objective is not what is important, "what matters is that it focuses a person's attention and involves it in an achievable, enjoyable activity" (Csikszentmihalyi, 2008: 216).

In order to develop meaning and create meaningful play the activity or design must connect to the user. It must have value and build a passion that will lead to the accomplishment of objectives. Meaning can be greatly enhanced when users are allowed to bring personal or social goals to the process and when those objectives are allowed to be customisable.

It's the objective of Rokos to "create playful, functional, sculptural products that behave in unexpected ways' (Rokos, n.p.: 4). The 13° 60° 104° Wine Decanter incorporates playful resting positions, that challenge the user's perception of stability and rewards them for exploring its form and function. The decanter encourages a richer more meaningful interactive experience. Figure 31.3 illustrates the phase the decanter may pass through. "At 13 degrees, the decanter begins the evening sober. As drinking progresses, at 60 degrees the decanter is a little tipsy. By the end of the evening, it sits at a drunken 104 degrees" (Rokos, n.p.: 4), and the user has benefited from its humanistic interaction.

Figure 31.3 13° 60° 104° Wine Decanter

Source: Rokos, 2012 (personal communication)

Social engagement

Social engagement is the utilisation of communities and support networks, both real world and virtual, of users and non-users with similar interests. These individuals are introduced and connect via the product sites or application and other communities. These communities are intended to support, encourage, enhance play, and ensure pleasurable experiences. Social engagements can allow for competition, pitting users against other users, in order to achieve beneficial outcomes. Social groups also allow for intrinsic and extrinsic rewards while helping to keep people motivated and coming back to participate with the products and services. This keeps a continuous interest in devices and activities. Successes and failures are shared through these social connections providing support and giving the user the ability to be part of a greater whole.

When meaningful play is combined with social engagement a change of behaviour is more likely because goals and objectives are reinforced and encouragement is provided to help accomplish tasks that will improve health and well-being. Combining meaningful play and social engagement provides a platform for the user and their objectives to evolve with the system while participating in a supportive and sometimes competitive community adding additional motivational factors.

An example of meaningful play and social engagement bringing about behaviour change is described as follows (see also Figure 31.4). An individual, wanting to improve and track their physical fitness, begins using a health tracking device. The device and accompanying website establish a connection to a supportive network of like-minded users. The user then competes within this network by participating in activity challenges. The activity is monitored through the device and the activity information is uploaded to the user account. Goal-driven visual feedback is displayed on the device and site. The user participates with the system with the hope that it will lead to improved well-being. They continue with the interaction because it is enjoyable and rewarding. As an added motivation status, trophies are introduced that can be transferred among community members. This creates a value in the accomplishment and offers an additional extrinsic reward to the user that currently holds the award. If the user is beaten and the trophy is transferred to a different user, the original user is likely to be motivated to re-

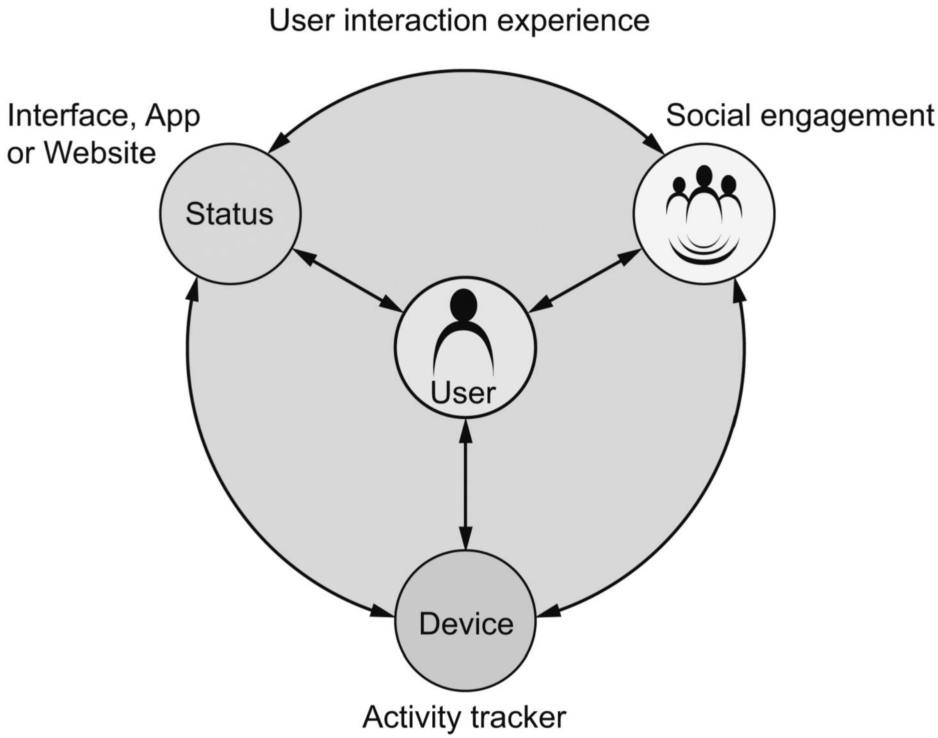

Figure 31.4 User experience

Source: Scott, 2012

obtain that status or seek a higher status. Social engagement sites may also have boards where users can post and comment on activities, successes, struggles, and questions in order to provide encouragement and support to one another. In addition to these possibilities, the site may also track personal improvements of the user and provide incentives through scaffold goals where the user is encouraged as they reach a certain level based on activity accomplishments. The system has to be monitored and the challenges regulated so the user will not become frustrated and lose motivation. Users should have the option of how to participate. Allowing a variety of options creates a space where the user has control and can participate at a level they are comfortable with.

Meaningful play is incorporated in the activities the user chooses to participate in. Social engagement is apparent in the community atmosphere. The combination of meaningful play and social engagement significantly increases the likelihood of user success in accomplishing related goals. The feedback provided to the user via status, social engagement, and device metrics allows the user to make educated decisions that can result in behaviour modification. Detailed observations must be conducted during pre-design phases in order to understand how these methods may affect the different types of users.

Playification principles of meaningful play and social engagement

The playification principles of meaningful play and social engagement work together to bring about behaviour change. Playcentric research methods afford the ability to identify the relationships between playful experiences, personality traits, and human values. This understanding enhances a model of playful engagements that, on the design side, can be used for design inspiration and to validate design decisions. On the user side, this information provides the statistics and feedback required to make informed decisions. In an attempt to better understand human behaviour, Volkswagen has developed and been testing The Fun Theory. This theory is "based upon the idea that something as simple as fun (or play) is the easiest way to change people's behavior for the better" (Volkswagen Sweden, 2009: para. 1).

Volkswagen conducted multiple social experiments to test the effectiveness of fun as an agent for behaviour motivation. Two experiment examples that illustrate meaningful play and enhanced engagement addressed how you inspire people to take the stairs instead of an escalator, and how to encourage the use of garbage cans instead of throwing trash on the ground. In the piano staircase experiment: "lonely stairs beside a busy escalator were made to look and sound like piano keys; this musical modification drove a 66% increase in the use of the stairs" (Chamandy & Aber, 2010: 13). Another experiment created an interactive garbage can that every time garbage was dropped into the can, you heard a falling sound with a splat as it reached the distant imaginary bottom. In the video documentation, users shared the unexpected results with others, who in turn also wanted to experience throwing away their trash into the modified can. This enhanced experience almost doubled the amount of garbage collected. The interactive trash can rewarded users with an unexpected amusing audible experience that incentivised throwing away trash. Their experiments varied but the results all showed that "fun is the easiest way to change people's behavior for the better" (Volkswagen, 2009: para. 1).

Structures for usage and evaluation

Playcentric processes enable the design researcher to discover meaning, understand norms, observe reality, identify obstacles and barriers, address users' needs, provide analysis of the problem, and guide the evaluation of the resulting design; all while enjoying the process and having fun. There are many ways to incorporate playcentric elements. Currently the most used is to incorporate gamification or games into research methods. Although those are relevant to play, for our purposes we will address less obvious ludic and playful applications in playcentric participatory ethnography and playful personas.

Figure 31.5 illustrates a normal client-led design process. The two methods in discussion are normally conducted during the pre-design and active design stages, but the personas may be used throughout the entire process to guide decisions.

Incorporation of playcentric research methods

The two methods outlined below are adapted versions of traditional ethnography and persona creation. These have been developed with the intent of rendering them more engaging, useful, and easier to connect the insights throughout the design process. Design decisions must be based upon insights gained through appropriate research. Without such insight, a designer is left to his/her own intuition, and subjects the client to speculation. Research methods must inform and act as a support structure for the design decisions.

Playcentric participatory ethnography (PPE)

In playcentric participatory ethnography (PPE) the practitioner is seeking actionable insights that develop as a result from playful experiences. If play is dominant in all human activity, then

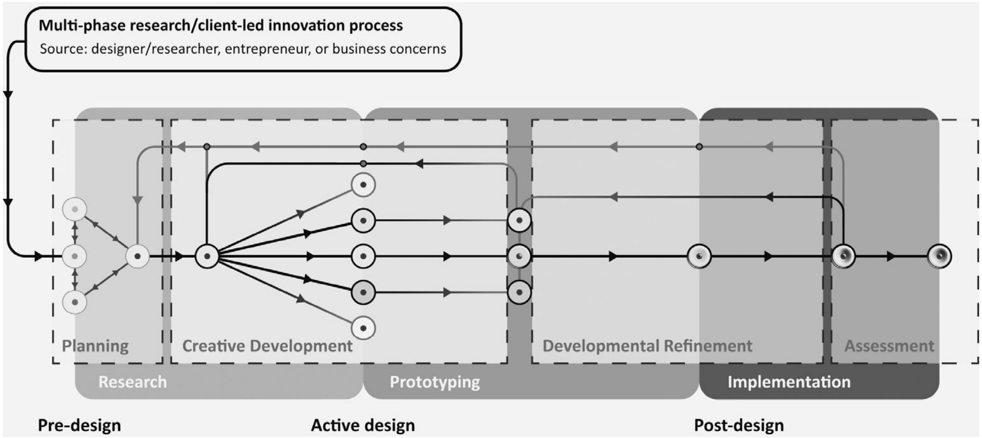

Figure 31.5 Design process

Source: Scott, 2012

it should be identifiable in observed activities. In a traditional ethnographic process "the observer looks, listens, asks questions, and records what is seen and heard" (Sommer & Sommer, 2002: 56). When PPE is applied within a design process it incorporates all of those activities but differs because the research participant structures the activity more as an open ended discovery play session with the objectives flexible enough to learn from interviews, observations, trace measurements, and hands on activities. It provides a holistic approach to study user experiences and behaviours. This is similar to how a child might learn to cook by cooking with an adult, watching, asking questions, mimicking the activities, and then recording their steps on a recipe card. PPE is similar to participant observation, in which "the observer becomes part of the events being studied" (Sommer & Sommer, 2002: 55), but it differs in that it's intended to be a shorter, more purposeful interaction with the participants, systems, and/or products in their natural environment. In addition to shared techniques like data collection, photo documentation, and task analysis, it uses a modified scoring system with categories based upon the 22 PLEX playful experiences. The direct participation with the activity and users removes a lot of the guessing and stresses normally connected with correctly interpreting the meanings behind only observed activities.

Although the PLEX framework was created as a source of inspiration in creative activities, its framework here has contributed to a deeper understanding of human experiences when observing human interactions. In Table 31.1 the framework is broken down into category names, which are italicised, and an example of what might constitute that category follows the name.

Figure 31.6, left, is an example of how play is contained in human behaviour. These "three wise students" decided to express the fun they were having by striking a pose before they initiated their PPE activities. See no, hear no, speak no problems illustrates the inclusion of humour and expression during PPE preparations. This simple playful pose set the tone for their PPE experiences. This demonstrates the idea that part of PPE is incorporating a playful state of mind.

The process for conducting playcentric participatory ethnography is as follows:

1) Preparation: Define the problem and goals. Gather background information, conduct market analysis, and determine user task identification, state objectives. The researcher

gathers valid background information of the required areas. This can be completed via literary reviews, surveys, questionnaires, interviews, and preparatory situation observation.

2) Planning: Identify the correct target people to participate with. Develop a structure and documentation plan that determines relevant playcentric queues. Do not attempt to solve a problem. You are looking for actionable situations that require improvement. Depending on PPE requirements create teams for documentation, or assign documentation methods.
3) Initiate: Capture findings, develop empathy and understanding for a user's situation. Part of this strategy during interaction, observation, and coding is to identify which if any of the 22 PLEX playful experiences exist in the area being observed and identify how these experiences are functioning as behavioural motivators. As part of the process, the playcentric researcher documents the preceived level of engagement. When conducting PPE try to identify activites connected with engagement or enjoyment. Look for signs such as smiles and other interpersonal methods of communication that show how people are engaging with each other, listen for laughter, watch body language.
4) Debriefing: Discuss all aspects of the experience. Conduct analysis in order to discover actionable insights. Review documentation looking for signs that illustrate participants' level of enjoyment, engagement, and interaction.
5) Evaluate and disseminate findings: Determine key aspects relevant to creation of an action plan with the goal of improving the situation of the participants. Document findings in a report.

Figure 31.6, middle, shows students conducting PPE step 2, preparatory planning for what they expect prior to experiencing the afternoon as a blind individual took them through his afternoon

Table 31.1 The 22 PLEX playful experiences

Captivation	forgetting one's surroundings
Challenge	testing abilities in a demanding task
Competition	contest with oneself or an opponent
Completion	finishing a major task or reaching closure
Control	dominating, commanding or regulating
Cruelty	causing mental or physical pain
Discovery	finding something new or unknown
Eroticism	a sexually arousing situation
Exploration	investigating an object or situation
Expression	manifesting oneself creatively
Fantasy	an imagined situation
Fellowship	friendship, communality or intimacy
Humor	fun, joy, amusement, jokes or gags
Nurture	taking care of oneself or others
Relaxation	relief from bodily or mental work
Sensation	excitement by stimulating senses
Simulation	an imitation of everyday life
Submission	being part of a larger structure
Subversion	breaking social rules and norms
Suffering	loss, frustration or anger
Sympathy	sharing emotional feelings
Thrill	excitement derived from risk or danger

Source: Walsh et al., 2010

Figure 31.6 The PPE steps – three wise students (Issler, 2013; personal communication) (left); students prepping for PPE activities (Scott, 2013; personal communication) (middle); specto PPE step 3 (Patterson, 2013; personal communication) (right)

routine. One team member followed documenting observations and looking for actionable elements of play. The other student, who participated by being blindfolded, recorded their impressions during and after the events. To make the experience more enjoyable the team joked about how silly the blindfolded partner was going to look as he/she stumbled through the afternoon activities. The experience allowed students to better understand the daily activities and development of the coping mechanisms of the blind individual.

PPE provides design researchers with the ability to understand the relationships between products, services and systems, and the person or group being affected by the usage or interaction in a timely manner. Figure 31.6, right, illustrates PPE step 3. During the debriefing it was addressed that walking over the train tracks and through traffic would normally have been a nerve racking experience, but because of the blindfolded participant's playful state of mind, and light hearted comments from her guide, she was able to enjoy the activity and let it become insightful.

As part of PPE, the PLEX framework provides a guide for observing playful human activity and the emotional responses of participants. It allows PPE to function as a strategy for getting in the middle of the activities and experiences. PPE, in combination with other research methods, help researches put together a detailed picture of what the real issues are. This insight can direct design.

Playful personas

Similar to PPE, the level of playfulness in a playful persona is dependent upon the state of mind and willingness of the designer to participate in discovery activities such as performance directed play-acting and role-playing. The real aspect of play in a playful persona can be determined by how the persona is used after it has been created. The strength of the playful persona is its connection to an imaginary exploratory space and the insights that come from simulations.

Process framework:

1) Gather research: Conduct background research in order to identify the demographic and psychographic information. This should include information such as age, education, relationships, job, location, etc. Do what it takes to get inside the mind of the intended users.
2) Imagine the individual: Visualise the person and how they live. Be specific, list human factors, their abilities, skills, and attitudes. Create the most in depth character possible.

3) Create the individual: Determine their environment, provide spatial and temporal boundaries, and establish rules that govern actions and activities and incorporate artifacts that are in the spaces the activities take place.

Exploration framework:

4) Play preface: Create buy-in, discuss goals and objectives, plan activities.
5) Play based discovery with the persona: Explore activity through the perspective of the archetype. Try to achieve the goals within the constraints of the proposed systems. Physically interact with the props that represent artifacts connected with the persona, test ideas and strategies, adapt and change the persona as the concept evolves.
6) Wrap up: Play test activity until objects have been met or fully explored. Clean up props.

In general, "personas are fabricated archetypes, or models of end users. All personas identify user motivations, expectation, and goals" (Visocky O'Grady & Visocky O'Grady 2009: 56). The Visocky O'Gradys go on to state that personas were originally developed out of the software industry in order to evaluate software in the place of actual test subjects because "merely being the victim of a particular problem doesn't automatically bestow on one the power to see its solution" (ibid.). Personas are now widely used in many fields including marketing, business, interaction design, Human Computer Interface design, graphic, and product design. A well-developed persona allows the designer to present and evaluate designs from the point of view of another person. It disconnects the designers from their preconceived perception, and establishes communication with a common verbal and visual vocabulary and objective.

According to Steve Mulder, "there is no one right way to create personas" (Mulder, 2007: 1). There are many types of persona; this material will address those that are developed in the pre-design area and are used to gain a better general understanding of potential users during other preparatory processes, and those that are created after initial research has been conducted. The latter group is where playful personas provide the most benefit. They have the purpose of communicating the identified insights through personification of personality and user traits and requirements. The preparatory personas are normally related to general demographic information and allow a form of stereotyping. They can be difficult to provide value later in the design process. Playful personas on the other hand are very detailed and provide a narrative that directs design decisions. The creation of these should be fun, creative, and memorable.

Playful personas contain a profile or narrative that explains and enlightens the user's needs, attributes, and behaviours. They can include psychographic information. Playful personas identify primary, secondary, and tertiary users and their playful experiences. Figure 31.7 is an example of a visually playful persona that was used to communicate the user's experience and needs. The creation of these is similar to the creation of a well-defined video game avatar, meaning that user profile visual characteristics are selected that will contribute to and visually explain the user and their backstory. They should represent a specific individual that embodies a unique user demographic. They should have a profile description which includes personal background, attributes, ability levels, and list their general needs. Think of these as visual storyboards; in order to keep them clear, visual elements should be carefully selected. These personas require the creation of scenarios that apply the insights and understanding gained through the other research methods, specifically playcentric participatory ethnography. These methods require the illustration and explanation of the user, the market category, and the areas of play related to the improvement of abilities: physical, cognitive, social, and emotional. They should be used to identify the ah-ha insights that link research and communicate design

Figure 31.7 Modified persona

Source: Peterson, 2011 (personal communication)

decisions. Playful personas are built from psychographics that outline the user's behaviours, attitudes, goals, and motivations. Use the Big Five Personality Domains as outlined by Walsh (and listed in Table 31.2) as a base to describe an individual's personality and attitude and decide if they will have a positive or negative effect.

When presented with new insights, don't be afraid to alter the persona and design direction. If others are involved create and disseminate personas that incorporate the data gathered and insight gleaned. Use these personas to explain user needs via scenarios. Communicate the value of these insights and the possibilities they hold for innovation. This should finalise the framework for all the design process. The analysis should re-energise the designer and create a buy-in effect that allows other participants/parties to understand possibilities. Playful personas are very effective when role-playing is used as part of the task evaluation sequence. If possible, dress-up like the persona you are portraying and use prototypes or props to act through all interactions.

Table 31.2 The Big Five Personality Domains

Dimension	*Positive correlates*	*Negative correlates*
Extroversion	Extroverted, enthusiastic	Reserved, quiet
Agreeableness	Sympathetic, warm	Critical, quarrelsome
Conscientiousness	Dependable, self disciplined	Disorganised, careless
Emotional stability	Calm, emotionally stable	Anxious, easily upset
Openness	Open to new experiences, complex	Conventional, uncreative

Source: Walsh et al., 2010

The use of artifacts allows the presenter to stay in character and focus the silliness and attention away from one's self and to the artifact or activity.

Playcentric theories used to create solutions to health issues

The Zamzee health monitoring device was selected because it illustrates how playcentric theories are being used to create solutions to health issues.

Zamzee by HopeLab (Figure 31.8, left) is an inexpensive 3-axis accelerometer and interactive website that tracks changes in physical activity and rewards the user for maintaining a specific level of activity. This system came about as the answer to one question: "how can we (HopeLab) have the greatest impact on tween activity" (Ruckus Research, n.d.: 1). Based upon a discussion with HopeLab researchers and analysis of their process, it was determined that they conducted what could be considered modified playcentric participatory ethnography by conducting many sessions of immersive participatory observation, piloting multiple sessions in school, participating with the users, and watching for playful interaction as research was conducted. They used the information and insights gained from this research to create behavioural profiles. These profiles, which contained most of the information and characteristic of playful personas, were used throughout the design process to ensure they understood the needs and insights required to engage the tweens, motivate the design teams, and validate the design decisions. These profiles were used to "represent the spectrum of risk for sedentary behavior" (Ruckus Research, n.d.: 7–17). Their research also led to the establishment of key design principles that helped to guide Zamzee's creation process. Figure 31.8, right, shows Courtney, an early Zamzee tester. She was one of many users Zamzee tracked and observed.

This device allows for the creation of systems (products and graphic interfaces), free spaces for playful activities, and the guiding open rules required for play to exist. In this example, the playification of health is employed as an approach for bringing about behaviour change. Playification elements were determined to be present in the interaction between the user and

Figure 31.8 Zamzee by HopeLab (Song, 2012; personal communication) (left); Zamzee user (Song, 2012; personal communication) (right)

the Zamzee device. The website incorporated more gamifaction principles. This product system provides a playful approach to overcoming childhood obesity by promoting physical activity, healthy lifestyle choices, and increased self-esteem and positive body image. In this situation, gamification via badge tracking and incentives on the website work in unison with the free play activities connected to the activity tracking device. Although playification and gamification can be found together in many products and services, they function independently of each other.

Nicole Guthrie, HopeLab Manager of Data Analysis, shared that one of the keys to Zamzee's success is the positive support and reward structure. This is possible because the social engagement is provided not by random community members but by family and friends. She explained that there was almost zero user drop-off when the tween was supported by their family and the system was integrated into school. With no support the tween lost interest in less than six weeks. She clarified that their data showed this type of reward and encouragement system boosted a 30–59 per cent increase in daily activity. That amounts to more than an extra marathon of activity a month. In order to motivate a wider array of youth, the rewards varied from virtual badges, gift cards, and prizes that could be selected from their website. Nicole stated, "Fun, joy, and play can change human behavior for the better. Zamzee is proof of this". Her goal has been to light a lifetime of physical activity in every kid (HopeLab, n.d.; Guthrie, 2012.

Opportunities for new design using meaningful play

Playification begins by using the imagination to create narratives and stories that can frame the space around the user. This includes rules, challenges, games, and gamification. In order for play to be truly meaningful, one must create a free space in which one can play and research. This space must allow the freedom to explore in positive environments where one can feel safe to try new things and fail. It must be an environment in which ideas and objects can be shared.

There is no one size fits all process for integrating playification, but there are a few useful tips that span all design applications and are especially relevant here. When designing for play it is important to think about the process of activities and not solely about the features. It's crucial to focus on the intended audience. Know the users by conducting playcentric participatory ethnography and by creating playful personas that represent users. These can be used to evaluate ideas throughout the design process. Identify and design for the user's method of play and motivations. Collaborate with the user if possible. Consider using PLEX cards to assist in the generation of new directions and activities. Combine these preparatory playcentric methods with competitive product analysis, literary reviews, observation, interviews, and direct participatory research to gain a holistic understanding of the user, activities, and systems.

Continuously monitor and evaluate throughout the design process. Build and test prototypes, play test often, continue to create different iterations that explore rule variations. Gather and access valid feedback to determine if the play is achieving the intended goals. Discuss possible improvements, and document and learn from both successes and failures.

Once the initial designs are completed, gather as much feedback as possible. This includes qualitative and quantitative sources. Use this information to make adjustments until it can be determined that an activity meets the needs of the user in a way that is highly engaging and enjoyable.

Design can be considered meaningful play within a framework of innovation. When incorporated within research methods and the design process, play will enable a deeper understanding of users and allow designers to develop better and more creative solutions.

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PART V

Examples of design research?

How we embark on design research; how we conduct design research; how we communicate design research

The contributions in the final part of *The Routledge Companion to Design Research* present eight examples of design research that illustrate how design research is tackled, conducted and communicated from a wide variety of professional and academic practices, disciplines and approaches. The eight chapters offer a diverse set of case studies from areas including interior and architecture design history, service design and fashion design. We start Part V with McKay's chapter which presents two design research case studies: one exploring process-related aspects of how designers design and one that explores the design activities of how designers generate form in order to understand how future generations of shape computation systems might enhance the act of designing. Both offer examples of how a researcher might go about investigating the process and activity of designing.

The use of mixed-methods and hybrid approaches in design research is a common occurrence in design research and has been discussed in Part II. The following chapters present three different manifestations of these approaches located in an interior and architectural context. Historical research in architecture is generally based on a single historical method of analysing the building, related plans, drawings and written sources about the project and biographies. Burton and Pedersen's chapter, however, presents an unusual example of a mixed-methods approach applied to interior and architectural design history. They propose that design history researchers may find it worthwhile to consider a mixed-methods approach as it has the potential to uncover multiple layers of data not easily uncovered through a single methodological approach. Their study of the nineteenth-century English designer, A.W.N. Pugin, uses methods from the study of material culture and phenomenology, and a framework rooted in the field of psychology in addition to the historic method. In a similar vein, Mouat's research challenges the traditional analysis of space by using an interdisciplinary approach that combines the analysis of built space with the analysis of cinematic space to understand the social and cultural construction of a space. Analysing how spaces are depicted in film offers an external perspective on how the public perceive their spaces, cities and architecture at certain periods of time. For Mouat, this is an often ignored but important perspective in architectural history since the traditional focus has been on authors and projects creating a narrative exclusively from the design discipline.

We move from examples rooted in observational, historical, cinematic and material culture analysis to the next set of examples that are practice-based and rooted in a range of academic, commercial and community settings. We start with Morrow's fascinating account of a project that has emerged from collaboration between a textile designer and an architect, who have developed technology that allows textiles and concrete to permanently co-form the surface of pre-cast concrete elements. The research investigation has resulted in the formation of 'Tactility Factory' and the development of 'skins' as a commercial product that can be applied in the building and interior design sectors. Morrow presents an excellent example of how design can be transformed into research by clearly elucidating the learning derived from the project so that it can be applied to other contexts. The next two chapters by Hagen and Robertson, and van Dijk and Raijmakers present examples of design research in commercial settings and how research knowledge can be derived out of the constraints and realities in professional settings. Hagen and Robertson's chapter presents an example of how a commercial project can be used as knowledge generation through the iterative design and development of a particular design research method, 'Mobile Diaries'. While Hagen and Robertson's chapter draws attention to how they have integrated the two domains of academic design research and professional design research, van Dijk and Raijmakers' example is a more straightforward account of a design research project commissioned by a major technology company. The focus of their project was to explore whether their client's new service concept met the needs and interest of several distinct target groups, and to identify which aspect of this concept would best match with the daily lives of the consumers. Both examples offer valuable insights into how design research is practised in a commercial setting and illustrate the increasing use of designerly methods for such projects.

The following chapter by Rijshouwer and colleagues describes the 'Streetstarters' project in Antwerp, Belgium; a participatory, design-driven approach aimed at developing a toolkit in order to enhance social cohesion at street-level. The collaboration between Pantopicon, a future exploration agency with a strong background in explorative, participatory research and concept generation, and Studio Dott, a creative agency with experience in product development, visualisation and prototyping, enabled the project team to go beyond the usual street-related activities organised by local authorities to create a design-led project that focused on participation and in creating a space for people to engage in dialogue and social regeneration. We end Part V with a fascinating research-through-design project, the 100-Mile Suit project by Cobb. The project is the result of a six-month design experiment that was intended to introduce a dialogue about resources and community; an attempt to unravel the disconnect of consumer to product. It was originally developed and displayed in an exhibition at the Philadelphia Institute of Contemporary Art, presented at the College Art Association Conference in Dallas, Texas and the final garment exhibited in the 'Ethics+Aesthetics' exhibition at the Pratt Manhattan Museum. The 100-Mile Suit project truly encapsulates the varied examples of design research demonstrated throughout this book and illustrates how it can be transformed and situated in a different context.

32

EXAMPLES OF DESIGN RESEARCH AND THEIR IMPLICATIONS FOR DESIGN AND DESIGNING

Alison McKay

Introduction

There are many definitions of design in the literature, and probably other chapters in this book. Adams et al. (2011) provide a categorisation of how designers from different disciplines categorise their design practice; these categorisations range from systematic decision-making and translation processes through to creative freedom and exploration. The case studies introduced in this chapter are based in product design. Key characteristics of product design for this chapter are that it:

(a) starts with a brief that identifies a problem to be solved;
(b) results in the definition of a solution of a physical product and, as a result, includes a shape definition;
(c) includes cognitive processes such as analysis (and evaluation), decision-making, synthesis (of needs, requirements, concepts, details, prototypes, and so on) and communication;
(d) is iterative and requires reflection time (Schön and Wiggins, 1992); and
(e) (both design and designing) is a part of a bigger whole and does not occur in isolation.

Design research results in new knowledge about designing as a process or activity (Alter, 2012) or about the results of design processes and the problems they are created for. Giard and Gilles (2001) identify four kinds of design knowledge. *Alpha* knowledge builds on qualitative data and is traditionally associated with the humanities whereas *beta* knowledge deals with quantitative data and is associated with the exact sciences. *Gamma* knowledge combines alpha and beta knowledge in disciplines such as the social sciences whilst *delta* knowledge is associated with practice in applied professions such as engineering and design. This chapter focuses on research related to design process and design activities and, therefore, the generation of delta design knowledge.

This chapter presents two design research case studies; each has been delivered to Masters-level Product Design students as part of a final year design research module where each project is designed to take 50–60 hours of student time, including writing a short journal paper. The first case study (see section below: *Design process case study*) explores process-related aspects of a team design project, through both literature review and experiments where a [student] design activity is observed and then analysed using Verbal Protocol Analysis (VPA). The second (see later section: *Design activity case study*) explores the use of shape computation as a means of exploring how designers manipulate shapes in creative design activities. Both case studies are presented in a way that readers might repeat the research in their own settings. Each case study description begins with a design context within which the project is carried out, followed by the research methodology used, results and experiences and then conclusions which highlight implications for design practice.

Design process case study

This case study explores process-related aspects of how designers do designing, through both literature review and experiments where a team design activity is observed and then analysed using VPA. Awareness of design processes and behaviours are important because they can have a significant impact on designers' professional effectiveness and efficiency. This is especially the case when working in multi-disciplinary design teams where there is a need to accommodate the different working styles of other individuals and disciplines.

Design context

The project is set in the context of a designer whose manager has asked him/her to lead a small design team working on a new design project. Before starting any design work, the manager has asked the designer to carry out a small research project and make recommendations on the following questions:

- What design process would the team use?
- How does this process compare with other processes the designer might have selected?
- What behaviours would the designer encourage during the design activity and why?

Methodology

This project has two phases. In Phase 1 published design processes are reviewed and contrasted with each other. Findings from this review are used to inform answers to the first two questions. In Phase 2 an experiment is carried out with a small team design task where participants are video recorded. The video recordings are studied with each student analysing the activities of a student in a different team. The purpose of the analysis is to gain insights into how students in design teams go about a design task and to identify characteristics of effective design activity. An adapted form of VPA is used for this purpose. VPA allows structure to be superimposed on rich data sets such as video recordings. The structure comes from a coding scheme. In this project the coding scheme used is based on the one used by Atman et al. (2005) (see Table 32.1), adapted to reflect team design activities.

The scheme has been designed specifically for the coding of design activities and, since it has been used by a number of other researchers in this area, its use improves the likelihood that findings from this project will be comparable with those of others.

Table 32.1 VPA coding scheme

Design steps	*Categories for this exercise*
Problem Scoping	Problem Definition (PD) Information Gathering (INFO) Identification of Assumptions (ASSU)
Developing Alternative Solutions	Generating Ideas (IDEA) Modeling Alternative Solutions (MODALT) Feasibility Analysis (FEAS) Evaluation of Alternative Solutions (EVA)
Project Realisation	Decisions (DEC) Modeling Selected Solution (MODSEL)

Source: Based on Atman et al., 2005

A schematic illustrating a trace that could result from a VPA analysis is given in Figure 32.1. It can be seen that the video is coded using the *Categories of Activity* on the top left-hand side. The darker shaded squares (to the right) represent the activity that was being carried out at a given time interval. One of the key decisions to be made when carrying out a VPA is the length of interval to be used (shown along the top of the trace). There is a balance to be achieved between shorter intervals which result in a more fine-grained analysis which is more time-consuming to produce and longer intervals which result in a more coarse-grained analysis but which is less time-consuming to produce. In this project, ten-second intervals are typically used; this gives a good balance between detail of analysis and time consumed to produce it. The *Design Steps* in the coding scheme (bottom left) are groups of activities. The lighter shaded cells (bottom right) appear where at least one of the activities in its interval falls within the given design step.

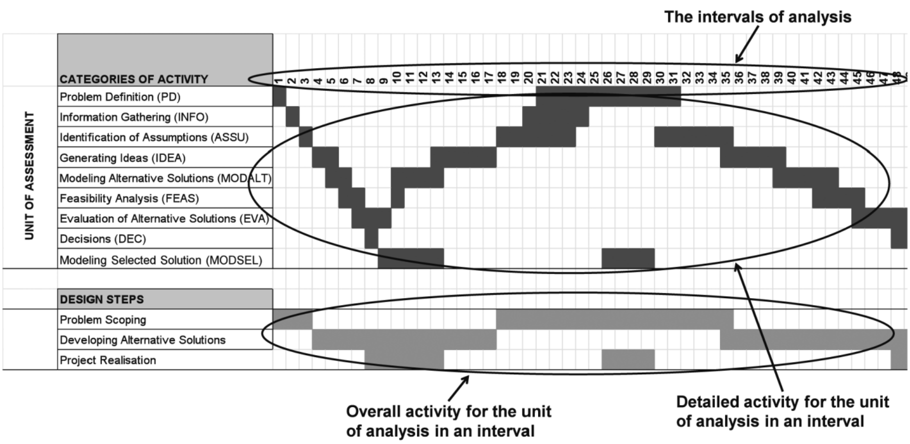

Figure 32.1 A schematic illustrating the results of a VPA analysis

Two kinds of VPA trace are produced. First, a trace for each participant is produced by coding the video footage. These are captured on separate sheets in a team spread sheet which are used to generate a compound trace for the team as a whole. In taking this approach it is essential to ensure that all participants in the group agree where on the video recording to start (because an obvious start point is not always clear) and that they use the same time interval. An important consideration when coding and later writing up this experiment lies in research ethics because this project uses human participants. For this reason, students working on this project are bound by a data protection policy. An example design brief and other details needed to run the project are provided in the Appendix. When run in parallel with multiple teams, results can be compared and contrasted across teams and from information available in the literature. Findings from this phase are used to support answers to the third question.

Results and experiences

A selection of VPA traces for the last five years, from 16 student teams, is included in Figure 32.2. Data for a further five groups are omitted: two because the data is not available in a legible form and three because the traces are sparse, indicating a problem with the coding process. The dashed line to the right-hand side of Figure 32.2 indicates the point in time five minutes from the end when the experiment instructor will have told the group they had five minutes left. A number of annotations have been superimposed on the traces based on a visual analysis. The hatched rectangles to the left-hand side of each trace give an indication of how long the students spent understanding the problem before they started developing solutions and the dashed grey rectangles to the right of each trace give an indication of how early in the process they stopped doing tasks directly related to understanding the problem. The hatched arrows indicate when project realisation activity started.

A visual assessment of the traces can be used to identify the extent to which teams iterate across the three design steps identified in the coding scheme. For example, some teams appear to have covered all three design steps more than once whereas other teams tend to follow a more sequential process.

Data from all 21 traces were used to construct Figure 32.3. These provide summary data for all teams. It can be seen from Figure 32.3 that 38 per cent of time is spent on understanding the problem, 45 per cent on solution development and 17 per cent on project realisation. The breakdown across individual teams is shown in Figure 32.3. When discussing these results in class, many students argue that the low amount of time spent in project realisation could be attributed to the fact that they had insufficient time to complete the project. Some evidence of this can be seen in Figure 32.3 where some teams did not start project realisation until they received the five-minute warning that the end of the task was imminent. In designing the experiment, one of the issues to consider is the length of time to make available; this is a trade-off between the time participants think they need and the time needed for coding the sessions.

Conclusions: implications for design and designing

This project was designed to support students learning and reflecting on how they work in teams and how this relates to product development processes. Students report that the project is effective in achieving this goal and influences how they behave in a major multi-disciplinary team project which is in its early stages as this project is in progress. The broader conclusions drawn in the previous section

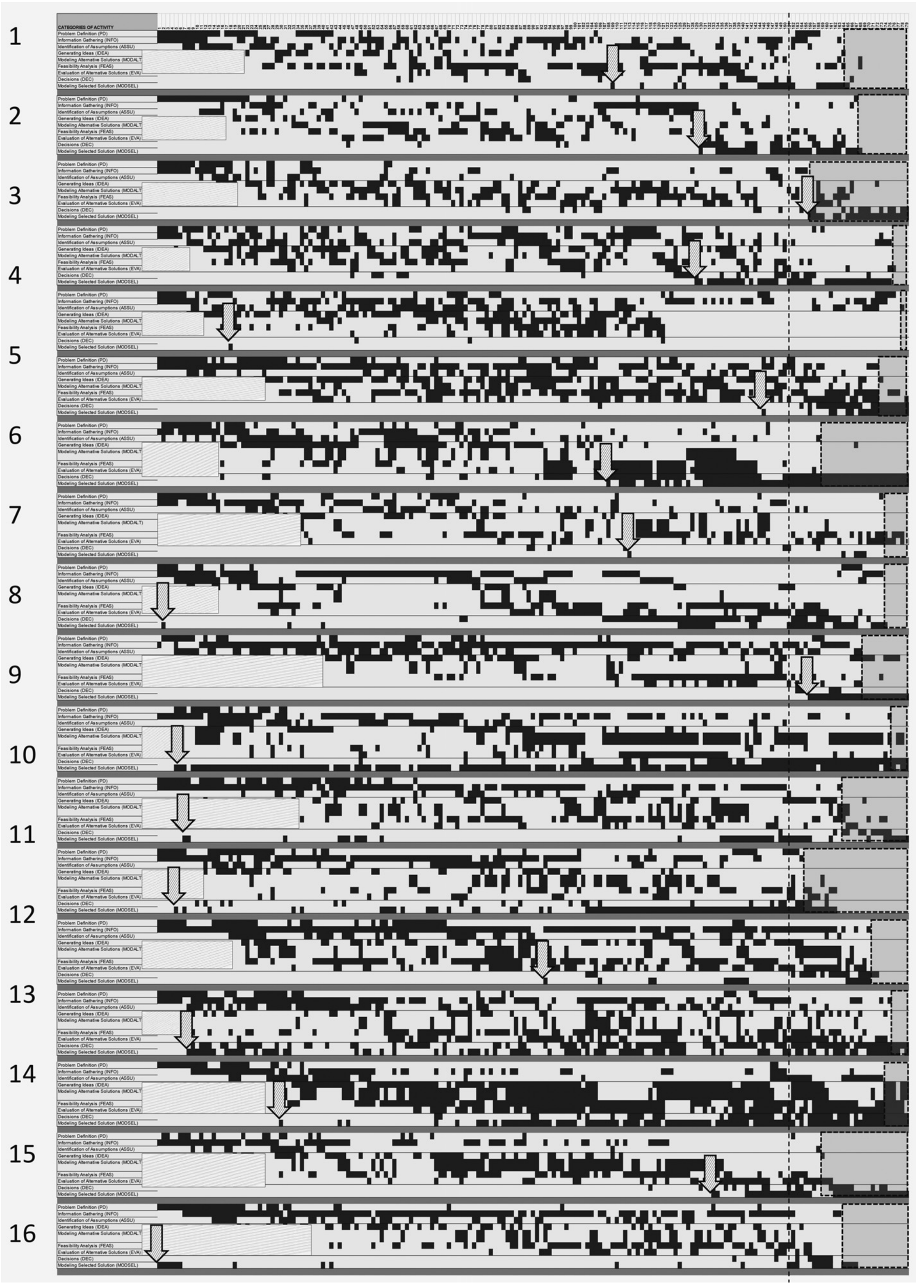

Figure 32.2 Selected VPA traces from 2008–2012

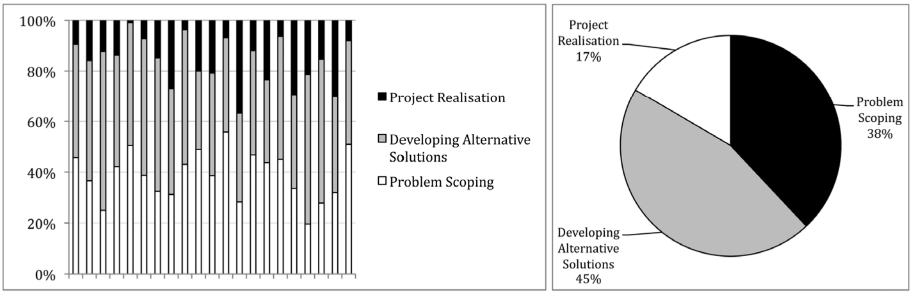

Figure 32.3 Time spent by teams in the three design steps (left) and total time spent by all teams in the three design steps (right)

are introduced to give examples of how data resulting from the project might be analysed but they are not suitable for wider use because they are open to a number of criticisms. A key issue lies in the reliability of the codings. Some of the available traces are not included in Figure 32.2 because they were sparse and no calibration or validation of the student coders, coding processes or resulting data has been made. If results from this project were to be used more widely, measures to ensure the reliability and consistency of coding within and across teams and years would be essential. This could be achieved through improved training of coders and through quality assurance of the results. A second issue lies in the data that is collected. When reviewing the traces it would be useful to have additional data such as if and when the team received information from the instructor's folder because this might correlate with shifts in activity within a team. Shifts can be seen in some teams after the five-minute warning when activity is directed to project realisation, in some cases for the first time within the half hour of the experiment. Other data that might be collected depends on the purpose to which the results are to be put. For example, information on the quality of the resulting designs (a research project in its own right) could be used to support students identifying more effective ways of working, and further information could be used to produce a measure of the quality of the process itself although this would require the establishment of quality indicators which themselves are still subject to debate.

Design activity case study

This case study explores ways in which designers (across a range of disciplines including product design and architecture) generate shapes, and how future generations of shape computation systems might enhance the act of designing. The goal of the project is to demonstrate how coupling learning about how designers generate shapes with understanding of principles of shape computation offers opportunities for designers to gain insights into their personal design practices. The project is important to students for two reasons. First, understanding one's own approach to generating shapes opens up opportunities for personal development of creative skills. Second, as design leaders of tomorrow, it is essential that student design researchers gain understanding of the potential and limitations of emerging technologies, whose implementation in product development processes they might be leading in the future.

Design context

The project is set in the context of a designer working for a firm that produces crockery for a major retailer and other high street stores. The firm is constantly updating its range with new styles of patterns, and the manager has asked the designer to carry out a small research project and make recommendations on the following questions:

- How do designers create products that are consistent with a style?
- How can a style be defined and communicated to clients and/or other designers?
- How can computational systems help in the generation and development of products in a given style?

Methodology

This project uses an action research methodology applied to a design case study. Three action research cycles are carried out. Each cycle includes the four core activities of an action research cycle: referred to by Coghlan and Brannick (2010) as Constructing, Planning Action, Taking Action and Evaluating Action. This section focuses on the Constructing and Planning parts of each cycle, in order that readers can replicate the research. Summaries of typical outcomes of the Taking and Evaluating action parts are given later in the chapter. The project is built around a design case study. The case study used in recent years is shown in Figure 32.4. The first action research cycle involves experimentation with the definition of style and allows students to see, first-hand, the drawbacks of using informal methods and potential benefits of using more formal (i.e. mathematically based and self-consistent) approaches. In the second cycle, shape grammars, which can be used as the basis of

Figure 32.4 Crockery design case study

formal style definitions, are introduced. They are used to underpin experiments with more formal definition of styles and the designs that can be generated from them. Finally, in the third cycle, experimental shape grammar-based computational design synthesis systems are used to specify styles and generate design shapes in the style.

The project is not limited to this case study. For example, in earlier years the design of martini glasses (based on the Bombay Sapphire designer glass competition (www.designerglasscompetition.com/)) was used as a case study. However, if the third cycle is to be completed successfully then the case study needs to be selected carefully to ensure that it aligns with the capabilities of the shape computation systems being used. Capabilities of currently available shape computation systems (all are research prototypes) are reviewed in McKay et al. (2012). The system used to generate examples used in this chapter supports 1D shapes in a 2D space such as the lines and arcs in the patterns on the surface of the crockery.

Results and experiences – describing styles

The purpose of this cycle is to encourage participants to think about the definition of styles. An early question usually centres on precisely what a style is. For example, some might regard style as being related to a design movement (such as Art Deco, Art Nouveau, Modernism, Neo-Classical or Post-Modernism) whereas others might regard it as being related to a brand (such as commonly recognised global brands like Coca Cola, Dove, Dyson and Apple). For the purposes of this project we assert that style refers to aspects of the visual appearance of a design that relates it to other designs in the same style. In this project we are concerned only with shape, but style can include many factors, such as colours, fonts and textures.

The plan of action for this cycle includes individual and group activities. It begins with an individual activity where each participant creates a new style for the case study (in this case a pattern for the serving plate) and writes a textual description of the style. Each individual then uses their description, which they are free to modify if they wish, to create three designs in the style, ideally using a CAD package to ensure that each design is unambiguously defined. Examples of such a style definition and two designs in the style are given in Figure 32.5.

For the next stage, the example designs are initially put to one side and the style descriptions are distributed to the group ensuring that no participant has their own style description. Each participant then creates three designs in the style description from another participant without collaborating with that person. Finally, all of the sample designs are pooled and an attempt is made to group designs in each of the given styles. The range of outcomes of this final stage is variable in that sometimes

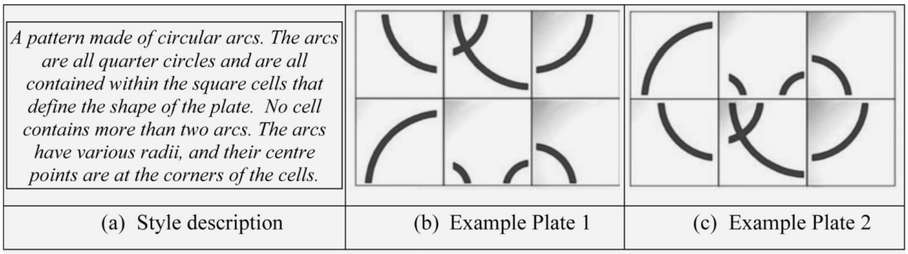

Figure 32.5 Example style description and designs in the style

the styles are relatively easy to group whereas on other occasions they are virtually impossible to group because the designs created bear very little resemblance to those of the creator's style. Seeing another participant's interpretation of one's own style description allows one to identify ambiguities which, in turn, can be used to refine the style description itself.

A key conclusion from the evaluation step in this cycle is usually that what seems clear to the creator of a style definition can be far from clear (or clear but in a different interpretation) to others, even across participants of similar educational backgrounds and ages, and who are known to each other as friends and peers. This conclusion allows participants to see and experience weaknesses of informal ways of defining styles and establishes a need for more formal approaches.

Defining styles

The purpose of this cycle is to support participants in exploring more formal ways of defining styles. A number of approaches are currently under investigation by researchers around the world. In this project, shape grammars are used to provide a means of defining visual aspects of a style; this is because the research group to which the project is linked has a track record of research in shape grammars.

Shape grammars were first proposed by Stiny and Gips in 1972. Since then their potential in capturing style and generating new designs in the style has been demonstrated in a number of disciplines including art, architecture and engineering design. In this cycle, the shape grammar formalism will be used to underpin the definition of the styles created in the previous cycle and the generation of designs in the style. To do this participants are given an introduction to the shape grammar formalism; a number of these are available in the shape grammar literature. An animated example of a shape-grammar-based design generation process can be found in Knight (1999). An example of a shape-grammar-based style definition for the crockery pattern in Figure 32.5 is given in Figure 32.6.

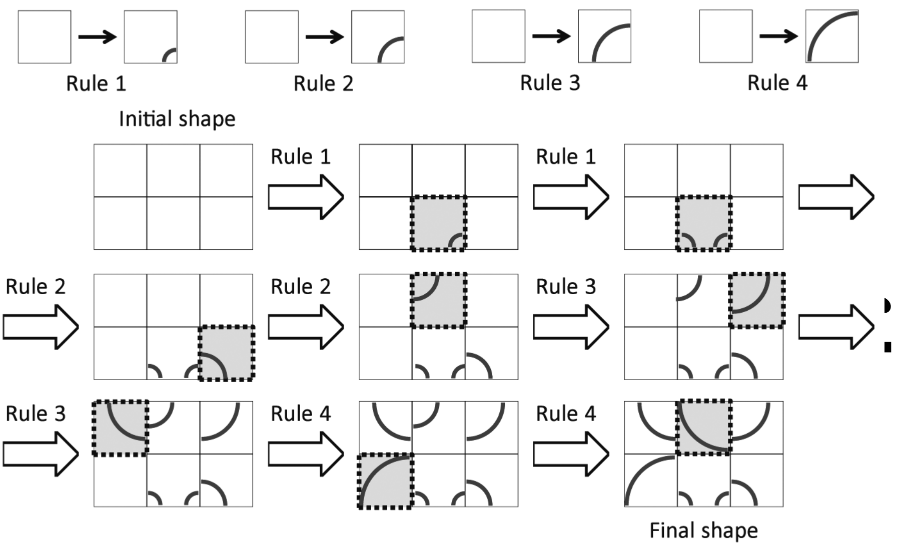

Figure 32.6 Shape grammar and generated designs for the crockery pattern

The plan of action for this cycle involves each participant taking the style they created in the previous cycle and defining it as a collection of shape grammar rules where the initial shape is the 2x3 grid given in Figure 32.5. Completing this activity requires further detail on the definition of shape rules which is available in the literature. Once the style has been defined through a collection of rules and an initial shape that forms a grammar, participants apply the rules manually to the initial grid and generate plate designs in their style. This is usually an iterative process where both the shape rules and possibly the initial description are modified to ensure that only designs in the style are generated. The grammar is evaluated by sharing it with other participants and seeing what kinds of design shapes they generate from the grammar. Typical grammar evaluation questions are: How **easy** is it to use (without help)? Does it generate the **previous** designs in the style? Does it generate **new** designs in the style? Does it generate **only** designs in the style? How might the grammar be improved?

A key conclusion from the evaluation step in this cycle is usually that defining a style in a shape grammar results in more reliable style definitions, especially when third parties use them to generate designs. However, using formal style definitions such as these to generate shapes can be tedious to use and, for this reason, computer implementation becomes an attractive option.

Computing shapes in a style

The aim of this cycle is to introduce participants to computational methods of design synthesis that are based on shape grammars. In his book, *Shape: Talking and Seeing and Doing* (2006), Stiny describes designing as "calculating with shapes" and outlines the steps needed to calculate with shapes as opposed to numbers. Calculating with shapes might be regarded as a natural human process but its replication in computational systems has proven to be more challenging. As a result, commercially available shape-grammar-based synthesis systems are not yet available. There are, however, a number of experimental shape grammar systems available. Details of current systems are available in McKay et al. (2012). In this cycle, participants use one of these systems to compute new designs in their styles.

Conclusions: implications for design and designing

This project was designed to support students learning and reflecting on how style is defined, shared, communicated and embedded within product development processes. In contrast to the design process case study where the problem for students is the vast number of processes and methods proposed in the literature, issues of how style and visual languages, for example of branded products, might be integrated into product development processes have had substantially less attention from the academic community. However, the management, communication and development of brands are regarded as critical in many brand owning businesses.

In this project students gain first-hand experience of problems associated with informal descriptions of visual languages of style. Many of these challenges arise from ambiguities in the description itself. For example, users of the language (sometimes including the author of the language him/herself) may misinterpret the author's intent and generate designs that are not recognised as being within the given style, and uncertainties arise regarding the range of designs that might result from the style description. Formal definitions of style, such as shape grammars, overcome many of these problems by providing mathematically founded means of defined (as opposed to describing) visual styles.

Shape grammar research could lead to a new generation of computer-aided design synthesis systems that support early design ideation processes leading to improved responsiveness to customer needs, reduced time to market and reduced through life costs in the product development processes of which they are a part. A key challenge in the development of such systems lies in ensuring that they act as catalysts rather than suppressors of human creativity and innovation. The system architecture given in Figure 32.7 is designed with this in mind. It deliberately decouples the designer designing shapes (using the seeing and moving processes described by Schön and Wiggins (1992)) from the computation processes of the design system. However, compatibility between the processes is essential if effective communication between them is to be achieved. Prats et al. (2009) report research that found correlations between the ways in which designers transform shapes when sketching and different categories of shape rule.

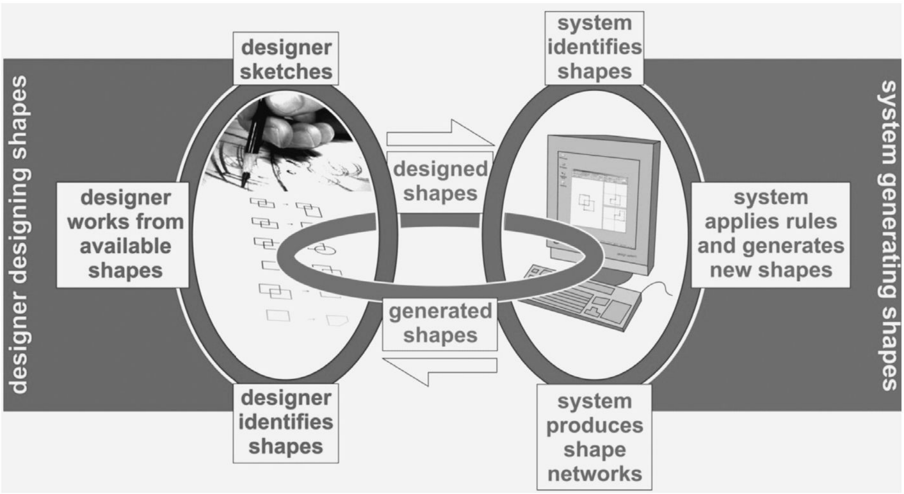

Figure 32.7 Computational design synthesis and designing

Conclusions: systems perspectives on design, designing and design research

The Royal Academy of Engineering describes a system as a set of parts that, when combined, have qualities that are not present in any of the parts themselves (Elliot and Deasley, 2007). The key characteristic of a system that makes it more than a collection of parts is the relationships between the constituent parts. Two kinds of relationship are commonly identified: part-whole relationships that define the composition of the system (sometimes referred to as systems of sub-systems) and connection relationships that determine how the parts interact with each other (sometimes referred to as systems of systems). Systems engineering (Blanchard and Fabrycky, 2006) relates to hard systems where the parts are physical artefacts. Soft systems approaches take the same view as RAEng (i.e. that a system is a collection of parts) but, in contrast to Blanchard and Fabrycky, the parts are social entities (Checkland and Scholes, 1990). Socio-technical systems thinking brings together hard and soft by providing means to enable the parallel consideration of social and technical aspects (Cherns, 1976). Ideas from these different kinds of system thinking can be applied to design research in a number of ways.

The first case study explores two kinds of design systems (the process of designing and the team task) and the street crossing solutions that result from the design task that can also be regarded as systems. The review of selected design processes from the literature provides insights into key characteristics of the process frameworks that are typically involved in the development of new products: these include decision gates where decisions are made and stages where activities are carried out. Systems thinking can be used as a tool for abstracting the different processes in ways that allow them to be compared and contrasted with each other. The VPA coding scheme highlights characteristics of design activity systems, such as the one involved in the design of the road crossing, which might be used within the systematic procedures based on the text book processes. Taking a systems perspective on the team task could lead to new kinds of analysis and insight that focus on how the people in the team interact with each other as opposed to analysing the activities of each individual. The design processes are typically systems of systems where relationships between different process steps are defined in terms of decision gates and information flows. If a process step is itself regarded as a system then it can, in turn, be defined as a system of systems where the systems are the activities highlighted in the VPA coding scheme. The VPA coding scheme itself has a hierarchy of activities (three design steps subdivided into nine categories of activity). The street crossing problem can be regarded as a socio-technical problem and initial observations indicate that, in the majority of tasks, the teams do consider both the physical infrastructure that might be created and the human behaviours design alternatives might encourage or enable. Taking a more systematic socio-technical systems approach might lead to new kinds of solutions that consider a wider range of socio-technical systems design principles (Clegg, 2000).

The design activity case study is related to an emerging generation of computational design synthesis system. It is likely that these will be implemented using computer-based technologies but if they are to support and enhance human creativity and innovation then it is essential that their design and implementation takes into account the needs of human creative processes. Given this, the use of socio-technical approaches in the design and development of such systems is necessary. The architecture provided in Figure 32.7 can be seen as a system level decomposition of such a system that explicitly includes people, technology and interaction between them. Shape grammars themselves can be regarded as systems for designing where the shape rules and transformations are key elements. Early work in this area (e.g. Prats et al., 2009) has begun to explore how shape transformations relate to transformations used by designers in their practice.

Acknowledgements

The content of this chapter draws on experiences of a Masters module in design research, delivered as part of the final year of an undergraduate MDes degree in Product Design at the University of Leeds. The VPA traces were produced by students on this module. A number of colleagues have contributed to the projects presented. Special thanks are due to Professor Mark Henderson (Arizona State University) who collaborated with the author supported by funding from the Leverhulme Trust (Reference Number F00122AF) on the development of the design process project. The design activity case study was developed in collaboration with colleagues (Dr Hau Hing Chau and Dr Iestyn Jowers) at Leeds and resulted from collaborative research with Professor Chris Earl, Professor Steve Garner and Dr Miguel Prats in the UK AHRC/ EPSRC funded Design Synthesis and Shape Generation project and the Leverhulme Trust funded Designing with Vision project. The crockery examples in the design activity case study are based on a product range from Sargadelos (www.sargadelos.com/) and the plate designs

were generated by students from the Universidade da Coruña as part of a study led by Dr Miquel Prats.

Appendix: details of the design process case study

Phase 1

The project is carried out over a six-week period. In the first two weeks students work in pairs to review design process aspects of product development and design methods published in textbooks. Results of these reviews are presented to the whole group so that all students have a detailed knowledge of one process and an awareness of others.

Key characteristics of these processes tend to be that there are clear activities that move from understanding of a problem through the definition of requirements to concept design and the development of a final design. Several include a planning stage. Successful processes typically result in a workable solution to the initial problem that is delivered within a required timeframe and at an affordable cost.

Phase 2

In the final three to four weeks of the project, groups of between three and five students carry out a video recorded team design task under experimental conditions. The same brief is used across year groups in order that results across different year groups can be compared with each other. If the project is carried out across locations then the brief is adapted in order that it applies to a local problem. For example, a version of this project where students compared the operation of UK- and US-based teams used comparable briefs for each location (Yasser et al., 2008). The brief for the Leeds-based design task is given below. To ensure consistency across teams, each group is given the same directions and the instructor has a folder of additional information that students can have on request. This folder contains data relevant to the design task. For example, for the street crossing design task it includes photographs of the road and buildings, costing data for options including bridge building, tunnelling and the installation of surface level products such as traffic lights and barriers, and data related to vehicular and pedestrian traffic.

Brief for the Research into Design Task (from Yasser et al., 2008).

Street crossing

University campuses are often overcrowded with pedestrians crossing streets, since walking is a popular form of transportation for university students. One busy intersection on campus is the crossing from the School of Mechanical Engineering to the Eldon pub. Dangers at this intersection include heavy traffic and buses, which run against the general traffic flow. The University would like to design a cost-effective method to cross this street, which would reduce the possibility of accidents at this intersection and enable reasonable access to the pub. Your work should contain a detailed description of your design and should include any relevant diagrams and calculations. Please clearly state all assumptions, which are needed in your analysis and try to keep your design simple yet effective.

Instructions for the Team Design Task (from Yasser et al., 2008).

Directions for the team design task

Today your team will solve a design problem. This activity is part of the curriculum and designed to give you an opportunity to apply design and team working skills you have learned to far. You will have a half-hour (30 minutes) to solve this problem. At the beginning of the exercise you will be provided with a problem statement and paper to document your design ideas. Your instructor has additional information in a folder and will provide this information only when you request it. Raise your hand if your team needs additional information. When you have completed your design, please submit all of the documents, drawings and notes you have created. You will be told when you have five minutes left. In modules where more than one group of students is completing the task, please do not discuss the task with other students until all students have completed the task.

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33

A MIXED-METHODS APPROACH TO INTERIOR AND ARCHITECTURAL DESIGN HISTORY RESEARCH

Kathryn L. Burton and Elaine L. Pedersen

Quality research is the result of the appropriate application and use of research techniques. "No single method of data collection . . . is ideal. Each has inherent strengths and weaknesses" (Abowitz and Toole, 2010: 108). A mixed-methods approach may provide stronger findings if the methods that have been selected each provide further insight on the subject being explored. Additionally, sometimes the methods may "counterbalance each other" adding a strength to the other method's weakness (ibid.: 112). Abowitz and Toole (2010: 113) believe that the use of mixed-methods is most effective when methods are mixed "that have different but complementary strengths and weaknesses". If a careful selection of methods is made and each type of method used balances and supplements the other methods, more inclusive data may be collected (Abowitz and Toole, 2010; Fielding, 2010). Many researchers conduct their research using one method that they have deemed appropriate to their research purpose, however, the use of mixed-methods research continues to grow (Fielding, 2010). Most typically when researchers use a mixed-methods research approach they are referring to the use of both qualitative and quantitative data collection methods (Abowitz and Toole, 2010; Creswell, 2009; Creswell and Plano Clark, 2011). However, a mixed-methods approach can be constructed from exclusively qualitative data collection when different qualitative paradigms are applied to the data. In fact, mixed-methods approaches have been called "multiple ways of seeing" (Creswell and Plano Clark, 2011: 4). While design scholars may typically use a mixed-method qualitative approach, design history scholars may find it worthwhile to consider the application of a mixed-methods qualitative approach because of the potential for uncovering multiple layers of data not readily available in a single methodological approach. Traditional historic design research uses the historic method and those in material culture may use the historic method and/or variations of artifact analysis, but it is rare to find much mixing of methods. A search of articles published across three scholarly journals, *Journal of the Society of Architectural Historians*, *Journal of Design History* and *Journal of Interior Design, Special Issue—Time: People + Products + Processes* (focusing on design history) bore this out. Of the articles reviewed (Bowler and Brimblecombe, 2000; Ortenberg, 2011; Kinchin, 2005; Bluestone, 2012; Yanni, 2003; Marcus, 2012; Lasc, 2013; Heathcott, 2012; Huppatz, 2012; Barnes and Jackson, 2012; Edwards, 2013; Al Shihabi, 2013) most did not explicitly reveal their methods, but the historic method was apparent from the authors' use of primary and secondary materials as data sources. In two cases other methods were evident in conjunction with the historic method; artifact analysis

(Al Shihabi, 2013) and a supplemental use of oral history (Marcus, 2012). While this small sampling of literature cannot be considered exhaustive, it does seem to represent a common practice among design historians to focus on the historic method for their research.

As a complement to the traditional use of the historic method we offer an innovative approach using mixed methods that may be beneficial to scholars who are working on complex

Case study

The use of the historic method as **the** method to study built structures, interiors and designers of the past is common practice. However, when studying A.W.N. Pugin, a pre-eminent nineteenth-century English designer and writer who advocated a neo-Gothic design style, the historic method alone did not appear sufficient to address the research questions. The context for the research was an examination of Pugin, his published written words and his design work for the parish church St. Augustine's, Ramsgate. The church, a symbol of Christian identity in nineteenth-century England, was designed by Pugin and built on his own parcel of land, next to his home (Figure 33.1).

Using no external funding Pugin was simultaneously designer and client. Three key research questions drove the research:

1) Was St. Augustine's a good 'fit' with Pugin's personal and zealously written architectural philosophies?
2) How did early nineteenth-century [English] culture and society, the period between the mid-1830s and the early 1850s, influence Pugin's design of St. Augustine's?
and
3) How does the design for St. Augustine's reflect Pugin's creative abilities?

Burton, 2007: 4

The selection of St. Augustine's as a subject of study made it possible to examine how closely Pugin followed his own published views on architecture since no external client demands would influence its design.

It was our belief, given the broadness of the research questions, that a qualitative interdisciplinary mixed-methods approach would provide richer data than would be possible from a using a single method or a single methodological approach. Using a creativity model developed by Mihaly Csikszentmihalyi (1999) – a scholar in the field of psychology – as a guiding framework, three different methodological approaches were used in the study. The historic method, representing the overarching research paradigm, was used in combination with artifact analysis, a material culture method, and a personal phenomenological exploration.

What follows is a general discussion of the creativity framework and the individual methods we used and their purposes within the context of the study. The individual methods are then discussed in greater detail, including information regarding the types of data collected using each method. Reflections about each method's usefulness to the study are also offered. The creativity model and its role in guiding the research are discussed under a separate heading. We conclude with a brief statement about the benefits of using an interdisciplinary qualitative mixed-methods approach for studying aspects of design history and discuss examples of other design-related research projects that use a mixed-methods approach or that could use this approach.

design research questions. Using methods from the study of material culture and phenomenology, and a framework rooted in the field of psychology in addition to the historic method, we present a case study of an historic investigation to demonstrate the usefulness of a mixed-methods approach to design history research.

Methods used

With regard to our first research question, *Was St. Augustine's a good 'fit' with Pugin's personal and zealously written architectural philosophies?*, Csikszentmihalyi's (1999) creativity model guided the use of the historical method, a modified artifact analysis method, and a personal phenomenological approach. The built structure, interior and fittings served as the 'artifact'. The structure and its fittings were observed and then analysed in order to match Pugin's words with his design actions (Figure 33.2).

Written documents were also examined to study Pugin and his written works. To study the influence of culture and society on the design of St. Augustine's for research question two, *How did early nineteenth-century English culture and society influence Pugin's design of St. Augustine's?*, the creativity model directed the use of the historic method and the modified artifact analysis method. To examine question three, *How does the design for St. Augustine's reflect Pugin's creativity?*, the creativity model once again functioned as a guide for the modified artifact analysis method and the historic method. The use of an interdisciplinary mixed-methods research approach provided a type of triangulation of data that is not always found in traditional historic design research.

Phenomenological method

Phenomenology is both a philosophical approach and a method. Most typically phenomenology is used in the study of human behaviour. "A phenomenological study describes the common meaning for several individuals of their lived experiences of a concept or a phenomenon" (Creswell, 2013: 76). Phenomenologists focus on "the world as lived by a person" (Laverty, 2003: 4); they assert that one only understands the phenomena via participation (Flood, 2010). Phenomenology can also be used in a more personal manner by researchers. With personal phenomenology a researcher personally reflects on the data being collected (Laverty, 2003); this data may be the study of participants' thoughts, but it may also include the researcher's personal observations. Similar to participants in a phenomenological interview, the design researcher involved with personal phenomenology faces a designed object and describes in detail the experience of viewing, using or experiencing the object or built structure. With the personal phenomenology approach it is the lived experience of the researcher that is important. This is the "discovery oriented approach" of phenomenology (Flood, 2010: 10). Since an individual's lived experiences are viewed as being influenced by the environment around them, the use of Csikszentmihalyi's (1999) creativity model in our study blended well with the personal phenomenology method because his model was designed around a similar belief.

Francis Violich (1998) developed a special type of personal phenomenology with which to study place and urban design, and thus it is an approach appropriate for studying built structures and interiors. Violich's (1998: 58) phenomenological approach does "not fully embrace phenomenology in its purist philosophical sense" because he felt that would limit "the comprehensive scope of experience" of place. However, using his personal phenomenological method one is able to approach a designed space via experiencing it with a minimum of preconceived ideas. In the phenomenological spirit, Violich approached urban areas with an

Figure 33.1 Southern façade of St. Augustine's Church, Ramsgate, England

Source: Authors' photo

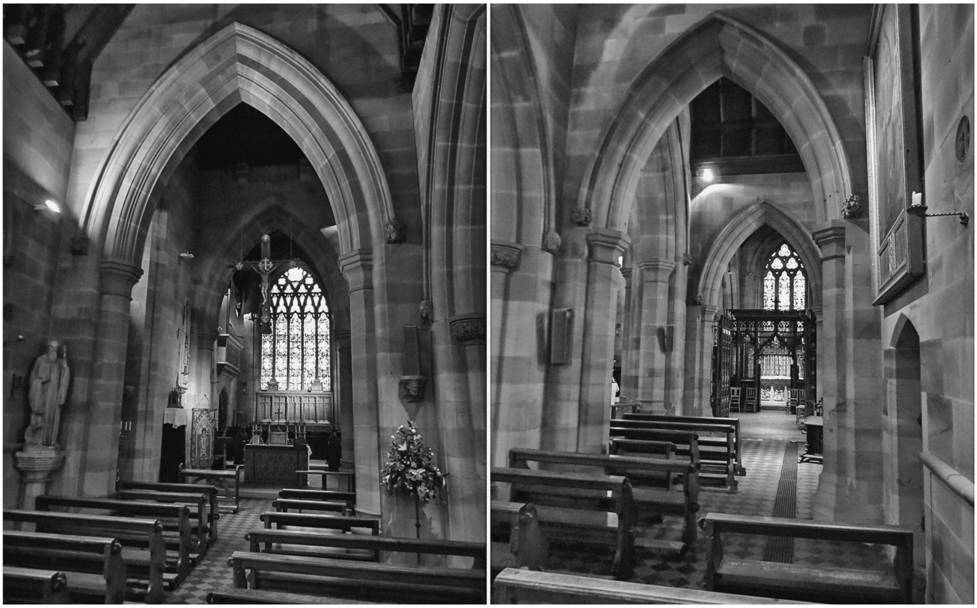

Figure 33.2 A view into the nave (left) and a view down the south aisle into the Lady Chapel (right) at St. Augustine's Church

Source: Authors' photos

open mind banishing, as much as possible, any fixed idea. He then systematically experienced the urban area completing what he called an "urban reading" (ibid.: 56). In this personal phenomenological method one approaches the space/place under study very slowly, looking at or 'reading' each area with total concentration. Depending upon the object[1] of study, the process might take one or more days for a comprehensive understanding. Notes are written and sketches are made throughout the process (Violich, 1983: 3).

Phenomenology was the first method used on site at St. Augustine's. The initial visit to the site by the lead author was one in which the psychological 'feel' of St. Augustine's was the primary focus; this is the 'lived experience' of Violich's personal phenomenology. As much as was possible all prior knowledge about Pugin and the church was set aside and personal feelings and emotions were allowed to surface and be acknowledged (Burton, 2007: 52). The discoveries from this approach were recorded in a personal journal.[2] The first encounter with the building was purposefully unstructured so that the building and its site could inform the researcher about the best path to take to explore it. Using this approach it was learned that details about how the parts of the entire complex (church, sacristies, cloisters and churchyard) fit together are only available by experiencing them first hand. For example, a floor plan of the complex seen beforehand offered insight into the layout of the complex, but only on-site observations enabled a clear comprehension of the scale, proportion and physical connections of the parts. Another example of the benefits of a phenomenological approach was the ability to gain a better understanding of the 'look and feel' of the church by experiencing the construction materials Pugin used. The literature described the exterior of the church as being constructed of 'knapped flint', a material not commonly used in the U.S. Pictures showed a dark roughly cut stone material covering the façade, but seeing and touching the material revealed the shimmering reflective and sharped-edged qualities the cut flint stone displays (Figure 33.3, left).

Later in the visit, seeing whole-rounded flint stones of the type Pugin had used laying on the beach nearby brought the understanding of this construction material full circle. Notes in the lead researcher's personal journal about this aspect of the church included "what catches the eye first of all is the knapped flint—very unusual looking—reminded me of houses and walls I've seen made w[ith] the end of bottles sticking through the mortar" (Burton, 2005). Experiencing the structure first hand and then recording personal feelings, like those above, deepened the pool of descriptive information available for use during the analysis and interpretation phases of the study (Figure 33.3, right). Developing a personal perception of the place prior to recording analytical data also allowed the lead researcher to "shake hands with the place" (Goldsworthy, 2001) and get to know it better (Burton, 2007).

Historic method

The *historic method* involves the identification of a central research question and then a determination of primary and secondary research sources that best enable the answering of the question. These sources form the historian's 'data'. It is the historian's task to identify relevant sources and then decide how best to make use of them to answer the research question. Primary sources, those sources from the time period and "produced by people or groups directly involved in the event or topic" (Rampolla, 1998: 3), are critical to the historic method. Written primary sources and other works that originated in the time period are examined and analysed. These sources can include letters, diaries, published works, sketches, and so forth. In traditional history the definition for the term 'source' is often limited to written materials or two-dimensional imagery, such as photographs, paintings or illustrations. However, in the design history field the extant designed object, such as a building or interior, is also considered to be a type of

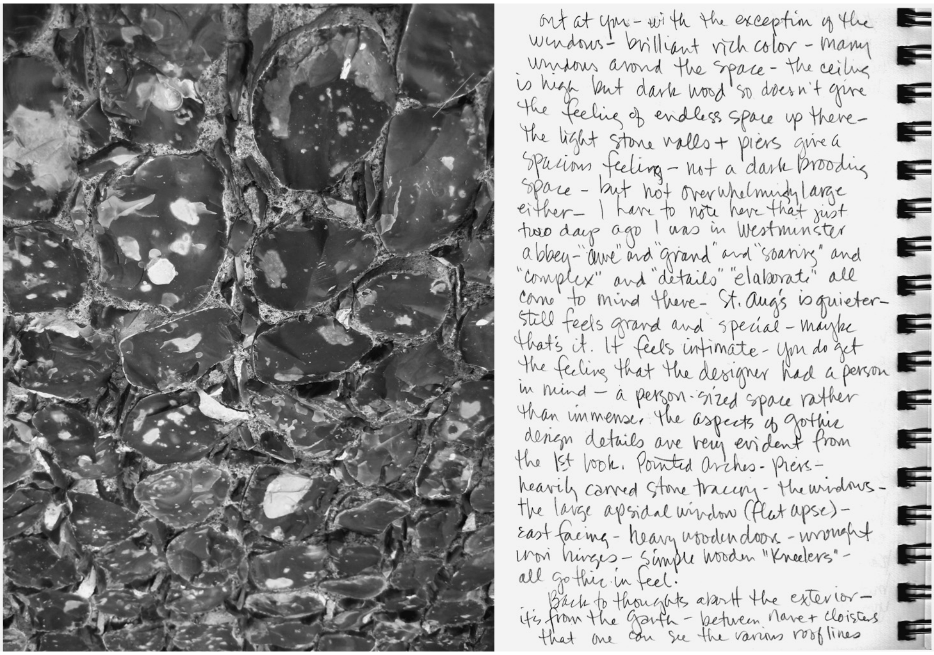

Figure 33.3 Close-up of 'Knapped-Flint' construction material (left) and excerpt from field notes kept in the 'personal journal' (right)

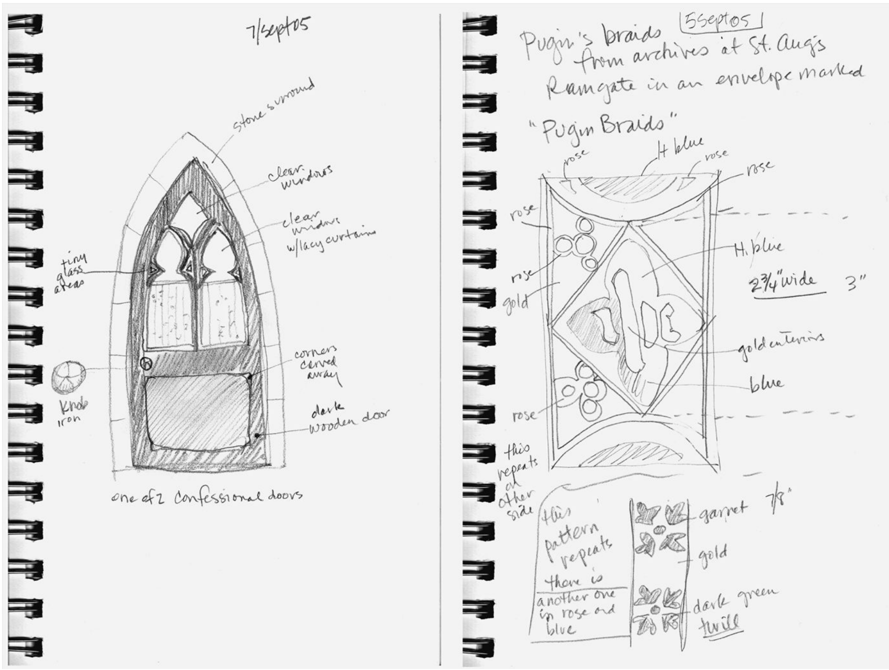

Figure 33.4 On-site sketch of confessional door, with field notes (left) and on-site sketch of decorative braids, with field notes (right). Artifacts found in the St. Augustine's Church Abbey archives

primary source. In architectural, interior and other types of design history, though sources do generally include artifacts, written sources are still important in the study and interpretation of the artifacts. Secondary scholarly sources are also useful to historic design research. They inform the scholar about current knowledge related to the research question. Both primary and secondary sources need careful evaluation by the scholar as to their usefulness, truthfulness and possible biases. Because one cannot fully know the past the historical scholar develops inferences from the analysis of all of the selected sources and uses that information to construct a picture of the past.

Using the historic method within our study of Pugin involved the examination of both primary and secondary resource materials. Among the primary resources we used were Pugin's own published words regarding his architectural philosophies in his works, *Contrasts* (1841b, reprint, 1973), *An Apology* (1843b), *True Principles* (1841a) and *Present State* (1843a, reprint, 1969), as well as his book *A Treatise on Chancel Screens* (1851). Original sketches and illustrations where Pugin laid out his design ideas for the church were examined as was correspondence between Bishop Thomas Griffiths and Pugin in which Pugin described his ideas for St. Augustine's. Pieces written by or about Pugin published in periodicals from the time period were also examined. Written and illustrative primary source materials were studied in museums and archives and were procured through interlibrary loan services at a western U.S. land-grant university. Articles from periodicals of the time period, *The Rambler*, *The Builder* and the *Ecclesiologist*, were secured via micro-film and/or micro-fiche. The Bloxam Archives at Magdalen College, Oxford, archives held at St. Augustine's Abbey, across the road from the church, and collections at the Victoria and Albert Museum, London, were locations where extant artifact primary sources were examined. Pugin's extant design work for St. Augustine's Church, its interiors and fittings on site in Ramsgate were, of course, also primary source materials that underwent examination and analysis. One especially interesting extant artifact observed during the study was a cope and hood designed by Pugin for use at St. Augustine's which is housed in the nineteenth-century British galleries in the Victoria and Albert Museum, London. Although now displayed out of context, away from the church, it was delightful to see it and to have witnessed the structure within which it had been worn.

Secondary sources, including books and book chapters about Pugin and his design work written after the original time period, were also important assets during the process of interpreting the artifacts in the context of nineteenth-century English design. Phoebe Stanton's *Pugin* (1971) and G. M. Young's book chapter titled "Portrait of an Age" (1963) are examples of secondary sources that helped us understand Pugin and the cultural landscape in which he worked. Direct insight into Pugin's architectural and design philosophies became possible via the historic method. Through reading his original written works and examining his extant design work, the building, interiors, fittings and ecclesiastical objects, Pugin's design ideas became evident.

Artifact analysis

Artifact analysis is used in the study of material culture. Scholars in the field of material culture recognise the importance of historical artifacts in the study of a designer/maker, a particular period of time or a selected socio-cultural system. The study of material culture is the study of one or more artifacts from a socio-cultural system and an examination of its use and meaning (Schlereth, 1982: 2). Artifacts, the extant cultural objects, are examined, and when possible the scholar looks for patterns among the objects "in order to determine change, the image of society, its issues, its definition of beauty" (Marchese, 1980: 607). As mentioned, some historical scholars have ignored the use of artifacts as historical data sources. However, "[a]rtifacts constitute the only class of historical events that occurred in the past but survive into the present. They can be re-experienced; they are authentic, primary historical material available for first hand study" (Prown, 1993: 2–3). Thus examining architecture and interiors using an artifact analysis based in the study of material culture method is appropriate.

The material culture method of artifact analysis consists of observing and analysing objects made and used within a given culture as a means of learning more about the culture. "Objects are analyzed for their construction material, their use, symbolism and aesthetics among other properties" (Burton, 2007: 53). There are several different frameworks of artifact analysis. Generally questions based on the selected artifact analysis framework are asked relative to the object, its milieu and use. Use of one or more of these frameworks helps ensure a systematic and valid approach to material culture scholarship. Development of these methods has strengthened the scholarship of material culture.

For the study of Pugin and St. Augustine's an artifact analysis framework was developed by combining two tools; one from E. McClung Fleming's (1974) artifact analysis model and the other an artifact analysis tool developed by Kathleen Bryant (2004). Fleming's framework involves several different strategies. Description and identification of the artifact is a first step; additional phases of analysis are evaluating the artifact, examining the "interrelationships of an artifact and its contemporary culture" (Fleming, 1974: 9) and evaluating and interpreting the artifact's meaning and significance in light of the scholar's culture. In all of these steps the history of the artifact, its material properties, its construction and design and its function are considered. Fleming's method also complemented the creativity model used in this study, which will be discussed below, as both focus on the examination of the influences of culture and society. The only portion of the Fleming framework that was not used was the comparative analysis step in which the artifact is compared with like objects. St. Augustine's was not evaluated against similar objects or designs due to its unique position among Pugin's work. Bryant (2004) developed analysis forms in order to record observations of individual interior artifacts and individual rooms. Artifact analysis tools created by Fleming and Bryant were adapted to the study of St. Augustine's to be used to record details of the structure. Forms were initially developed to record information regarding the interior, exterior and objects found at the church. The forms required that the location of each section of the interior, exterior or object being examined be keyed to an existing floor plan for ease of reference. The name of the part of the building (or object) being observed, a visual analysis and physical description of it and its function were to be recorded on the forms. Other spaces on the forms were meant to be used to document further information about the building (or object) found after the site visit, cultural analysis of the artifact and interpretive remarks.

Although Bryant (2004) utilised individual artifact analysis forms to record observations of the various components related to interior design in her study, the forms we developed were not employed on site due to the encumbrance they presented given the comprehensive nature of the task at hand. At the site it was determined that filling in the spaces created on the sheets limited the amount of information that could be written down so a more fluid system was devised in the research journal. Nevertheless, the exterior and interior of the building were observed using a systematic process. It is this 'systematic process' that differentiated the artifact analysis phase from the phenomenological approach used earlier in the study. Using a fact-finding and analytical mindset the lead researcher took detailed notes in the research journal and keyed the notes to the floor plan in an organised way that satisfied the essence of the forms. Locations of doors, windows and architectural details were written down. Materials used for all features within the church were described and recorded. Information regarding imagery used in stained-glass windows and statuary was also recorded. Multiple methods of recording physical details were used. Sketches were made that included structural details, construction materials, architectural features and decorative elements (Figure 33.4).

Multiple photographs were taken making a visual record of each wall, the ceiling and flooring throughout the space. Video tapes were made of both the interior and exterior in an attempt to fully document the structure through visual means.

The data collected during the artifact analysis phase of the study was integral to the work of comparing Pugin's published design philosophies with his design for the church. Without a detailed artifact analysis of the structure, its interior and fittings the 'fit' between Pugin's written words and his design work would be impossible to discern. As previously discussed, artifact analysis also includes evaluation and interpretation of objects relative to the culture and society of their origin. In our study these actions were taken using the creativity model discussed below.

Guiding framework: creativity model

In order to study the creative individual, Csikszentmihalyi (1999) suggests the examination of three systems: domain, field and individual, which he nestles within the larger contexts of culture, society and personal background (Figure 33.5).

Csikszentmihalyi's systems framework helps "define the cultural, societal and personal background of the creative person under study so that the work they produce can be better understood in relation to its time and place" (Burton, 2007: 62). He describes 'domain' as the influence of culture on creativity and states that cultures are "systems of interrelated domains" (Csikszentmihalyi, 1999: 317). 'Fields' are "made up of individuals who practice a given domain

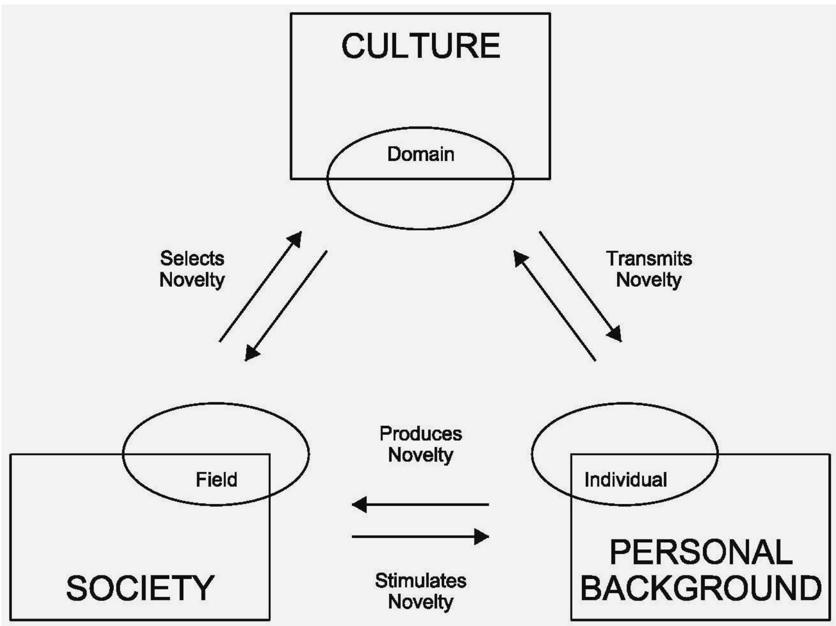

Figure 33.5 A systems view of creativity

Source: Csikszentmihalyi, 1999: Figure 16.1

and have the power to change it" (ibid.: 321). The term 'individual' refers to the person being studied. The creativity model:

> includes a series of suggested questions [and hypotheses] that direct and support the researcher's focus on specific cultural, societal and personal background systems that are considered keys to allowing (or disallowing) creative activity to flourish during the time period under study. The questions [and hypotheses] range from those about the means of storage of information and the accessibility of information within a culture to questions about the value of creative thought within society. Other questions [and hypotheses] relate to the personal background of the individual and ask, among other things, about the level of support given to the creative person by family members.
>
> *Burton, 2007: 62*

Questions about the influence of personality characteristics on creative activity are also asked in the model. In combination with the historic method, literature written about the social milieu in which Pugin worked was examined and primary and secondary sources relating to cultural influences on architecture and design, such as religious beliefs and overriding aesthetic theories of the time, were considered. Primary and secondary sources about Pugin's life were analysed to create a sense of Pugin the man.

> [I]mportant to understanding the field-domain-individual relationship in this study was an examination of the influence of symbols on architectural designs of the time period. Symbols used by Pugin in the context of his design work were analyzed using artifact analysis and the historic method.
>
> *Burton, 2007: 63*

Major cultural and societal influences on Pugin's design work including religious ideology, aesthetic ideals, familial support and personality attributes were discovered based on answers to questions listed in the creativity model framework. Using the creativity model and our mixed-methods approach enabled us to determine that, in answer to our first research question regarding the 'fit' between Pugin's writing and his design work for the church, Pugin did indeed follow his own written architectural principles in the design and construction of St. Augustine's. Because of the broad nature of our research questions two and three the Csikszentmihalyi framework helped us concentrate on critical issues as it outlines them. As we explored the ways in which nineteenth-century English culture and society influenced Pugin's work and how the design for the church reflected his creativity, the questions and hypotheses within the model helped focus our efforts.

Conclusions

We have described a study that used an interdisciplinary qualitative mixed-methods approach in which Pugin, a nineteenth-century English designer, his writings and his design work at St. Augustine's was the focus. Use of an interdisciplinary mixed-methods approach is highly recommended for those studying the design process, designers and designed environments whether contemporary or historical. The use of multiple methods taken from the point of view of a variety of scholarly paradigms enriches research projects in ways unattainable using a single-method approach.[3] In our study the use of the phenomenological approach added a layer of rich 'human' experience which expanded the quality and quantity of data available in later analytical phases. The application of Csikszentmihalyi's creativity model resulted in a focused approach to researching the issues relevant to the development of a creative individual – from the influences of culture and society to the influences of personal background. The use of the model also tied the different methods together.

An interdisciplinary qualitative mixed-methods approach, however, is not limited to the type of research questions we have been discussing. Jean Parsons (2012), an apparel designer and academic, is one design researcher who is currently using a mixed-methods approach in her design research. In Parson's current design work she begins by searching for extant, primary sources, specifically historical apparel patents, that include a garment pattern. She analyses the patent and pattern using a modified artifact analysis approach. Parsons then experiments with modifying the patent pattern for contemporary bodies, she designs printed fabric specifically for the new modified pattern and she tests the resultant pattern and fabric. Although a rarity, an example of a qualitative mixed-methods approach being employed in design history is found in Timothy Brittain-Catlin's (2006) study of A.W.N. Pugin's convent designs in the U.K. Brittain-Catlin began by using the traditional historic research method and discovered that none of Pugin's floor plans for his English convent designs survived. With information gathered from Ordnance Survey plans, surviving photographs and a modified artifact analysis of extant structures he drafted out reconstructed floor plans. The resultant drawings then helped Brittain-Catlin test his theories regarding the connection between Pugin's spatial arrangements for the buildings and their impact on convent life.

Violich, in his 1983 discussion on the phenomenology of space, suggested that environmental designers might benefit from mixing quantitative methods with his personal phenomenology approach. He suggested that their use of "objective survey methods stressing quantifiable responses to explain preferences and behavior pattern" (p. 2) might be enhanced by having a "'dialogue' with urban places themselves" (p. 2). It would also be useful to mix personal phenomenology with several other types of qualitative methods to study urban design. After conducting a personal phenomenology of a selected urban location, one could observe how the urban space is used and conduct interviews to answer specific questions about perceptions and use of the space.

We do need to add a note of caution in our support for mixed-methods research, whether in the design history area or any area of design scholarship. There has been ongoing discussion of the feasibility and advisability of mixing different paradigmatic methods (Creswell and Plano Clark, 2011: 39; Morgan, 2007; Teddlie and Tashakkori, 2012). Depending upon the definition of the concept paradigm it is believed by some scholars that different paradigms focus on different worldviews, and this in turn influences all aspects of research from the type of question to the type of method that is considered acceptable. It is important in the consideration of methods for a particular study that one determines the compatibility of the data collection and data analysis procedures as well as any underlying assumptions about research, data, and so forth.

A potential pitfall of mixed-methods research is lack of expertise for each of the methods used by a scholar in any one research project. Mixed methods, whether mixing quantitative and qualitative or two or more types of qualitative methods, is most successful when the scholar has expertise in each method (Creswell and Plano Clark, 2011: 13; Teddlie and Tashakkori, 2012). It has been suggested that both proper training in each method and experience with each method is necessary before methods are mixed in one study. One means of achieving expertise on each method is by using a team approach where one member of the team would be 'the' expert in a particular method and the remaining members would have at least "a minimum competence level" in each method used so scholars may more easily communicate with each other about all phases of the research project (Teddlie and Tashakkori, 2012: 777). Having experts in each of the methods also makes it more likely that the most recent techniques will be known and can be considered for the project (Creswell and Plano Clark, 2011: 14).

At present there is little agreement as to the actual 'mixing' of methods with regard to any recommended research design or order of methods in terms of which method is used first (Creswell and Plano Clark, 2011: 280; Denscombe, 2008). The methods used should match the research purpose, but the order in which the methods are used and which specific methods to use need to be carefully considered by each individual scholar or team. Finally, for the greatest success with mixed-methods, scholars need to clearly discuss their methods along with discussing the assumptions held by researchers among the team and the rigour of each method with regard to collecting and analysing.

In our study of Pugin and in the examples we have given above of other mixed-methods approaches to design research, the use of multiple methods and method paradigms adds dimensions to the discovery of new knowledge that may not have occurred without the use of multiple methods and approaches to the research questions. While the premise that the research question dictates the choice of method remains true we encourage design scholars studying interior, architectural and urban spaces to consider the benefits that might be gained by mixing several appropriate methods and approaches. No one method is perfect, and, as we have discovered, a variety of perspectives on a subject may be realised with the application of multiple methods.

Notes

1 The 'object' could be an interior, a building (both exterior and interior), a street or an entire town.

2 Although sketches and notes were not written at the time of the initial observation, as per Violich's approach, those features do appear in both a personal journal, written later in the day after the first site visit, and in the research journal, in which more precise analytical observations were made. On site it seemed more important to spend time absorbing the experience rather than to begin by writing or sketching.

3 There is much discussion in the literature about paradigms and mixed methods. Some of the discussion is related to the definition of paradigm and other scholars are discussing whether paradigms can be mixed within one study. All of the current discussions raise important issues; however this discussion is beyond the confines of our chapter.

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34

RESEARCH ON HISTORY OF ARCHITECTURE

An interdisciplinary approach that uses films to investigate the discourse of spaces

Cecilia Mouat

Cinema is able to vividly reproduce architectonic spaces. Location shooting and set design are not only the settings where the action of the film takes place; spaces in films also communicate meanings and produce cultural discourses. These discourses influence our perceptions and spatial experiences of the real world by promoting negative or positive values linked to certain places. An interdisciplinary approach that combines the analysis of the built space with the analysis of the cinematic space serves to explain that spaces can be seen not only as physical configurations, but also as constructed discourses that function within a process of accumulation.

This chapter describes a historical research approach to investigate the discourse of space, and presents the main findings of a study on American and British films produced between the 1930s and 1960s. This study is based on the analysis of cities, neighbourhoods, and domestic spaces that appear in films as valuable sources that not only give visibility to certain places, but also create a dominant discourse of space. This chapter also suggests that the analysis of the cinematic discourse illuminates historical aspects that are not evident by traditional analysis of spaces.

Including products of popular culture to analyse architecture

Historical research on architecture has been traditionally studied, to put it simplistically, through two main forms of analyses: one is based on built projects and interpretation of graphical documents, such as plans, photographs, and drawings; and the other is based on the study and interpretation of written sources, such as biographies, writings, etc. Both analyses are focused on authors and projects, and even if these studies include historical contexts, they create a narrative that emerges exclusively from the design discipline. As an example, historians, such as Henry Russell Hitchcock, Nicolaus Pevsner, and Siegfried Giedion, wrote the first official history of the Modern Movement in Architecture. These scholars celebrated modernist projects and influenced many generations of architects and scholars, however even modernist housing solutions were included in governmental documentaries of the 1930s to 1940s produced in America and Britain, such as *Housing Problems* (UK, 1935); *The Great Crusade* (UK, 1937); *New Town for Old* (UK, 1942); *Proud City* (UK, 1945); *House for Veterans* (US, 1946); and *For the Living* (US, 1949); commercial films produced in Britain and America used modernist spaces to portray places of work and productivity, and to represent the twentieth century's image of the poor, but rarely as houses of normal families. In the 1930s to 1960s, American and British films represented domestic spaces as cozy houses, recalling a traditional architectural style of small villages inherited from past centuries. Cinematic representations of metropolitan spaces were systematically associated with poverty, with representative examples, such as *Boy of the Streets* (US, 1937) and *Love in a Dole* (UK, 1941); delinquency and crime illustrated by films, such as *The Asphalt Jungle* (US, 1950) and *Night and the City* (UK, 1950); or at least metropolitan spaces were linked with selfish interests and sexual temptations with illustrative examples, such as *Mr. Deeds Goes to Town* (US, 1936) and *Room at the Top* (UK, 1959). On the other hand, small towns close to the countryside, and low-dense suburbs with single-family homes and cared gardens, were presented in commercial films as appropriate environments to maintain moral values and raise a healthy family. Examples such as *Our Town* (US, 1940) and *This Happy Breed* (UK, 1944) illustrate this trend.

The apparent discrepancy between the discourse of design disseminated by intellectuals of the design field that promote the urban lifestyle and the aesthetics of the Modern Movement in Architecture, and the discourse distributed by commercial films, which condemn the metropolitan space and celebrate traditional architecture and low-dense solutions close to the countryside, suggests that cinema, as the most influential form of popular culture during the first-half of the twentieth century, should be included in historical studies of architecture. Films not only illuminate the common public perception regarding their spaces, cities, and architecture in past periods; they also inform how dominant discourses of spaces are distributed and reinforced through cinema.

Defining discourse of spaces and the notion of historical a priori

During the second-half of the twentieth century, scholars from fields such as history and geography have moved their spatial approach from a notion based exclusively on formal and geometrical aspects to a socio-cultural critique. French social theorists – such as Michel Foucault, Henri Lefebvre, Michel de Certeau, and Pierre Bourdieu – and British geographers – such as David Harvey and Doreen Massey – and the American Edward Soja understand space as an artifact that is socially constructed.

Representation of spaces in films can be seen as clear forms of social products that pervade the formal construction of historical knowledge. Using the terms of John Gold, 'Grand Narratives' in historical research are those stories that unify properties and act as taken-for-granted frameworks (Gold, 1997: 1). In films, grand narratives of spatial discourses can be seen as systematic associations between certain spaces and recurrent stories, characters, and specific kinds of social life. A cinematic space can communicate positive or negative values; can be the backdrop for a criminal, or the backdrop for a happy and well-constituted family. Thus, a research on spatial discourses using films must be focused not only on the identification and description of spaces, buildings, or cities that appear on screen, but also on the kind of stories and characters that inhabit these spaces. If we see that certain associations between spaces and values are systematically used in many films, we can understand that these spaces communicate a dominant discourse.

Film theorists tend to explain the emergence of certain film genres that speak about cities by relying on contingent facts that supposedly define their emergence. For example, *Film Noir* that depicts the city as a dangerous place is commonly related to World War II, the fear of the atomic bomb, or the presence of German film directors who were strongly influenced by the Expressionist Movement. Suburban comedies are also related to the boom of suburbanisation that occurred in America after World War II. I am not arguing that these facts did not influence the emergence of these genres, but suggest that films are also linked to broad cultural categories that shape the historical a priori of the time.

The discourse analysis elaborated by Michel Foucault understands discourse as a historical phenomenon. His analysis involves research into the historical conditions and the power relations that interact in a particular time period, and facilitate the emergence of certain discourses. From this approach, discourses are shaped through networks of relationships among dissimilar elements that do not necessarily have linear and causal successions. The elements that form a discourse are not connected by general rules; neither do they present horizontal coherence between their elements (Foucault, 2010: 72). Foucault calls this approach 'Historical Discontinuity' establishing non-traditional connections between disciplines, and opening up the exploration of new relations among seemingly disconnected events. The historical discontinuity framework and the genealogical approach are not focused on authors (film directors, and/or architects), but instead on certain discourses and their rules of formation. These discourses are shaped through relations among dissimilar elements, such as: (1) urban planning, as a regulatory institution supported by the government; (2) urban models that define types of neighbourhoods, and/or city growth; (3) urban regulatory laws, such as zoning uses that operate as strategies and tactics of power/government seeking to use space for particular ends; (4) the process of systematisation and distribution of the discourses that allow them as games of truth or take-for-granted frameworks (for example the planner who recommends specific urban models, the sociologist who opines what are the best forms of human communities, or films that represent urban models associated with particular forms of social life); and (5) the process of 'subjectivation' that articulates the learned discourses as knowledge and as the production of political subjectivities and self-forming subjects. The subjectivation has to do with the way individuals perceive themselves and understand the world they live in, and how taken-for-granted frameworks explain the events that surround them. The historical discontinuity allows us to understand that discourses are formations that occur through a process of 'accumulation'.

Foucault's foundational book, *The Archeology of Knowledge*, explains the context from which the notion of historical discontinuity emerged. In *The Archeology*, Foucault considers the author as an operator, an emergency surface, who is not only exposed to certain discursive practices, but is at the same time the response and result of the discourse. This theoretical model suggests that film directors and architects are not only creators inspired by their originality, or influenced by certain economic, productive, and technological processes, but also under a dominant discourse or historical a priori that tends to be invisible because it affects the way the knowledge is apprehended.

Methodological considerations to analyse spatial discourses in films

Films can be studied from multiple approaches, including research focused on actors, plots, directors, genres, the film industry, etc. Any film can be studied as a unique text; however, in order to research dominant discourses, we first have to consider that the study must include a significant number of films. If the aim is to identify whether a trend is systematically repeated, we could not deduce dominant discourses by analysing a few examples. Second, we need to define a historical period and a place in which we investigate a specific topic. Third, we must select films in which we can observe the phenomena we are investigating. The selection criteria cannot be random samples, but rather directed samples, requiring the review of many films to ensure the proper range of material to observe our research topic. Fourth, we need to complement our film analysis with the analysis of architectural projects, urban models, and urban laws that surround our studied historical period, focusing on the widest range of previous discourses, and discourses at the period films are produced.

The research I conducted focused on American and British films produced in the 1930s to 1960s aimed to include the Post-Depression, Inter-War, and Post-War eras that implied significant changes in the process of urbanisation and city growth of both countries, establishing the urban and architectonic themes as relevant topics within the cultural discourse of the time. The research aimed to identify the most predominant urban models and housing models that appear in films; as well as illuminate how film genres represent spatial discourses.

In terms of methodology, the selection of films had to include American and British movies produced in that period in which urban spaces and housing play a relevant role within the story. Many films that discuss city spaces have been commented on by the scholarly literature of the topic providing some examples of films included in this study; however, an extensive search of films was required including reviewing more than 300 films and a final selection of 87 films. These selected films belong to diverse genres, considering films that set the action in a city, stories that describe how social life of the characters is influenced by the city space, and films that describe a community organised in certain spaces that influence their communitarian life.

The film analysis was complemented with the study of the main urban models promoted in America and Britain during the first-half of the twentieth century, such as the Garden City model promoted by Ebezner Howard, and the urban models promoted by the Modern Movement in Architecture, such as the well-known 1920s' *Siedlung* in Berlin, among others. The study also included the analysis of urban laws and governmental initiatives, such as the slum clearance programme of America and Britain, and the New Deal initiatives promoted by President Roosevelt, to mention just a few examples.

In order to identify the most predominant urban models and architectural models of housing commented on in American and British films in the 1930s to 1960s, the analysis emphasised the pro-filmic elements, or what kind of city and houses were placed in front of the camera. In order to identify how American and British films commented on urban discourses in the same historical period, the study compared the rhetorical practices and film techniques that were used to depict spaces in specific historical genres. This analysis aimed to illuminate possible links between certain film genres and certain spatial discourses.

The dichotomy between city and nature

Many aspects of the Garden City's discourse were borrowed from other discourses of the time. The ideas of decentralisation of cities, the democratisation of wealth and power, the need to revitalise British agriculture – besides the influence of cultural movements, such as the Arts and Crafts Movement that claimed the return to hand-made traditions – and influential writings by sociologists at the end of the nineteenth century and beginning of the twentieth century were discourses, which as a whole reacted to the 'evils' of industrialisation. In 1887, the German sociologist Ferdinand Toennies wrote *Community and Society* (*Gemeinschaft und Gesellschaft*) (1957), which reflects the great division between folk and urban society, or between the intimate relationships of family and community, and the impersonal alliances born of modern polity, economic exchange, and state power. Toennies defines community as the social system that involves an everyday life; face-to-face interactions between a relatively stable set of persons in relatively fixed institutions. On the other hand, he defines a society merely as a collection of communities, with a market town, where many relationships are no longer face-to-face, and institutions are impersonal rather than personal. This dichotomy serves also to illustrate how American and British films represent urban spaces in the 1930s to 1960s.

In American and British films produced in the 1930s to 1960s, metropolitan spaces are portrayed as places without identity that refuse to support moral values and any establishment of family life. For this reason, the representation of domestic spaces that portray middle-class families in metropolis is rare in the films produced in that period. By contrast, domestic spaces of apartments, as the most distinctive housing model of metropolis, serve as backdrop for poor people, youthful singles, easy women, and terminal bachelors. On the other hand, small communities close to the countryside are represented as the most desirable form of living with spaces that stimulate face-to-face interactions, family relationships, and significant milestones that generate places of memory and identity.

The clear dichotomy between the metropolis linked with negative values, and small communities and suburban neighbourhoods as safe and 'appropriate' places for common families, creates remarkable dominant discourses in all the studied film genres. The condemnation of the metropolitan space and the cellebration of those spaces that are articulated around a limited number of people in low-dense pattern, a relevant presence of nature, and meaningful places – such as Main Street, the church, and community clubs – are systematically repeated in most of the analysed films. This common discourse was represented in different ways according to each genre.

Our kids deserve a better place to live

During the 1930s, American urban dramas about kids, such as *Wild Boys of the Road*, *Dead End*, *Boys of the Streets*, *Boys Town*, and *Angels with Dirty Faces*, portray boys that live in slum's apartments. Their homes are located in dense zones of the metropolis, especially in New York City, and the streets seem to be the only playground for kids and represent a bad influence over them. These films necessarily associate urban poverty with juvenile delinquency, dysfunctional families, and reform school. Streets are represented by narrow and dark spaces, surrounded by deteriorated and overcrowding buildings, filled by clotheslines, escape ladders, dense activity, street fights, and criminals who inhabit the same neighbourhoods and became idols for the kids.

Children living in poverty were also the main concern that appeared in American and British documentaries of the 1930s to 1940s, such as the American *The City*, *A Place to Live*, and *For the Living*; and British documentaries, such as *Housing Problems*, *Homes for Workers*, *Proud City*, and *The Way We Live*. These films strongly condemn the slums of big cities and systemaically represent urban poverty by a landscape of clotheslines, smokestacks, small patios, and narrow streets that seem to be an inappropriate and dangerous space for innocent children. These documentaries also presented the urban solutions for slum dwellers, ranging from modernist multistoried buildings surrounded by open spaces and parks to low-dense solutions of townhouses close to nature. All these documentaries reiterate the inclusion of natural landscapes, sunny valleys, and parks as the only possible solution to create happy lives.

The representation of slums in documentaries helped to create a sort of visual cliché, broadly used also by British fiction films, not only during the same decades when these documentaries were produced, but also in the decades after. The inclusion of smokestacks, clotheslines, and children playing in narrow streets were used to portay suffering working-class characters and to condemn industrial cities. British films, such as *Love in a Dole*, *Odd Man Out*, *The Card*, *Room at the Top*, *Saturday Night and Sunday Morning*, *A Taste of Honey*, and *The Loneliness of the Long Distance Runner*, produced in the 1930s to 1960s, demonstrate that landscapes of poverty had to be necessarily linked with dense urban spaces, lack of greenery, rowhouses, and industrial zones, but never with natural landscapes, the countryside, or low-dense communities.

The dangerous city

American and British crime films produced during the 1940s to 1950s, such as the American *The Street with No Name*, *The Naked City*, *Dark City*, *The Asphalt Jungle*, *Panic in the Streets*, and *On the Waterfront*; and British films, such as *Brighton Rock*, *Odd Man Out*, *Night and the City*, and *The Blue Lamp*, use night scenes of urban spaces, isolated sites in industrial zones, empty parking lots, abandoned warehouses, docks, and alleys as backdrops that serve for persecutions, shootings, killings, or dealings between gangsters. Crime films portray the metropolis as a dangerous, crowded, and impersonal modernity that refuses to support traditional moral values and any establishment of lasting relationships, nor the option to start a family. Metropolitan spaces seem to stimulate criminal behaviours, promoting a moral ambiguity, where everyday people may gradually become criminals.

American comedies produced in the 1930s to 1960s portray the metropolis as a place to work more than a place to live, except for those that cannot afford a single-family house (the poor people), or for 'suspected' people who do not fit with the lifestyle of decent families. The metropolis is usually presented at the opining of many American films by aerial footage of skyscrapers, where the big city is used to both contextualise the story and represent the vertiginous modern world. In examples, such as *Mr. Blandings Builds his Dream House* and *Don't Eat the Daisies*, to mention only a couple of films, the city is described as an inappropriate place to raise a healthy family. Both films illustrate how 'normal' families cannot live in apartments and have to move to the suburbs. In *Father's Little Dividend*, the married daughter who lives in a downtown apartment because 'they can't afford a better place' moves to an extension of the suburban house of her in-laws before the birth of her baby. In *The More the Merrier*, the single lady that decides to share her tiny apartment with two male roommates is involved in serious accusations that she must marry one of them; and in *The Bachelor and the Bobby-Soxer*, the bachelor obviously lives in an apartment, while the teenager and her judge sister live in a traditional single-family house.

The apartment with its blurred boundaries between the public and the private space appears as an undesirable lifestyle for common people, especially for Americans. Pamela Robertson Wojcik notes that the predominance of suburban spaces for the married white leave the apartment as the only choice for excluded people from the suburban imaginary, such as singles, divorced, African Americans, working-class whites, ethnic minorities, and gay people (Robertson Wojcik, 2010: 18–19). The stigmatisation of the apartment is illustrated by American films, such as *The Lost Weekend*, where the apartment is the setting for the emotional crisis of an alcoholic New York writer; *Scarlett Street*, *The Apartment*, and *Any Wednesday*, in which urban apartments serve for clandestine-extra marital relationships; *Dark Victory* and *Come Blow your Horn*, that portray libertine singles who live in apartments but move to the suburbs when they decide to marry and put their life in order; *Pillow Talk*, *Return to Payton Place*, *Who's Been Sleeping in My Bed*, and *Sex and the Single Girl*, that represent playboys living in downtown apartments. In British films, such as *Room at the Top*, *Look Back in Anger*, and *Darling*, apartment dwellers are portrayed as irresponsible individuals that reject family commitments.

The stigmatisation of the apartment functions as a strong cultural framework that defines and shapes individual identities, creating the differences between the normal and the abnormal, as well as the poor and the middle-class family. In the same way that poverty has been associated with tenement buildings in American fiction films, American and British documentaries strongly represent the relocation of former slum dwellers in high-dense modernist buildings. These dwellings, with their distinctive aspect, became the image of the poor in both countries.

All the good things are framed in natural landscapes

On the other hand, films that portray small communities close to the countryside, representing healthy lifestyles and normal people, are illustrated by American and British Family dramas of the 1940s. Examples, such as the American *Our Town*, *It's a Wonderful Life*, and *The Magic Town*; and British films, such as *This Happy Breed*, *Million Like Us*, and *London Belongs To Me*, represent ordinary families as the main social nucleus and the foundation of any healthy society. These films celebrate the decent life, the honesty, and the face-to-face interaccion in the community, which can be produced only in small groups of single-family houses or low-dense townhouses, where tree-lined streets, lush parks, and closeness to nature seem to ensure the safeness and the confidence to face all kinds of problems.

In British films, spaces that represent well-constituted and middle-class families are systematically portrayed with the inclusion of growing gardens. Gardens seem to be not only an important part of British tastes, but also a differentiation between the middle-class and the poverty of slums, characterised by lack of greenery and overcrowding. As James Maude Richards argues in his book, *The Castles on the Ground* (first published in 1946), the Englishman's passion for gardening may be seen in other places than suburbia, but only in suburbia can an Englishman exercise his passion. He also points out that the suburban house with its own garden is the Englishman's idea of his own home, except for the cosmopolitan rich, a minority of freaks and intellectuals, and the very poor (Richards, 1973).

In American and British films, the bucolic natural landscape seems to function as a symbolic element and appears as the most recurrent backdrop for romantic encounters and happy moments. In *The Loneliness of the Long Distance Runner*, nature functions as a trigger of conscience, as the instance of reflection and deep thought. While Colin, the young convict, runs through the open fields analysing his criminal past and making decisions for the future, the only moments of happiness that he remembers are portrayed by natural landscapes. In *Love in a Dole*, that portrays the story of a struggling working-class family that live in an industrial slum in Salford, Sally, the daughter, falls in love with the socialist agitator Larry and their romantic encounters are framed in bucolic landscapes, far away from the city. When Sally sees the natural landscape for the first time in her life, she comments, "Here is so lovely, make me see things different; I never want to come back". Then Larry responds, "Think about these poor people who do not have any chance to a better life . . . we have to fight". Here the natural landscape not only is the backdrop for love, but also a reason for the workers' struggle. In *A Taste of Honey*, when Jo and Geoffrey go the countryside, it is the only time that Geoffrey kisses Jo and asks her to marry him. We see them running in freedom through the open fields, making plans for the future. In *It Always Rains on Sunday*, the only time that the urban townscape shifts to a natural and bucolic landscape is when Rose's daughter, Vi, goes with her boyfriend to the countryside to spend a quiet day together. In American films, such as *Our Town*, *Kings Row*, *The Magic Town*, and *All That Heaven Allows*, romantic scenes are always framed in natural landscapes.

The previous discourses and the formation of the historical a priori

American and British films produced in the 1930s to 1960s systematically linked negative values with dense urban spaces and promoted low-density solutions, close to the countryside, as the main desirable lifestyle. While poor people were never represented in small towns, nor in low-dense suburbs, criminals and people of questionable morality were systematically portrayed in metropolitan spaces and apartments. These discourses, broadly distributed by diverse films genres, not only are the mirror of historical contexts influenced by the Wars, the Great Depression, and the boom of suburbanisation, they are also rooted in previous cultural discourses broadly distributed in America and Britain.

At the end of the nineteenth century and beginning of the twentieth century, the green argument emerged as a clear discourse that functioned as an opposition to the unhealthy and overcrowded industrial city. The green environment – represented through nature, open spaces, gardens, and sun light – became the package of solutions to improve the life conditions of the population. The green argument was installed as a social logic, based on supposed rationalistic and scientific rigour, demonstrated by social studies, statistical surveys, and supported by the expertise of professionals and governmental institutions. Overbuilt and overcrowded settlements with poor hygienic conditions helped to propagate physical illness, affecting the health conditions of workers. These conditions became associated with other moral behaviours, establishing from a supposed scientific approach that overcrowding generates crime, vice, and perversion. The green ideal as a clear unit of discourse became a form of knowledge and an unquestionable truth, validated by institutions such as urban planning areas, sociology departments at universities, political leaders, and influential writers. From this context, it is not surprising that the two main urban models developed during the first-half of the twentieth century, the Garden City and the models promoted by the Modern Movement in Architecture, included the green discourse as a relevant argument. Both models also distributed a group of statements that were systematically repeated and articulated through precise laws, regulating the use of the space and promoting specific housing models through governmental plans. In America and Britain, the Garden City model was extensively developed in the form of new suburbs, and the 'Radiant City' proposed by the Modern Movement was partially used to design specific social housing projects and some New Towns in Britain. America encouraged the single-family house, and apartment buildings were mainly low-price solutions for social housing. In Britain, the townhouse was the main model developed in suburbs, and high-dense buildings were promoted for social housing too. The cities of both countries strongly promoted the dispersion of new neighbourhoods rather than the concentration of housing in the inner city. This process of dispersion was encouraged through large investments in highways and railways, as well as the promotion of car ownership, especially in America.

Discourses that link poverty with criminality and industrial cities emerge in different times and countries. The American kids' films of the 1930s and British films that appeared two decades later, such as *Violent Playground* and *The Loneliness of the Long Distance Runner*, portray similar discourses. This fact illustrates that the emergence of genres cannot be explained exclusively by the influence of historical events that occurred when the genre emerged, such as the Great Depression or slum clearance programmes, but also by broader discourses that form the historical a priori.

Conclusions

An interdisciplinary approach that combines the analysis of the built space with the analysis of the cinematic space serves to understand that space is also a social and cultural construction. This study suggests that cinema, as the most influential form of popular culture during the first-half of the twentieth century, provides a critical insight into the cultural impact of both modernism and industrialisation in America and Britain. This research also illuminates how dominant discourses of spaces, rooted in old cultural traditions that condemn the metropolis and celebrate the countryside, were systematically distributed through American and British films produced in the 1930s to 1960s. Cinema has served to create meanings and values associated with spaces, affecting the way designers and everyday people perceive spaces and define preferences. This approach suggests a reflection on our understanding as designers. Are we operators immersed in a historical a priori, which has created cultural frameworks that influence our preferences and decisions in terms of design?

Although this study describes the analysis of architecture and city design researching on cinematic spaces, films can also be used to analyse dominant discourses of industrial objects, fashion, architectural landscapes, interior design, and decoration, only to mention a few examples. The combination between the analysis of what appears on screen with the analysis of how these cinematic elements 'speak' in films (how they are depicted by characters, or how they are associated with certain values) seems to be a powerful instrument to illuminate dominant discourses of design.

Other elements of popular media, such as magazines, posters, and TV shows, can also be used to understand discourses of design. We should collect the widest range of discourses that surround our historical period in order to understand intertextual and inter-institutional relations that link popular culture with social, cultural, political, and ideological trends. In the same way, this interdisciplinary approach suggests that the availability of media in our present time, including millions of images and videos distributed by the internet and social media, can be analysed as relevant sources that provide critical insight into the cultural impact of contemporary design.

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35

DRIFTING WALLS

Learning from a hybrid design practice

Ruth Morrow

Introduction

This chapter draws on the learning that has emerged from a long-term collaborative design-led process that conjoins research, scholarly activity and design-based approaches. In essence the project is founded on a collaboration between a textile designer and an architect, who have developed technology that allows textiles and concrete to permanently co-form the surface of precast concrete elements. The chapter provides a fuller description of the project, its background and drivers, followed by a discussion of the processes at the heart of the project (i.e. conceptual, technical, contextual and structural).

Throughout the project the aim has been to achieve what Bonsiepe calls 'critical operationality' (Fathers, 2003: 52). Being critical and informed by surrounding contexts within a design process is one level of critical operationality. However a further level is to elucidate that learning in order that it can be applied and tested in other contexts. It is only when this level is reached that design becomes research. More specifically it is what Bonsiepe calls 'endogenous design research' (i.e. research initiated from within the design process that then contributes to a "pool of knowledge specifically related to design" (Crouch and Pearce, 2012: 31)). The chapter will conclude by highlighting lessons learned and discuss, more generally, those issues that relate to Design Research.

Project description and background

The project investigates the possibility of *making hard things soft* by combining textile and architectural thinking. It has led to the development of patented technology that allows the designers to uniquely manufacture tactile precast concrete surfaces (known as 'skins') where concrete and textiles permanently co-form the surface (Figure 35.1).

The project evolved initially in academia but now resides in the commercial world, as the spin-out company, Tactility Factory (TF). The original design and technology founders are now company directors, fully involved in the commercialisation of the technology and bringing the resultant 'skins' to market in the building and interior design sectors.

Despite its commercial direction, the project did not begin as a response to a gap in the market. Neither did it identify a problem to be solved, nor indeed was an initial research question

Figure 35.1 Linen concrete. This shows linen permanently co-forming the surface with concrete. This has become known as 'vinegar and chips' (left); close up of Velvet concrete surface (Damask design) (middle); Velvet concrete panels installed in private residential setting (right)

postulated. Instead the project began out of a desire on behalf of the project initiators to simply work together. Both participants (Trish Belford, textile designer and myself, Ruth Morrow, architect) are experienced practitioners/teachers in our own right with many years of experience in designing and delivering products, ideas, services, etc. Both of us have a strong preference and instinct for collaboration and are curious of each other's design professions. Though sometimes viewed as an unprofessional motivation, the immediate and, consequently, sustained friendship between us as project initiators has been crucial in sustaining the creative and critical approach at the heart of the project. Design processes that involve teamwork are also social processes and the importance of social interactions and relationships in such instances cannot be underestimated (Cross and Cross, 1996: 316).

The urge to collaborate on a project was quickly followed by the need to develop an agreed conceptual stance. This was partly driven by the necessity to classify, justify and seek funding, and partly because after many years of teaching design, I, as an architect, had a stronger than usual commitment to developing clear conceptual frameworks as a means to maintain design clarity. Concepts such as 'making hard things soft', 'making the world a softer place' and 'mainstreaming tactility' evolved from these early discussions. Whilst those outside creative disciplines may balk at such utopian statements, designers are at ease with the process of 'making mad ideas sane' and in this instance the team wanted to adopt such devices both to flag up the project's social intent and to bring focus and distinctiveness to the project's ambitions (Morrow, 2011). Whilst utopian goals may be unachievable, the journey towards them releases interesting potentials.

Being from two different professional contexts (architecture and textiles) also chimes with much current thinking in design theory that argues that cross-programming of skills, cultures and practices also has the potential to evolve innovative outcomes. In this project it also created a place of professional freedom: uncompetitive and not overly judgemental. Again in the early stages of evolving a conceptual framework, environments that are too judgemental, or have 'anticipated' outputs, can already distort the natural progression of a project.

As project initiators our interest and commitment to collaboration certainly overlaps, but we draw on diverse motivations. For Trish the project has allowed her to get closer to architecture, a world to which she has longstanding personal and family connections. After 20 years in the textile industry, running her own manufacturing business, she was left wondering how the textile industry might respond to the influx of digital imaging. She wanted to pursue new opportunities to use the tactile, textured approaches upon which she had previously built a strong reputation. In the early phases of the project Trish was most interested when experiments resulted in the textiles becoming heavy, altering their natural drape. She saw opportunities in exploring erosion and distortion as a means to soften materials, using the techniques and the 'textile thinking' she had mastered during her career.

On the other hand, as an architect I was interested in the politics of space and the sensorial depletion of architecture as a consequence of modernist 'styling' and changes in construction practices. I am also interested in how feminist and inclusive design agendas alter the production of built environments, and mindful that advances in architectural representation distance the architect from the process of fabrication. As a consequence the project became a vehicle to directly experience and engage in the subtle manipulation of the material, alongside exploring the possibility of designing for diverse, non-normative users. In parallel, I was also re-imagining one of the four missing appendices of 'On the Art of Building in Ten Books' by architecture's forefather, Leon Battista Alberti (1404–1472) (Alberti, 1988: 367). The lost appendix was called 'the service that the architect provides' and through reflecting on the work of TF I extended the 'service' of the architect, beyond designing buildings, to "interconnecting strategic vision to material and social experience, through a design-led process" (Morrow, 2008: 64).

The project's formation was timely on a number of levels. The themes and processes reflect shifts in contemporary thinking, mirrored by such 'trend forecastors' as Li Edelkoort, who declared that "super technology is going to ask for super tactility" and that the "future is hybrid only" (Edelkoort, 2012). It was also timely for us, since having built a foundation of discipline specific skills we were better able to act with a critical awareness of our own professions. Being based initially in academia also allowed the project the intellectual freedom to develop through those early stages. A project such as this would have been unable to evolve in a commercial setting. (This flags up a necessary but little explored inter-dependence between innovative design practice and academic environments.)

TF also draws on the expertise of weavers, precast concrete specialists, digital textile designers, patent attorneys, marketing experts and business advisors. Over the last three and a half years it has resided in the commercial world, funded by start-up grants, innovation awards, commissions and private investment. Of the many technologies and techniques developed during the investigative period of the project the company is currently commercialising four processes exemplified in the surfaces: Linen concrete, Velvet concrete, Linen and Stitched concrete and Crystal concrete (Figure 35.2).

These surfaces or 'skins' as they have become known (10mm thick) are used in a variety of interior applications. During the curing process they can be folded or curved, forming column surrounds or friezes. Once fully cured (hardened) they can either be applied directly onto walls as a wall covering or they can be cast into other structural pieces of concrete. As 'skins' they are used decoratively within high-end interior design due to their uniqueness and desirablity, but when cast onto larger elements of concrete, the integration of TF skins onto the surface of heavier concrete elements allows them to retain their thermal mass but without the usual acoustically harsh and visually ugly finishes that exposed concrete presents. This is significant where increasing the thermal mass of a building can reduce its energy consumption.

So in addition to making beautiful and tactile surfaces that feel crafted and 'antique', the technology emerging from the TF project expands the potential of a global material, concrete;

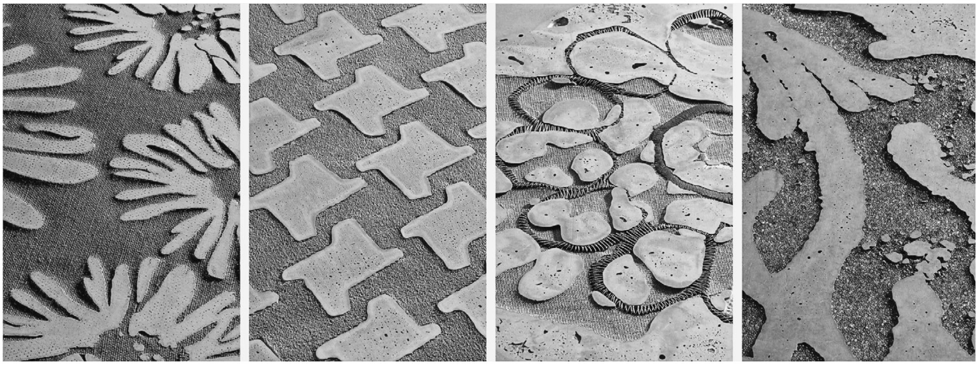


Figure 35.2 Left to right: Linen concrete (Petal Design); Velvet concrete (Dogtooth Design); Linen and Stitched concrete; Beaded Crystal concrete

overcoming the grey, cold, acoustically harsh and 'unfriendly' characteristics of concrete to become colourful, warm, acoustically soft and user friendly. In terms of production, TF's technologies articulate the surface of concrete without the need for expensive moulds or post-demoulding processes. It would seem that the outcomes of this creative process are potentially huge.

How the project evolved

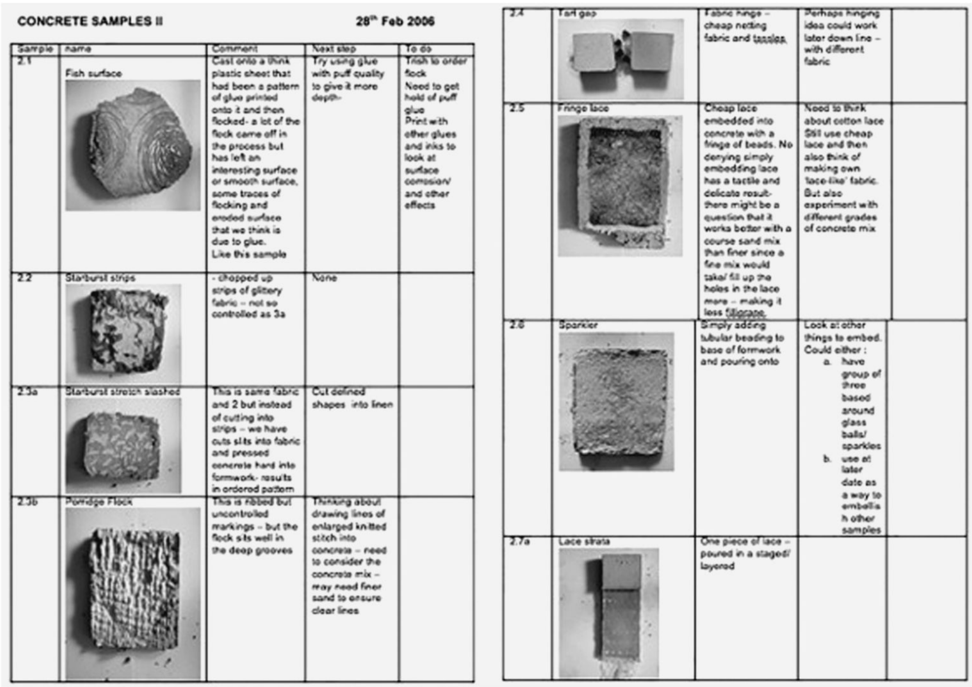
From its inception the project very quickly began to work on several areas of development: conceptual (what?), technical (with what?), contextual (why?) and structural (how?). All areas are live, interrelated and ongoing.

Conceptual process

The project began within the realm of free experimentation, i.e. 'messing around' with a range of materials (not only concrete) to respond to the idea of 'making hard things soft'. These early material trials were used as conceptual maquettes. So what looked on the surface to be samples of hybrid materials (in the early stages they were rather *raw* samples) (Figure 35.3) were in fact representations of ideas, proposals and possibilities.

This disjuncture, between the actuality of the material maquette and the idea, is something for designers to be mindful of, especially where critique from people who don't share in the design vision can undermine the early stage of building 'conceptual-belief'. Keeping the process internal at that stage might be advisable, though as teachers the TF team had good reason to externalise the process from the beginning: warts and all! The use of maquettes is especially interesting in the world of collaborative conceptualisation. It is recognised that the early stages of such design processes can be susceptible to disagreement and misunderstanding, particularly where design teams are drawn from diverse disciplines. Discussion around an artifact helps to overcome issues of differing culture and professional language, allowing each contributor to reveal their interpretation, preferences and imaginations. Maquettes effectively function in this instance as a neutral third party. Once conceptual ideas are settled on and shared, it then becomes easier to build a delivery strategy. However, it is also important to revisit and reaffirm the conceptual framework throughout the process. Inevitably this also occurs through other means than generating samples: by defining research aims, business plans and giving public presentations. The hybrid culture that is part of the process of bringing concrete and textiles together has naturally evolved a TF-specific language, a third nomenclature to describe its unique processes and outcomes (Morrow and Belford, 2013: 411). Such terms include 'skins' instead of 'surfaces', implying touch, flexibility, wrapping; and phrases such as 'linen and chips', a term used to describe the odd but strangely natural marriage of linen and concrete, evoking tangible, almost tangy contrasts and yet imbuing Linen concrete with a sense of cultural normality and accessibility. Being involved in design teaching, there is an understanding within the team that crafting and using verbal and visual conceptual language as precisely as possible is key to focusing creative processes.

Figure 35.3 Early maquettes suggesting the co-forming of concrete and textiles



CONCRETE SAMPLES II 28th Feb 2006

Sample	name	Comment	Next step	To do
2.1	Fish surface	Cast onto a think plastic sheet that had been a pattern of glue printed onto it and then flocked- a lot of the flock came off in the process but has left an interesting surface or smooth surface, some traces of flocking and eroded surface that we think is due to glue. Like this sample	Try using glue with puff quality to give it more depth-	Trish to order flock Need to get hold of puff glue Print with other glues and inks to look at surface corrosion/ and other effects
2.2	Starburst strips	- chopped up strips of glittery fabric – not so controlled as 3a	None	
2.3a	Starburst stretch slashed	This is same fabric and 2 but instead of cutting into strips – we have cuts slits into fabric and pressed concrete hard into formwork- results in ordered pattern	Cut defined shapes into linen	
2.3b	Porridge Flock	This is ribbed but uncontrolled markings – but the flock sits well in the deep grooves	Thinking about drawing lines of enlarged knitted stitch into concrete – need to consider the concrete mix – may need finer sand to ensure clear lines	
2.4	Tart gap	Fabric hinge – cheap netting fabric and tassles.	Perhaps hinging idea could work later down line – with different fabric	
2.5	Fringe lace	Cheap lace embedded into concrete with a fringe of beads. No denying simply embedding lace has a tactile and delicate result- there might be a question that it works better with a course sand mix than finer since a fine mix would take/ fill up the holes in the lace more – making it less filigrane.	Need to think about cotton lace Still use cheap lace and then also think of making own 'lace-like' fabric. But also experiment with different grades of concrete mix	
2.6	Sparkler	Simply adding tubular beading to base of formwork and pouring onto	Look at other things to embed. Could either : a. have group of three based around glass balls/ sparkles b. use at later date as a way to embellish other samples	
2.7a	Lace strata	One piece of lace – poured in a staged/ layered		

Figure 35.4 Spreadsheet critique

Technical process

The technical challenges of the project have been multiple and have involved several phases. Perhaps naively we had thought that the technical development would eventually come to an end, but as the team's knowledge and expertise grows so too does its ambition and drive for advancement.

Technical development began with a phase of **Testing and Evolving Materials**. After working through the conceptual maquettes, the team had settled on the use of concrete with textiles. A more rigorous series of experiments ensued, generating samples that combined concrete and textiles in various forms and carrying out a range of comparable trials. A process of 'spreadsheet critique' evolved that combined photography and commentary to record the trials, document initial impressions, exact closer critiques and set out the next steps and associated resources and risks in development (Figure 35.4).

External experts helped the team reflect on and refine the more specialist technical challenges. For example, a textile chemist tested yarns for resistance and longevity in alkaline environments (concrete is highly alkali) and a precast concrete specialist provided input on a variety of mixes and mould surfaces. This expert input allowed the team to better understand and pursue textiles and corresponding concrete technologies with more focus.

The second phase involved **Developing Textiles Specifically for Concrete**. As understanding grew of the yarns and textile constructions most favourable to TF concrete processes, the natural progression was to manufacture textiles specifically for use in concrete. This textile development led to enhanced integration of concrete and textiles. It also allowed the team to determine its own designs and own concrete mixes to suit a range of textiles. At one stage the project experimented (part-funded by an Art and Humanities Research Grant) with building its own textiles from the ground up, but gradually we moved to deconstructing and reconstructing existing textiles.

At this point a new technical challenge emerged, i.e. sourcing existing base textiles to suit our processes. Our processes required textiles that used the correct yarns, were suitably constructed and had been finished in a manner that we were aware of (textile mills often do no disclose their finishing processes). Researching and testing sourced textiles took a considerable amount of time.

The latest, though not necessarily the last, stage in the technical process involves **Refining Production and Product**. In this phase, driven by commissions, the processes were assessed for deliverability, cost and risk. Some were set to one side, whilst others were refined to become the four processes TF currently markets. Commercialisation has also required development in packaging, handling, installation processes and a range of fixing technologies, all of which are specific to TF's 'skins'. In the last 12 months we have completed a funded project to progress with scalability and out-sourcing in line with our ambition to license or partner with other manufacturers, both in precast concrete and textiles.

Contextual process

In parallel to technical progression, members of the team also craft the intellectual context of the work. This is done perhaps not with the same intensity or steadiness of pace as the technological developments, but occurs in bursts of insight and moments of frustration where things don't seem to occur as anticipated. The process may seem unplanned but we have come to understand its function in positioning and giving momentum to the project. The contextual process comes in several guises. First there has been an ongoing process of uncovering and mapping the contemporary and historic precedents in textiles and architecture that inform the project (Belford and Morrow, 2009; Morrow and Belford, 2008). In addition we have tried to build a theoretical context for the work to help reveal and better manage its cultural shifts and challenges. This working of historical, contemporary and theoretical contexts came full circle recently when the project was analysed through the lens of feminist practice – a theme that had emerged in early conference papers.

This ongoing process of reflection and contextualisation occurs because the team is also based in academia and has a default attitude to research, but interestingly, and perhaps controversially, we are beginning to contemplate that the crafting of an intellectual space for the work also helps to hone it commercially. This process of contextualisation, reflection and theorising on and through the work chimes with Bonsiepe's statement that "located at the interface of industry, the market, technology and culture (living practice), design is eminently suited in engaging in culturally critical exercises" (2007: 31). For that reason we see this as an ongoing long-term process.

Structural process

Finally, the project continues to aim to develop an operational mode and company structure that best supports its conceptual, technical and contextual thinking, and the hybrid materials and intellectual property that emerge. We began thinking in this area relatively early as we participated in a number of hypothetical business plan competitions, hoping that they would release suitable mentoring and funding. Whilst that has been partially the case (certainly in terms of funding), we have also become increasingly aware that despite the plethora of writing and discussion about the Creative Industries most business advisors are unable to provide any meaningful guidance. Instead, as a company we can quickly become bound up by overly bureaucratic processes that do not suit the part-time, light, flexible and hybrid nature of our work. Inevitably we have to 'make do' with existing models of business structure, marketing, etc., but 'the fit' is less than satisfactory. Of all the areas of development this is probably the most unresolved and unsatisfactory and remains a central concern as we move forward. It is certainly our experience that in developing an innovative approach, and hence an innovative product, there is an urgency to develop other models of sustainable and creative governance structures.

Lessons learnt

The project's journey has, at times, been very bumpy. However, it is surprising how far it has progressed and what has been achieved. We have learnt about ourselves as designers, makers and managers of creative processes, about varying styles of creativity and (de)motivations. During this time we have evolved the mantra, 'make the problem explicit to resolve it' but often the problem (and the solution) is bound up in gut reaction and tacit knowledge. Polanyi, when defining tacit knowledge, asserted that "we can know more than we can tell" (Polanyi, 1966: 4). This is also reflected in Wajcman's feminist deconstruction of technology where she argues that technology has three intertwined components: the 'things', i.e. material stuff and software; the knowhow; and the user interaction. This knowhow or tacit knowledge is passed on not by explanation but by demonstration, mirroring and mimicking (Wajcman, 1991: ch 6).

Nevertheless, the aim of this chapter is to try to make explicit and externalise some of the inherent knowledge, knowhow and learning emerging from the process. Constructing this chapter is thus also a part of the project's own learning process. In the following sections, reflections are categorised into four separate areas – Hybridity; Time/craft/beauty; What's existing; and Communicating product purpose.

Hybridity

The project is hybrid on a variety of levels: hybrid because it brings together two diverse material cultures (textile and concrete) and their associated industries; and hybrid because it exists between academic and commercial worlds. Being hybrid is the trend-forecasters dream: the exotic outcome of cross/interdisciplinary collaborations. The project has certainly burnt brightest at those moments of cultural friction when the greatest intensity of creativity and innovation has been released. But the lack of a 'home culture' has meant that it is difficult to find support and to easily communicate the project. The dark side of hybridity is managing this cultural homelessness. An alternative strategy is to portray the project in different ways to different audiences. Whilst this might be enriching in the short term, in the long term it is exhausting.

Many in the commercial world see no value of the company's link to academia and indeed the same can be said for many middle managers in the academic world. Even though we as a team might understand the importance of hybrid practice, we can't also, at the same time, effect the cultural shift required to support such work; so instead our stance is to not reveal one world to the other. Again this is a false, exhausting and certainly unresolved situation. We would contest that although the concept of hybridity is celebrated, the consequences still require some honest and direct investigation.

Time/craft/beauty

At the start of the project there were few guarantees that we would end up with a new material, though as experienced practitioners we were certain something interesting would emerge. In the end not only have we evolved a new material but also a new culture. As we have built the business, material development has also continued. Crafting both has not been a perfunctory process, but rather one that has quality at its heart. Nevertheless in comparison to other spin-out projects we are mindful of the amount of time it has taken to develop both outcomes: seven years. But we are reassured from two directions. First, in the area of building a new business, where recent research shows that "The majority of [start-up] businesses show no growth for their first six years. Indeed rapid growth, when it happens, appears to begin after six to eight years of trading" (Bridge and O'Neill, 2012: 137). And second, we believe it is possible to draw comparisons between crafting a material and becoming an expert, which Sennett (quoting Levitin) writes as typically requiring 10,000 hours (Sennett, 2009: 172).

As designers, we tend to have a higher expectation in relation to quality. This can be counter-productive for two reasons. First, it is debatable the degree of quality that is perceptible by others. Second, there is a witnessed phenomenon where the aesthetic coherence or 'beauty' of an artifact can sometimes belie its cleverness, masking the complexity of the processes from which they result and making it seem somewhat indulgent (we occasionally compare this to the stereotypical view of beautiful women being intellectually vacuous). Building an explanation of the technology and processes that underpin the product has therefore become quite crucial, and in TF we have made a conscience attempt to make the story of the material development as much a part of the experience of the product as its own tactile aesthetic qualities.

What's existing

Typically the most obvious issues often become the least considered. In the instance of this project it has been building off our own existing skills. The project has made real efforts to call on the surrounding legacies and existing expertise of Northern Ireland's indigenous industries (construction and textiles) and as teachers of design we understand the importance of lineage and the potential for reinvention of existing knowledge. Yet at crucial times we have overlooked the team's internal skills. The most obvious example of this was when we realised we had concentrated almost exclusively on generating textiles through processes that required external input (weavers, knitters) and had done little to build off Trish's own skill in printmaking. The non-textile designers in the team associated print solely with image-making, however Trish's unique skill is to use print techniques to create tactile surfaces. This overlooking of existing skills may be the result of an instinct that drives designers towards unknown positions. Finding the balance between drawing on core skills and knowledge and moving into new and 'high risk' territories of knowledge is a critical part of sustaining a creative process, and one that needs constant consideration. Johnstone, in his invaluable book on improvisation, says that to strive after originality takes the creative practitioner far from their 'true self', resulting in mediocrity (1989: 88). The mistake is to associate innovation with new territories and to underestimate the value of mining the existing.

Communicating product purpose

Innovative design is not only about the production of something new but also about embedding that outcome into societal cultures. Communicating the value and purpose of the outcome and how it can fit into people's lives seems imperative. As architects we are sometimes guilty of handing over completed work with little cultural explanation. Whilst that is possible in those instances where the client/user accompanies the designer on the design journey, it is less successful where design development processes are remote from the eventual end user.

One insight into this issue, that determined the thinking within the TF project, resulted from a revisit to the seminal Stuttgart housing development: Weissenhofseidlung. A housing block designed by Corbusier in 1927 had recently been renovated: one half functioning as the visitors' centre and the other restored to Corbusier's original design. It was/is a highly innovative design. Not only was the external expression of Corbusier's housing block radical for its time (flat roofs, minimal expression and white render), but also its internal spatial organisation. Minimal in floor area but highly flexible; beds could slide away during the day and walls could be pushed back, reconfiguring the space. However, as the museum guide acknowledged, Corbusier's radical internal organisation was 'profoundly modified' within ten years of its construction to better accommodate its occupants' life styles.

The visit to Corbusier's housing occurred just at the point where Alsop's urban housing block, 'Chips', with Manchester developers, Urban Splash, was published online. In comparison, Alsop's housing block, 80 years after Weissenhofseidlung, was conventional. But Chips was radical in its explicit connection to the market place. An animation used in the publicity material was (in the words of the communication agency) "made to show what life will be like in the Alsop designed building in the Chips development". It illustrated a range of cross-generational life styles (though in reality most of the apartments were bought by young professionals) and flagged up the "fantastic folding doors", the "flexible space" and the "amazing pod kitchens". Whilst it is possible to be cynical about the hyperbole marketing, there is no doubt that those who bought the apartments were better prepared for living in flexible space than Corbusier's residents.

Through the TF project we have come to understand that no matter how good the product itself is, if people don't know how to bring it into their lives then investment in delivering a quality outcome is, quite simply, a waste. Telling the story of the design, in an accessible way, seems to be as much part of the process as designing the product in the first place. This is new territory for the architect in the team and the beginning of a process that has led to an, at times reluctant, acknowledgment of the importance of marketing processes in order to fully complete the task. Marketing, in the widest sense, is now TF's central challenge and a critical strand of our business and investment plan.

Conclusions

In conclusion, it is worth examining some observable differences that have arisen in TF between traditional approaches to design and research in order to contribute to the relatively recent discourse on Design Research. Of course this is done in the full understanding that design relies on designers and hence is subjective and likewise that "research is an objective quest for knowledge that is always informed by the subjective position of the researcher" (Crouch and Pearce, 2012: 38). Nevertheless, it is worth aiming for some objectivity to allow for the transfer of shared experiences.

There are two areas in particular that this process of reflection on TF has uncovered. First are the beginning points of design and research. Design can legitimately begin, even before a brief, with conceptual statements and open experiments; where the only guarantee of any outcome lies in the profile and previous experience of the design team. Traditional research cultures on the other hand tend to regard such utopian, conceptual beginnings as irrational, unjustifiable, too wide to deliver to and ultimately high risk. Instead research usually begins with a question or hypothesis with a process that quickly limits the scope of the investigation. In the case of TF, we did eventually frame the work through research aims and objectives for those instances where we had to draft funding or award applications. This process helped to reframe the project from the wider vision of 'making hard things soft' to the question: How might the collaboration between an architect and a textile designer result in making 'hard things soft' and what outcomes might emerge? As we progressed, that question also rolled out further into a number of aims:

- to apply textile technology, technique and thinking to the manufacture of concrete surfaces;
- to place design thinking at the heart of the fabrication process;
- to build creative technical collaborations that lead to beautiful and useful products;
- to build organisational structures that ensure continued innovation and longevity;
- to observe, analyse, document and, where possible, share learning from the process.

These aims not only provided clarity for people beyond the process, but they also focused the process. This use of explicit aims is relatively rare for designers (at least in the field of architecture). Perhaps one consequence of the evolving Design Research culture is to widen the focus beyond the final artifact to include the overarching theoretical intention of the praxis and its methodology. The aims defined are also then the basis of measuring the effectiveness of those intentions. However, it is important to say that had we, in TF, begun our process through a carefully considered research question and associated set of aims, we would have almost certainly lost motivation. Creative practitioners are frequently inspired by utopian aspirations, so it is vital that Design Research protects that space for conceptual thinking, messy making and utopian visions, from which more refined research objectives can emerge.

The second area to consider is the separate and distinct natures of design and research. In the case of TF, the design process was commission-led and, for the most part, funded by commercial R&D grants. As such, design processes are more closely linked to delivery of a 'useful' outcome. They are pragmatic and able to accept compromise in order to deliver on time and within budget. Research on the other hand can unpick and dissect ideas, contexts and problems without necessarily putting them back together; and indeed can result as much in failure as it can in demonstrable success. Design on the other hand, driven by timelines, may make large leaps and draw on tacit knowledge. These seemingly unjustified leaps overstep the usual sequential, rationalised arguments of research and propel the process faster towards a result. However, left unanalysed they perpetuate an unsustainable, non-transferable design culture that is costly, un-learning and undervalued. Bringing the reflective and analytical culture of Research into Design means there is opportunity for some of that tacit knowledge and knowhow to be shared amongst a wider community; and replicated and tested across other contexts. As practice-based researchers and creative practitioners, we enjoy, in fact require, the concurrence of both cultures: conceptual, pragmatic, creative design, alongside analytical, investigative, reflective research, in order to move our processes forward effectively. We have found the in-between space of Design Research to be a natural and rich habitat.

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Website

Tactility Factory Website: www.tactilityfactory.com

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DESIGNING MOBILE DIARIES

Negotiating practice-led design research in a professional design setting

Penny Hagen and Toni Robertson

Introduction

This chapter presents a case study of practice-led design research in a professional design setting. In practice-led research the means through which research is generated is often the production of an artefact (Hobbs et al., 2010; Rust et al., 2007). In this case the generation of knowledge about design practice was enabled through the iterative design, development and implementation of a particular design research method, Mobile Diaries, within a specific commercial design context. Mobile Diaries are a self-reporting method used in early, exploratory design research. They allow participants to capture, reflect on and share the personal, mobile and ongoing aspects of daily life and extend traditional approaches to self-reporting through the use of social technologies such as mobile phones and blogs.

There were two primary outcomes to the research. The first was the development of a specific early design research method, Mobile Diaries, that could be, and was, deployed on real world design projects. The second was an empirical investigation into the nature of participation in the early phases of design in the context of social technologies. The research was conducted in partnership with a small social design agency in Australia where the first author was an employee in a design and management role. It was also the focus of her PhD research.

The particular practice-led nature of this research influenced both *what* was researched (i.e. the research focus) as well as *how* the research was designed and conducted. The research responded to and was, necessarily, shaped by the demands and realities of the everyday commercial practice in which it was situated. Central to the research journey and research design was working out how to be responsive to the demands of the professional design practice setting whilst also defining and demonstrating the appropriate rigour of research required within academic practice. In this chapter we share this journey with a focus on the issues we identified and needed to address as part of negotiating a practice-led approach in a commercial setting. We also describe how we integrated and remained accountable to the two domains and practices of academic design research and professional design throughout.

The following section provides some background to the benefits and challenges of practice-led design research. From there we describe the approach we took to initiating and conducting field studies in which Mobile Diary prototypes were trialled and iterated. This is presented in four parts: i) a description of the Mobile Diary method, ii) how the initial research focus was defined, iii) the issues we identified and needed to address in introducing academic research to this particular setting and iv) the design and role of each of the field studies. The final section describes how the research project was kept rigorous and accountable to research practice through phases of action, reflection and documentation of that reflection, through the lens of Scrivener's (2000a) model for practice-led research. In closing we summarise some of the benefits of this approach to design research.

Some benefits and challenges of a practice-led research approach

In practice-led design research, a particular experience of practice acts as the source of our understanding about design. Sevaldson (2010) argues that design research based in design practice results in new knowledge that can only be developed from within design practice. Stolterman (2008) argues that design research that seeks to contribute to design practice needs to be grounded *in* design practice. Underpinning our project was a commitment to develop design methods, and research about design methods, which had value to both design researchers and design practitioners. However, doing design research in a commercial context requires us to engage with two practices that have quite different goals, directions and outcomes.

Commercial design practice is known for its rapid pace. Projects are structured around the client service relationship and billing cycles. It is proprietary and sharing is often discouraged due to issues of confidentiality or concerns about intellectual property (Davis, 2008). Information sharing is informal and *ad hoc* and the validation of knowledge is not considered 'rigorous' by academic standards (Hobbs et al., 2010). In contrast, academic design research practices involve deliberate and accountable research design, careful choice of methods and accountability of methods to their outcomes. It also requires a deliberate and formal sharing of the research with the research community, preferably via peer-reviewed outlets.

In this chapter we share how these differences impacted our research approach and how we accounted for them. Rather than picking and applying a particular approach or set of methods, we found that it was necessary to develop strategies for integrating and managing the relationship between these two sets of practices as we went. While we suspect a number of the issues we encountered and document in this chapter will not be new to those practising research in commercial settings, it is rare for 'implementation' details to be reported in any detail. As described in the following sections, we needed to feel our way through it.

Introducing, designing and managing the research

In the sections that follow we describe how objectives and inputs from both commercial design practice and academic design research were synthesised to frame-up each step in the research process and move it forward. It begins with an explanation of the Mobile Diary method itself.

Introducing the method

Mobile Diaries are a self-reporting method that makes use of social technologies such as mobile phones, photo messages and blogs to support self-reporting by participants. These personal, connected and portable tools enable participants to make available insights about day-to-day life experiences, behaviours and attitudes that are often difficult, or impossible, to access through traditional methods such as observation or interviews. They have been used to explore, for example: everyday sustainability practices; the role of mobile technologies in people's lives; how people perceive and manage personal finances; and a 'behind the scenes' look at people's jobs.

A typical Mobile Diary study involves one to ten participants and runs from one to three weeks. Participants are given a Mobile Diary pack containing analogue and digital self-reporting tools, instructions and guides for generating their reports and access to a dedicated private blog. Throughout the day participants use a mobile phone to capture images, text and audio and send this to the blog. Depending on the study participants may be asked to create collages, mind maps, videos and blog messages. Participants receive prompts, questions and reminders via the mobile phone and the blog during the study and can communicate with the design researchers using their blog or text message. The structure of the diaries is open-ended and questions and prompts are designed to encourage participants to capture a variety of material. As design researchers receive reports they respond with new questions or dig deeper into particular areas, potentially redirecting the focus of the study as a result.

Figure 36.1 shows a typical Mobile Diary pack, including a video camera, a mobile phone, physical collage and/or mapping activities, and a physical notebook containing information about the study and prompts for data collection. Interested readers can find a detailed description of the design of Mobile Diaries in Hagen et al. (2007), Hagen and Rowland (2010) and a rationale for the name 'Mobile Diaries' in Hagen, (2011: 108).

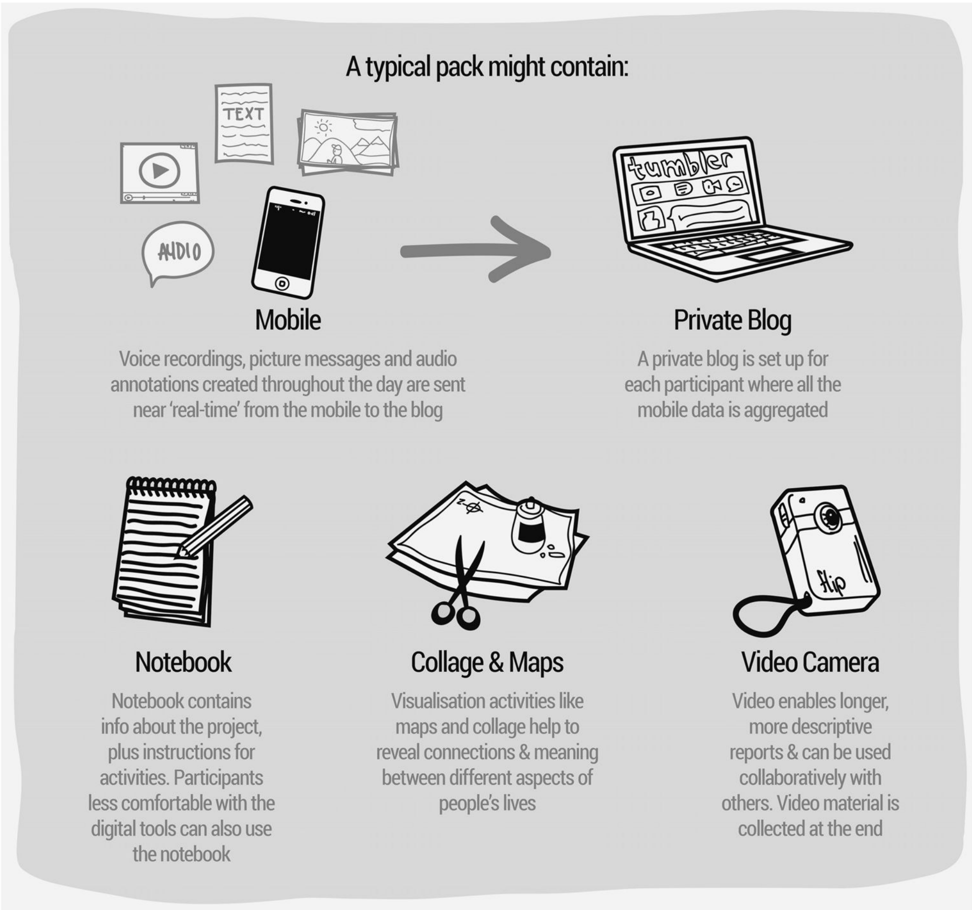

Figure 36.1 A typical Mobile Diary pack

Defining a research focus

In developing and evaluating the Mobile Diary method we drew upon a number of existing research methods. These included Cultural Probes (Gaver et al., 1999), Mobile Probes (Hulkko et al., 2004) and Context Mapping (Stappers and Sanders, 2003). Neither the Mobile Diary method, nor our understanding of how it could be used to support participation in early commercial design research, existed prior to the research project. Both were designed, defined and refined during the practice-led research process and in response to the needs and constraints of the particular design context.

We began the research with an interest in the potential for combining mobile tools and self-reporting. This was inspired by an earlier review into emerging mobile research practices (Hagen et al., 2005). One of the trends we identified in that review was the use of mobile, digital and networked technologies to augment traditional self-reporting methods such as paper diaries. Such approaches allowed researchers to respond to the distributed, mobile and social nature of mobile technologies and use. The first author also used one of the most innovative methods, Mobile Probes (Hulkko et al., 2004), as a part of a workshop in Sydney. The method was both straightforward and engaging and we were motivated to understand how such mobile self-reporting techniques might be put to use in a commercial context.

At around the same time, the first author had begun employment in a design and management role at a social design agency that specialised in projects with an environmental, community and political focus. The agency was interested in extending their repertoire of collaborative, contextual and exploratory design research techniques. They were also open to being involved in a practice-led research partnership. In addition, the agency also had a number of mobile projects on the horizon; there was a particular appeal to research that focused on mobile technologies and practices.

An initial research question was developed, shaped by the needs of the design practice context and informed by existing academic research practices, concepts and studies: *How could mobile technologies as self-reporting tools assist design practitioners in understanding mobile practices?* The next step was to understand what it meant to introduce and 'set up for' academic research practice in this particular commercial context.

Setting up for and integrating academic practices

One of the advantages of doing the research in this particular professional design setting was that we were able to design and evaluate the method in the context in which it would be used, based on the lived experience of those participants who would ultimately use it. We could involve the design agency's design team, the design agency's clients and their end-users in the process of developing and evaluating the method. However, this was a new kind of partnership for both parties. There was a lack of existing guidelines or protocols for how we would manage it. We were unsure of the potential impact of introducing a research project, research practices and accompanying academic accountabilities to the design team, to projects and to client relationships. While there are numerous examples of researchers doing contextual research within commercial organisations as 'insider researchers' (e.g. Robertson, 1998; Gothe, 2006; Howard, 2012), we struggled to find examples where the researcher was *also* the designer responsible for maintaining commercial relationships with clients. In working out how to 'start', the following issues were identified and influenced our approach to planning the research approach:

- a lack of experience publishing research or similar structures for sharing design research findings outside of an individual project within the design agency;
- the need to introduce new consent processes with clients and end-users so that research could be published;
- the practical administration and ethical considerations of gaining consent from individual staff inside larger and politically complex organisations;
- tight budgets at the design agency and a lack of dedicated research and development resources (R&D);
- the need to clearly separate what was 'research' from standard commercial and billable work when collaborating with clients;
- the need to manage the dual role of 'researcher' and billable designer when collaborating with clients;
- a lack of familiarity with the actual method being proposed (e.g. self-reporting) to the internal design team, clients or their users;
- the nature of the method that we were looking to trial: self-reporting requires participants to take on a relatively high workload and we were potentially asking participants to share and document electronic aspects of their personal or work life;
- the potential 'brand risk' for the design agency if the research was 'unsuccessful' or appeared not to deliver meaningful results;
- access to client/s who might be keen, willing, able and open to participating in an experimental research project and to having that research published.

As outlined below, these considerations shaped our research approach and the design of the field studies. They also influenced which clients and which projects were considered as possible candidates for the project.

The field studies

An overview of the empirical research activities is shown in Figure 36.2. A fuller description of the process and each of the studies is available from Hagen et al. (2007) and Hagen (2011). The empirical research began with exploratory interviews. This was followed by two field studies over which the concept and tools for the Mobile Diary method were prototyped and evolved. The first study involved members of the design agency using the Mobile Diary method themselves while the second involved a client who was interested in the potential of the method.

The outcome of these field studies was the development of the Mobile Diary platform and two subsequent commercial deployments. These last two deployments informed the overall evaluation of the method. These field studies did not just commence one day, rather they were carefully negotiated into being. They began with exploratory interviews which acted as a stepping-stone into actual fieldwork.

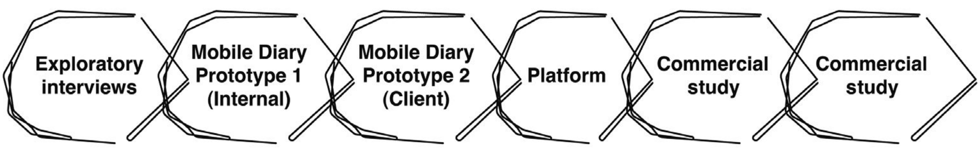

Figure 36.2 An overview of the empirical research activities and resulting commercial work

Exploratory interviews

Stakeholder interviews are often used in design projects during the required gathering phases of a project (Preece et al., 2002). They are a common starting point for exploring issues and provide an opportunity to connect personally with stakeholders (ibid.). If kept brief and conducted in a convenient location, they can be little burden on the participant. In this case they provided a safe and familiar mechanism to ground the investigation and instigate a 'research relationship' between the design agency and their clients. Two interviews were conducted with participants representing possible clients. Both were planning mobile projects in the near future. These initial interviews enabled us to test findings about mobile use and practice from literature in our particular context. They also offered some early validation that the issues we were exploring were genuine and appropriate for the research.

Several more interviews had been planned, but this process of locating the research within a design context and moving into the field shifted the focus of the investigation. First, several planned mobile projects were put on hold and this impacted the availability of potential candidates for interviews. Second, the experience of the initial two interviews encouraged us to shift our research focus away from mobile methods for understanding 'mobile services' towards the contribution that mobile devices as self-reporting tools could make in the early, exploratory phases of design research. A more appropriate next step was to design a field study that would allow us to evaluate how the self-reporting methods being documented in literature could be adopted and adapted to benefit this specific commercial context. Prototyping an actual method would better help us explore this question and it was decided that further interviews were not a priority. They did, however, help to 'break the ice' in terms of how to start 'doing' research work, alongside commercial work, within the design agency.

Mobile Diary Prototype (1)

The next field study, the Mobile Diary Prototype (1), was designed to achieve a number of objectives. Primarily it would allow us to initiate the idea of Mobile Diaries and begin to understand the form they would take. The goal was to experiment with, translate and evaluate aspects of self-reporting methods and the capabilities of particular tools documented in literature in our specific commercial context. It was not appropriate or possible to just take one of the methods existing in literature and start applying it within the agency context. In some cases we didn't have access to the particular technologies and resources, more importantly the studies documented had not necessarily been developed for commercial use, or for similar design contexts. The process of moving from theory to practice needed to be one of selecting, combining and comparing aspects from different approaches and developing a hybrid method suitable to the specific design context. In this way the fieldwork took the form of an 'iterative trialling and building up' both of the Mobile Diary technique, as well as the criteria against which its value as an early, generative research method was evaluated.

The fieldwork was done within an internal project where members of the design team (voluntarily) used the prototype Mobile Diaries themselves for two weeks. In this first Mobile Diary prototype we trialled different types of mobile, digital recording devices with each team member using and evaluating either a camera phone, digital camera or digital video camera. Each pack also included a set of instructions and open-ended prompts, as well as a mapping and collage activity. Figure 36.3 shows the Mobile Diary prototype packs.

The goal of the study, decided collectively by the design team, was to document 'signs of sustainability in your neighbourhood'. This topic was selected because of its connection to the

Figure 36.3 Mobile Diary prototype packs

types of social and sustainability projects the agency was involved in. It was likely to generate experiences, reflections and data similar to some of these projects. Figure 36.4 shows the examples of reports that were generated during the Mobile Diary prototype study.

Using the prototypes with the internal design team also had the following benefits:

- It allowed us to gain a preliminary insight into the potential design outcomes and contribution to early design research the method could provide.
- It sensitised the design team to the potential opportunities and challenges of using such tools and techniques, prior to attempting to deploy the method with clients.
- It enabled us to experience and evaluate the approach first-hand, rather than rely on the documentation of others.
- It allowed us to avoid any commercial conflict with paying clients while we were still evolving the method.

It also provided an opportunity for the design team to directly experience and feed into the development of the method. Opportunities for this feedback were created through interviews, workshops and questionnaires. We designed the feedback processes such that they could be fitted in around a normal working day and were open, collaborative and informal enough to encourage participation and critique.

The findings from this first field study reinforced the value of methods like Mobile Diaries to support early design research. They also demonstrated that the digital, mobile and networked nature of some of the tools (e.g. mobile phones, blogs and cheap video cameras) potentially enabled participation in the design process in ways beyond those reported in existing self-reporting studies. For example, the potential for Mobile Diaries to be a way to 'learn about social technologies' was picked up on in the following study. As a result we paid more attention to the impact of social technologies on how participation might be enabled or was changing in the design and evaluation of the second prototype.

Mobile Diary Prototype (2)

The first prototype used by the internal design team acted as a successful proof of concept for both the method and our approach to evaluating it. As a result we felt confident deploying both within a commercial project context. This second study aimed to test out findings in a real-world project context and would enable us to include the client perspective in developing the method. The second Mobile Diary prototype included a refined set of technologies and

Figure 36.4
Examples of Mobile Diary reports from the first prototype study

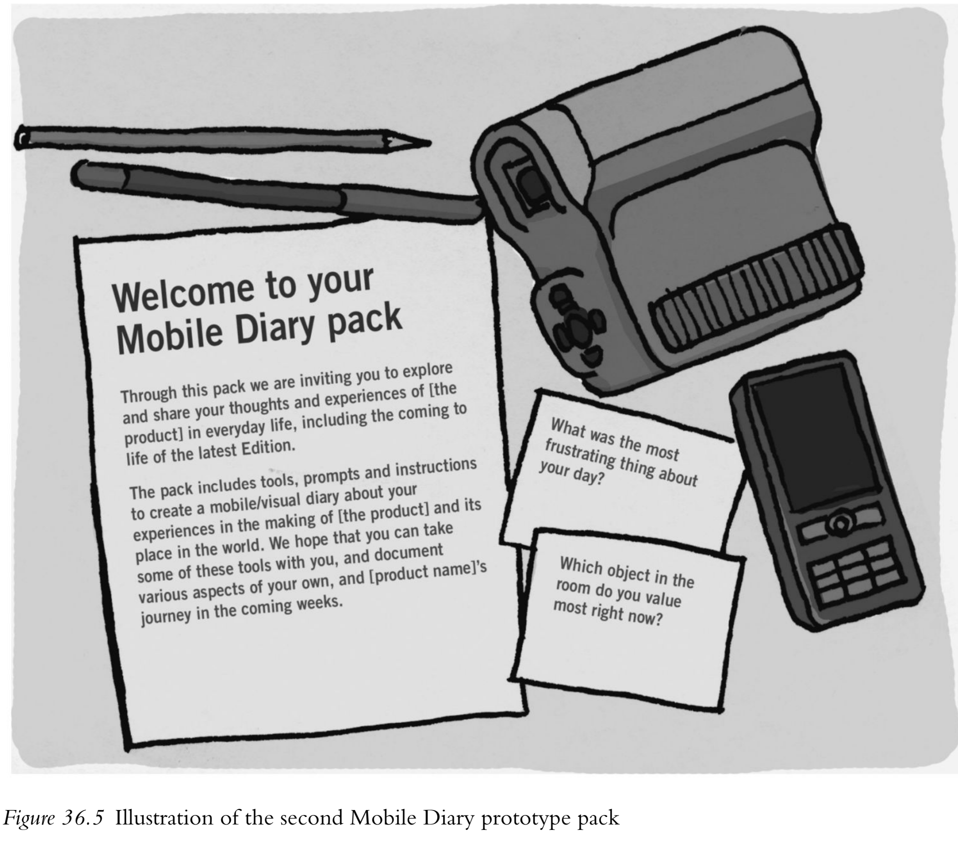

Figure 36.5 Illustration of the second Mobile Diary prototype pack

structure. Our experience of the first prototype suggested that the mobile phone and the video camera generated different but complementary types of reports. The former lent itself to snapshots throughout the day and the latter to more in-depth reports. As a result both devices were included in the second prototype. We also continued an open-ended approach to prompts and structure but included more prompts and communication during the three-week study to encourage reports and reassure the participant they were on the right track. We also put more emphasis on the inclusion of comments with visual reports, as we had found the photographs without annotations in the first prototype too ambiguous. Figure 36.5 illustrates the second Mobile Diary prototype.

It took several months before we were able to identify a suitable client with a suitable project. The client who was eventually recruited had a keen interest in participating in the research and was open to its experimental nature. She was the owner of the business, and this meant that communications and decisions about process and participation could be undertaken directly rather than needing to involve the approval of 'management' as would have been the case with other clients.

The client and her assistant used the Mobile Diary prototype to report on the behind the scenes development of their products. From a financial perspective the effort spent in running the Mobile Diary study could be clearly separated from the billable work the agency was doing for this client. But it was anticipated that insights generated from the Mobile Diary study would help inform paid work on the client's website. It would also inform the development of a planned social platform that would support interaction with the client's community of users. For this reason the client was also interested in learning about the potential of mobile blogging and how she might share more about her product through such social technologies. The Mobile Diary prototype gave her an opportunity to experience some of these technologies and practices for the first time and explore different ideas. Figure 36.6 shows examples of the reports generated during the Mobile Diary study.

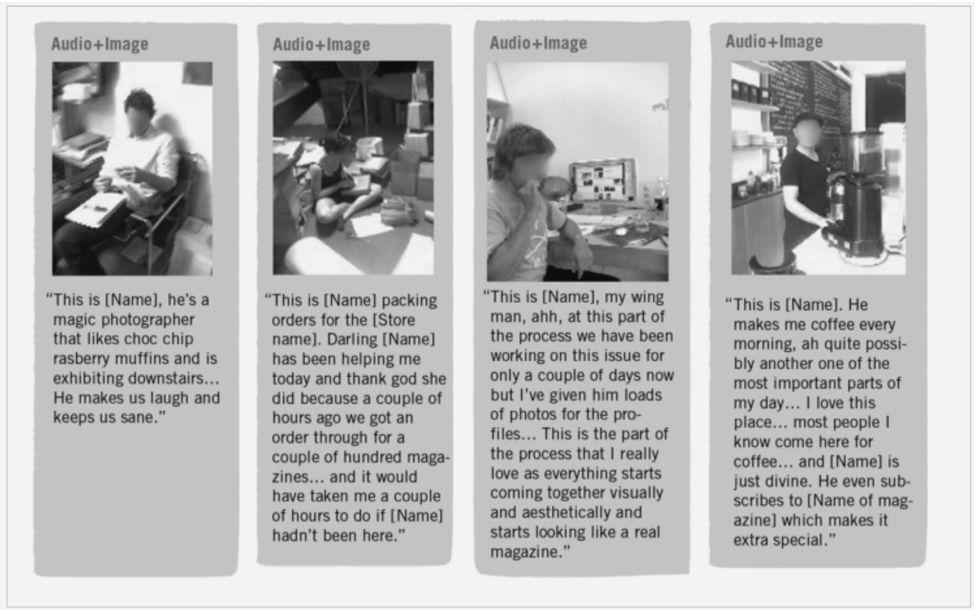

Figure 36.6 Mapping the participants across the day

The results from this field study confirmed the value of the Mobile Diary method as an early design research tool, as well as the particular tools and format that would be the most effective for self-reporting. They also suggested that mobile and social self-reporting tools could be used to create the potential for new forms of 'participation', particularly when designing other social technologies such as community platforms. A larger project and/or more participants might have generated more, and perhaps different, data. However, what was important here was not the number of participants (or even projects), but that we were able to quickly and cheaply evaluate if and how the Mobile Diary method could be of value to the agency and its clients.

The commercial studies

The first two field studies using and prototyping the Mobile Diary method enabled the design agency to see the value of the approach and feel confident to 'sell' the method commercially to clients. The design agency agreed to invest some funding into the development of a blog platform to support future commercial uses of the method. Mobile Diaries were then quite quickly deployed in two subsequent commercial design research projects with clients; the first to six households to explore sustainability habits and practices, the second to five young people as part of an investigation into technology and its potential to connect young people to social causes. In both cases the Mobile Diary research was intended to inform the development of future social technology platforms. These subsequent deployments helped to confirm the findings suggested in the earlier field studies. These method case studies have been documented in various forms (see for example Hagen and Underwood, 2008; Hagen and McFarlane, 2008).

At this point the academic research and commercial practice parted ways again. Ideally we would have written up the results of both these studies. However, it was not clear whether the participants would participate in the same way if they knew the research might be published (even anonymously) or whether clients would be willing to allow the data to be shared outside of their organisation. A deeper, more established research practice within the design agency might have allowed this tension between professional practice and academic research to be addressed in different ways.

Managing and integrating design practice and research practice

The previous section described the process of designing, evaluating and implementing the Mobile Diary research method in the commercial setting. This section articulates the role of reflection and documentation in connecting this process back to a broader research context and practice. To do this we draw upon Scrivener's model for practice-led research in art and design (Scrivener, 2000a; Scrivener 2000b; Scrivener and Chapman, 2004). We begin with an introduction of the model followed by a discussion of how it applies to the case study described in this chapter.

Scrivener's model is based on Schön's (1983) theory of the reflective practitioner. Schön describes design practice as a problem-setting activity, with cycles of *reflection-in-action* and *reflection-on-action*. We take action, reflect upon it, and then make a move based on our new understanding of both the object of design and the 'design space' in which we are operating. Scrivener (2000a; 2000b) argues that by making the naturally occurring episodes of reflection more public, and their documentation more systematic, the practice of design can also become a rigorous research practice. To elevate everyday design practice to design research, public and systematic documentation is required. This documentation may account for the decisions, reflections and learning of the designer throughout the process, as well as identify the acts through which such reflection occurs, e.g. writing up descriptions of the work and analysing the design process itself.

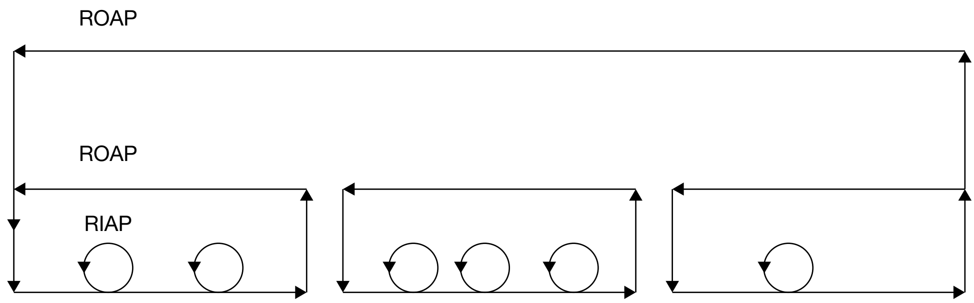

Figure 36.7 Scrivener's model of reflection in and on design episodes and projects

Figure 36.7 shows a reproduction of Scrivener's model of practice-led research (2000a). In it Scrivener differentiates between two different forms of reflection: *reflection-in-action-and-practice* (RIAP) and *reflection-on-action-and-practice.* (ROAP). RIAP takes place during a 'work episode' while ROAP that takes place at a break point (e.g. the end of the day or week) or at the end of the activity. It is reflection at these points that provides the primary material for communicating the research and the descriptions of decisions made (Scrivener, 2000a; Scrivener and Chapman, 2004).

Figure 36.8 visualises our research in relation to Scrivener's (2000a) model for practice-led research. It shows the periods of action and reflection inherent during, between and after the studies. Each field study is a complete work episode. There were breaks within the studies that provided additional points for reflection often in collaboration with other stakeholders who participated in the evaluation and evolution of the Mobile Diary method (e.g. via workshops and interviews). During each episode is reflection-in-action as a matter of course, and between each episode is reflection-on-action. The totality of the fieldwork makes up another larger work episode upon which reflection takes place.

The cycles of action and reflection were central to connecting and moving back and forth between theory and practice. Concepts from the research literature were explored in relation to findings from the empirical research. Findings from the empirical research were also connected back to existing concepts in literature and used to further develop the criteria for evaluating the effectiveness of the Mobile Diary method as a generative and exploratory design research method.

This iterative moving back and forth was an important part of understanding how academic literature could inform professional design practice. It also allowed for the findings of the practice-led research to be understood in relation to, and located within, existing, ongoing academic dialogue about design methods, participation and social technologies. The language and concepts used to describe aspects of participation evolved throughout the research as we came to better understand what needed to be accounted for in that particular practice domain and context.

Throughout this process, documentation in different forms was critical to externalising the research and making it available for analysis and scrutiny. For example, accounts of the design evaluation and decision-making processes made visible where and why particular decisions about tools and research design were made. It also illustrated how our work was building on existing studies and concepts from literature.

The writing of academic papers was an important part of articulating and evolving ideas, exposing the work, gaining feedback from the research community and establishing the research within the research context. In addition we found that writing client proposals and commercial documents that included details about the Mobile Diary research method was also key to reflection and to a maturing of ideas. Equally, the desire to pitch the concept of doing Mobile

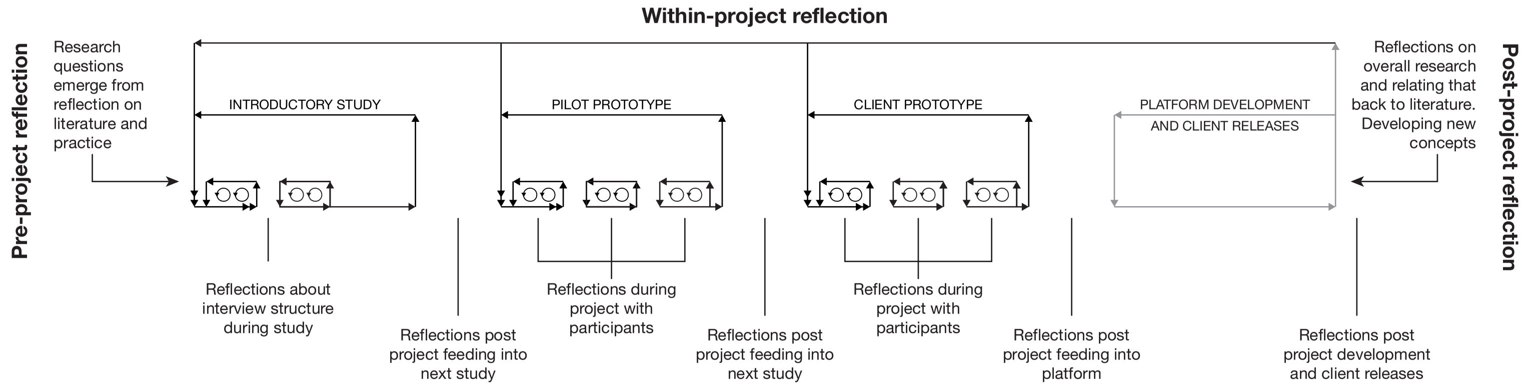

Figure 36.8 Our research process mapped to Scrivener's model

Diaries to clients motivated us to develop strategies to articulate the benefits and issues of the method as well as helped to identify the challenges to using such an approach.

Scrivener identifies three significant stages of reflection during the research process: *pre-project*, *within-project* and *post-reflection*. In our research these stages represented different ways of working and different kinds of outcomes. The *pre-project* phase was represented by the development of the initial focus for the research. This was generated through reflection on existing knowledge and questions from both design and research domains. The outcome of this phase was the initial inspiration for the Mobile Diary method and potential evaluation criteria against which to evaluate the success of the method. It also sensitised us to particular concepts, such as the implications of different structures in self-reporting to participant control and participation, and provided a language that we could draw upon to describe key concepts, qualities and theories.

The *within-project* phase was represented by the field studies and was characterised by many cycles of reflection-in-action. This phase was intensely pragmatic and concentrated, mirroring the rapid-paced context of commercial practice. The outputs of this phase included the development of a specific method that could be, and was, deployed in practice as an early design research method on commercial projects. It also provided the empirical basis for an investigation into participation in the context of social technologies.

The *post-reflection* phase represents the reflection-on-action-and-practice that took place on the totality of the fieldwork as a single episode. At this point the research shifted 'modes'. While there was movement between theory and practice all the way through, the most significant 'theory building' happened in this phase and the central research question was reframed within a broader philosophical stance around participation. It was a theoretically driven analysis and reflection that looked at the combined outputs and learning from the fieldwork in relation to current (and evolving) understandings of social technologies, self-reporting and early design research. The research question evolved during this stage of the research to the more focused: *How are social technologies impacting on the nature of participation in design?* Outputs of this final phase included c*onceptual tools that reflected the impact of social technologies on self-reporting* as well as *strategies to support new forms of participation* in the design of social technologies themselves (e.g. Hagen and Robertson, 2012).

Conclusions

This chapter has shared a case study of practice-led research in a professional design setting. We have paid particular attention to the influence of the commercial setting on the shape and outcomes of the research. We have outlined some of the issues we identified and addressed, and the strategies we employed in integrating and managing the two domains of academic design research and professional design practice.

Many of these issues related to the changes required to the conventional commercial design process when a specific design research component was included. At the outset of the project it was not immediately clear how the directions, goals and outcomes of academic design research would be balanced against the commercial drivers and structures of professional design projects. We were unsure, for example, how the role of the academic design researcher would align with that of the professional design practitioner within the same project, or the best process for integrating typical research structures such as publishing and consent into existing budget-conscious commercial design engagements.

Critical to navigating this was the use of an iterative process based on cycles of field studies and regular phases of reflection, evaluation and re-alignment. Each of the field studies was shaped both by what we sought to investigate, as well as by the context in which we were investigating it. We began with exploratory interviews as a stepping-stone into the new dual context and relationship. A shift to prototyping then allowed us to explore and evaluate concepts found in literature in a commercial context first-hand, and enabled us to prepare for introducing the method to clients and client-projects. Potential client partners were selected not only in terms of their compatibility in relation to the topic but also with consideration to their openness to research and experimentation. Also central to the strategy was to allow the research questions, focus and approach to emerge and evolve through the combined inputs and influences of the academic research goals and the specific needs of the particular commercial setting.

Building and evaluating the method from both professional and academic perspectives required the translation of concepts from literature into the professional context and back again. Documenting and externalising a language and concepts relating to the Mobile Diary method throughout the research was an important part of locating the findings from the practice-led research in relation to ongoing dialogue within academic literature. Scrivener's (2000a) model of practice-led research also provided us with strategies for making visible and accounting for these movements back and forth between the two different domains and practices and between different modes of action and reflection. In the last phase of the work for example, the post-reflection phase, we left the professional domain entirely to focus on writing up the research and locating it within broader research frames and contexts.

Together these strategies allowed us to remain accountable to both domains and practices of academic design research and professional design throughout. They provided the flexibility to identify and address the various issues as they arose as well as a range of resources, including the different perspectives of our participants, to use in that endeavour.

For us, the process also and always required that we weave in an additional set of relationships, expectations, outcomes and accountabilities into both the design project and the research project. Whilst challenging, this interweaving provided the opportunity to make discoveries about design practice that would not have been available otherwise. It enabled us to identify particular challenges to supporting participation in design and to account for some of the questions and conditions professional design practitioners face. For example, the specific design context, including the types of clients and the types of projects the design agency was working on, exposed new questions that could not have been defined at the outset of the research. The focus on social technologies and participation that became central to the research project emerged in response to challenges and patterns of use specific to the commercial context we were working in. It was the outcomes of the field research that gave the design agency the confidence to invest funds in developing the method for commercial deployment.

Participating in the research also provided benefits to the partner agency in ways we hadn't anticipated. In addition to building their repertoire of methods, the experience was instrumental in helping to foster a culture of ongoing learning about practice within the agency. It also helped position the agency as innovative and illustrated their commitment to user-centred design to new and existing clients.

Working across the two domains of academia and industry is both complex and rewarding. To do so requires balancing and negotiating two different sets of practices. We hope that this chapter can offer one example of how the strengths of each can be marshalled to provide benefits to both.

Acknowledgements

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37

PROBING AND FILMING WITH STRATEGIC RESULTS

International design research to validate, explore and develop a new product-service concept

Geke van Dijk and Bas Raijmakers

This case study describes a project commissioned to STBY[1] and her partners in the REACH[2] network for Global Design Research by a major, global technology company. The client team were interested in exploring two things: whether a new service concept they were developing met the needs and interest of several distinct target groups, and which aspects of this concept would best match with the everyday lives of these consumers. The design research project STBY created, and executed with the REACH network, involved engaging with over 120 participants in three different geographical locations. Both group sessions in User Experience Labs and individual ethnographic interviews to create Design Documentaries were used as a method. The results were presented to a large number of internal stakeholders of the global technology company. This case study relates how the project was set up, executed and how the results were integrated in the work of the client teams, and includes reflections on the approach and methods used in this project.

The client brief for the design research

The project had two distinct goals set by the global technology company in their brief, meaning careful thought had to be put into the best methodology to adopt. The first goal was to elicit feedback from several different groups of consumers on a new, early stage concept direction for a product-service combination. The client wished to gain feedback on the design, functionality, price, availability and intended purpose of the new concept. The concept consisted of a new technological device combined with a range of optional service elements. As, at the time of the design research project, the concept only consisted of a non-functioning physical prototype, a series of creative exercises had to be developed that would allow participants to explore future potential usage of the device and the intended services in the detail required.

The second goal did not focus on the concept itself but the context in which it would have to be used and accepted by consumers. This exploration of the wider context of use around the new service concept required a markedly different approach, as material had to be gathered which would allow the concept itself to be analysed in relation to people's everyday behaviours, routines, aspirations and apprehensions.

It was decided at the outset that the project should maintain an international focus. Both of the design research goals were to be examined in three countries (UK, Spain and Russia), with the insights gathered allowing the client team to separate local cultural influences from universal responses when analysing the results. As is often the case, this all had to be achieved within a short timescale – at the project start only six weeks were available before a final presentation needed to be made to internal management teams.

Overview of the bespoke design research process

A project with several goals, executed in different markets and integrated in the clients' design and strategic processes requires a bespoke approach. Unlike straightforward market research methods, design research methods are often tailored to fit the specific needs of a client brief. Instead of following a standard set of methods such as questionnaires, a bespoke combination of methods that are tailored to the task at hand needs to be created. Figure 37.1 gives an overview of the methods and the approach that was created, and its results.

The two goals the client put forward required a staged approach where the first goal was met first via User Experience Labs, a method developed by STBY based on methods such as Design Probes (Mattelmäki, 2006) and moving beyond standard methods such as the well-known focus groups. These group sessions were held in parallel in three countries.

Consequently, from these group sessions, four individuals were selected in each country to do some further design research with. They were called 'key users' as they seemed to fit the intended target group particularly well. With each of them we spent several hours in their own environment, to better understand the context in which they lived, and in which the new concept would have to not only 'survive' but also add value. From these visits resulted short films, made using a method called Design Documentaries (Raijmakers, 2007), which is based on the more general method of ethnographic interviews.

Results from the group sessions and the individual ethnographic interviews included probe materials created by the people participating in the User Experience Labs, profiles of the key users that took part in ethnographic interviews and films (Design Documentaries) that resulted from these. All of these materials were used in workshops with client teams to explore opportunities for the new concept (two spaces that offered clear opportunities were found). Consequently, with designers and strategists in the client teams, several propositions within these opportunity spaces were developed.

This is where the involvement of STBY and the REACH network as design researchers ended. The global technology company further developed the propositions, merged them with other existing work and eventually introduced new products and services in several markets around the globe as a result. Such a follow-up process is complex rather than straightforward and can take easily a year to complete. Many decisions need to be made before a product or service enters the market. The design research materials that result from a project as described here are also designed to act as supporting evidence for these decisions further down the line.

Agile teams of T-shaped people

A bespoke approach requires an agile design research team. The team for this project consisted of STBY as coordinator of the design research undertaken by her partners in the REACH network for Global Design Research in Russia (Summ()n[3] in Moscow) and Spain (fuelfor[4] in Barcelona), whilst also conducting the fieldwork for the UK section of the study. This is one of several such collaborations undertaken in the REACH network in the years since its origin in 2008. Each of these are testament to how agile collaborations can deliver consistent results

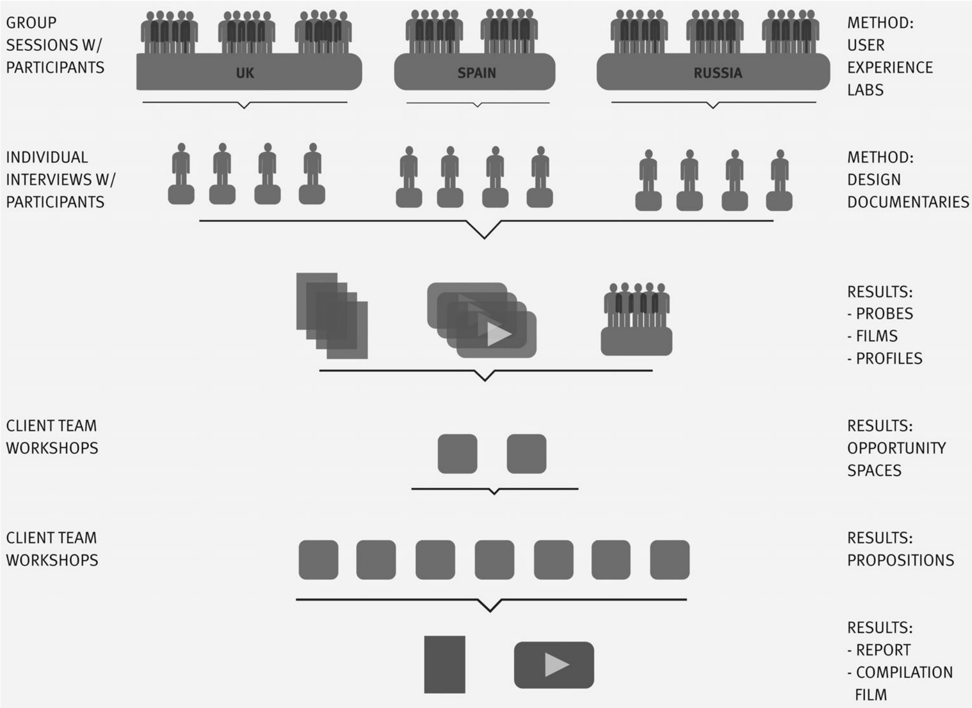

Figure 37.1 Overview of the bespoke design research process and its results

on a truly global scale, using the internet as a tool to share and communicate throughout the project, and getting together at crucial moments to analyse and synthesise.

All people in the core team at STBY and her REACH partners are ‘T-shaped’ (Kelley, 2006) in that they share a common expertise in design research whilst also each possessing a background in a wide variety of different fields. Every person involved in the network has at least one deep expertise next to several more superficial expertise that allow them to collaborate well with others and avoid getting stuck in one deep expertise. These other expertise range from filmmaking to graphic design, product and interaction design, as well as social research, psychology, organisational strategy, and more. This range of expertise is also crucial when working with clients – such as the one of this case study – who bring a multidisciplinary team to the project.

Recruitment and selection of research participants

Due to time constraints and the sheer number of participants, STBY recommended that a professional recruitment agency would be used. At the outset the client provided a range of characteristics for the different groups they would like to get feedback from. STBY worked with the client team to refine the recruitment profiles in relation to the project’s goal, in order to ensure that the aims for the design research could be met. Once this had been agreed, the completed detailed set of person specifications were sent to the recruitment agency along with an agreed timescale.

Regular contact with the agency is vital throughout this process in order that the emerging sample can be fine-tuned before participants are finalised. Thorough documentation of this process, meanwhile, meant the recruit could be repeated along similar lines in the other research locations, achieving a consistency in the global sample, which is crucial for any subsequent analysis.

Consistency is not achieved via rote repetition, however; local cultural factors, which may otherwise skew a research profile also need to be taken into account. This requires close collaboration between local partners – each an expert in their region's culture – and the wider project team. STBY's role in this process is to ensure that the needs of the client are effectively interpreted within this local cultural context – design research cannot simply be 'cut and pasted' from one location to the next.

Recruiting over 100 people in three different countries within such a short timescale was a significant logistical challenge. In such a situation, the process can only succeed when all the actions undertaken are done so with the ultimate aims of the project in mind. This means working closely with the client team to solve challenges and interpret new information; all of this in an atmosphere of collaborative acceptance of solutions.

Dealing with language issues, local cultural factors, location problems and last-minute adjustments to the sample each presented their own challenges to this project. Ultimately, however, a complex sample based around a variety of demographic and socio-economic variables was recruited both on time and on budget.

Refinement of the proposal into a design research plan

A design research plan is a detailed specification as to how the aims of a project can be met within the timeframe and budget available. It outlines the approach taken and the methods used in more detail than the initial proposal that was written by STBY to win the project. An initial kick-off meeting with the client team allowed the design research team to garner a deeper level of insight as to what the client team ultimately hoped to achieve. This is only possible when consultancy and client teams work together in an open way based on trust, to 'fill in the blanks' of a more generalised Request For Proposal (RFP).

Rather then developing the design research plan as an overly prescriptive set of 'rules' that aren't flexible enough to be continually useful as a project evolves, STBY's preferred format is to produce a set of 'Design Research Guidelines'. These guidelines cover each step in the proposed process, outlining both the activities to be undertaken and the intended outputs of each of these stages. This provides a flexible framework for the project, which can be used to orientate other stakeholders – both design research partners in the REACH network and colleagues within the client team – in the design research process.

The benefits of this approach are usually very clear once the project gets underway. The guidelines act as a common point of reference for both design research and client team, ensure a consistent approach across geographical locations and provide a clear indication of the various design research materials which need to be developed.

In this particular case, two key methods were chosen: User Experience Labs for the first stage, to address the first goal with its focus on the existing concept of the client; and Design Documentaries for the second stage, to address the second goal where the perspective of the project team had to broaden to better understand the context in which the original concept would be introduced.

In User Experience Labs, participants are asked to respond individually to designed tasks, called Design Probes (Mattelmäki, 2006). This can be a sheet with a timeline of a week and several stickers with activities the research is interested in to put on the sheet to indicate when the participant performed these last week, with some space to write little stories about these activities too, for instance. The purpose is to collect a large number of stories around a certain topic, and then briefly discuss these in the User Experience Lab to make sure the design researchers understand well what each participant has documented, not just what they do but also why. Some of the tasks are also done collectively. Co-creation is then an important element, as described by Sleeswijk Visser (2009), for instance.

Design Documentaries (Raijmakers, 2007) are based on the thinking and practices of ethnography (e.g. Hammersley and Atkinson, 1983; 2007) and documentary film (e.g. Bruzzi, 2000; 2006), and bring the more than 100 years of experience that documentary film has with telling stories about everyday life into design research about and with people and the context they live in. Design Documentaries are based on the idea of empathic conversations (Raijmakers et al., 2009) between design researchers, the participants in the research and all stakeholders in a project. These conversations are designed as research and focus on collecting stories from participants as well as expressing these in visual ways to project stakeholders. Design Documentaries do this through film, generally in very short films of up to three minutes, each containing one story of one person to allow the films to be used as material in workshops and throughout the design process.

Development of the research materials

In the User Experience Labs the invited participants had to be probed on their behaviours, needs and motivations in relation to the service concept in a manner which would provoke insightful, engaging, but still accurate, responses. This was achieved via the development of a range of bespoke design research materials or probes, each of which were integrated into the design research plan in a manner that ensured they worked in line with the ultimate aims of the project. This meant making sure each probe supported the next stage of the design research. The materials produced for the User Experience Labs had to generate structured results, which could be quickly and easily interpreted during a collaborative workshop with the client team. They also had to support the 'translation' of the insights from three different countries into a common 'language' that could form the basis of this analysis.

This involved working with a variety of different materials: participants completed paper exercises, worked in small groups to build and construct models and even developed their own imagined customisation of the service concept that they were asked to present on video. To use such creative tools effectively is one of the challenges of design research, one that was managed by each of the local design research teams in close alignment with STBY and the client team.

Conducting the User Experience Labs

A series of User Experience Labs was held across three global locations, with around 120 different participants in groups of about ten at a time, mostly in the design studio of the local consultancy. The User Experience Labs organised for this project saw several different profiles of consumers (e.g. women between 20 and 40) invited to group sessions in which their relevant behaviours, routines and perceptions could be explored and recorded. The emphasis when organising the sessions was on making this experience as engaging and interactive as possible.

A series of unique exercises was prepared beforehand, each of which was carefully designed to elicit thoughtful responses to the service concept, whilst also provoking and maintaining the interest of the participants. Sitting quietly at a table and filling in a questionnaire is not something most people enjoy, nor is it likely to prompt any useful degree of reflection on such a complex subject as a future new service offering.

The emphasis placed on engagement, however, also extended in this instance to the client team. Drawn from a predominantly marketing background, they were used to observing such sessions from behind a one-way screen, whereas STBY's approach instead favours more involvement in the sessions and direct contact with the participants.

The sessions were run with groups of around ten people, split into smaller subgroups for some exercises, and coming together for plenary discussions at various points in the programme. Moderated by the design research team, these sessions facilitated an open, collaborative, but still focused exploration of the topic at hand – one which could be consistently replicated across the regions involved. The exercises were designed to capture and structure initial insights on paper and video, which were further explored in the ethnographic immersions that followed.

Creating the Design Documentaries

The subsequent round of ethnographic immersions allowed the design research team to explore in even more detail some of the findings from the User Experience Labs. The group sessions had allowed the team to identify the most promising candidates for the immersions, whilst the participants themselves benefitted from already having been introduced to the topic in the labs, the new service concept. This is one of the key strengths of designing research around multi-stage participant contacts.

The ethnographic immersions also served as a way to illustrate some of the findings from the User Experience Labs. By structuring the interviews around the creation of a series of Design Documentaries, of about three minutes each, the team was able to curate a repository of around 30 films that examined the potential usages of the new service concept from a number of real-world contexts and perspectives.

On top of further enriching the material gathered in the User Experience Labs, the films were designed to add another level of detail that could only be derived from speaking with people at length in the environments where they typically make use of services relevant to the topic of this project. Moreover, the short films also served as an engaging and resonant introduction to the themes that had started to emerge.

Initial review and analysis

The initial review stage of this project was designed as a joint 'pre-analysis'; an opportunity for the design research and client team to engage themselves with the emerging insights and ensure the final results were focused on the project objectives. In this instance this meant working with the client team to define and curate the potential Design Documentaries that could be edited from the material collected during the immersions. A three-hour interview generates a great deal of material, which can be filtered and interpreted in a number of ways and also used to tell a variety of stories. This stage in the process involved an initial review of this material by STBY and her REACH partners, before making suggestions as to which of these stories they'd like to tell, the final decision then being made in collaboration with the client. Typically, the number of films suggested by the design research team to the client is double the amount of films actually made. Generally many more stories are collected than can be edited, which is a good thing because the client can help choose which stories will resonate most inside their organisation with the design and strategy teams.

The benefit of this approach is also that the client team is able to gain an early understanding of the type of insights that are emerging. They often take this as another opportunity to further focus the work on the topic and issues at hand. When completed in close collaboration, this step in the process allows the teams to grow closer in their understanding and move smoothly and quickly into the subsequent synthesis and reporting stage.

Synthesised analysis in a collaborative workshop

The final analysis stage of this project again moved through several distinct stages. The synthesis of the emerging insights was conducted in an interactive workshop that brought together all three design research teams, as well as the core client team, together with several other stakeholders from within the client organisation. This workshop allowed the refinement and consolidation of insights developed from the design research results we had created so far through the User Experience Labs and the Design Documentaries. These results were further analysed and synthesised into a series of insights and opportunities related to the research objectives.

Successfully running such a workshop requires careful preparation, throughout which attention must be paid to a number of different factors. First, the workshop should always be designed around the people who will be participating. In this instance the core client team wanted to use the workshop to introduce a number of colleagues from various departments (marketing, strategy, design) to the research, and involve them in the analysis. STBY, meanwhile, ensured that the design research teams from each location were also present, further enhancing the local cultural perspectives present in the research material that had been collected.

Working with people from diverse backgrounds in such a workshop can be a challenge, because several different voices and perspectives are an inevitable part of the collaborative analysis. Working with the films, however, means the stories of the participants in the research can serve as an engaging and empathic common reference point for the topic being examined. The workshop was structured around watching a curated selection of these films in small groups, with the analysis being structured around direct references to evidence present in the films. This helps anchor discussions in real-world examples, and helps keep diverse teams focused on the issue at hand.

Obviously constant attention must be given to the overall aim of the project; the workshop is of little use if it does not produce coherent results that contribute to the research's ultimate objectives. The exercises developed in this case, therefore, were focused on producing synthesised insights developed from both User Experience Labs and Design Documentaries, and also designed so that these results could be combined into a structured overview of the insights and opportunities that were created. The benefit of placing such an emphasis on output within this collaborative context is the greatly enhanced ownership participants feel towards the results, and the ease with which these results can then be communicated to a wider audience.

Synthesis of results in a visual diagram on a poster

The clustered and structured insights and opportunities produced in the workshop were eventually communicated via a visual diagram on a poster that provided a highly engaging overview of the results achieved. Processing the results of the workshop into a diagram provided an easily accessible visual overview of the main findings, which still made clear references to the specific stories told by the participants in the films. This 'at a glance' introduction to one of the main results later proved to be highly useful when communicating the results within the client organisation worldwide.

In regards to the service concept itself, meanwhile, the Design Documentaries produced from the immersions were used to map a number of further potential opportunity areas. These were in turn used to develop a series of initial related service concepts in the workshop at the culmination of the project. Mapping opportunity areas and detailing these with alternative concept directions in this manner provided a much more cohesive overview of where the original concepts were situated in relation to people's lives. This 'anchored' the feedback from the User Experience Labs into a structured account of people's current usage and activities, adding a behavioural component to the overall service concept being reviewed.

Ultimately, this meant the client team came out of the project with a much clearer view of which markets their service concept was aimed at, what attributes it would need in order to succeed and what changes might need to be made.

Final report and compilation film

Making sure the final delivery of a design research project is successful and relevant to all stakeholders requires close collaboration with the client team. The final reporting in any project should not only be concerned with producing a structured account of the work undertaken. Thought also needs to be given to how the results can be communicated to new audiences, and how the materials generated can be of future value to the client organisation. The report and presentation STBY designed in this instance went through several iterations to make sure they were focused upon current internal priorities.

In addition to a clear account of the insights and opportunities identified in the design research, the report produced for this project also included an extensive documentation of each step undertaken, taking care to explain the methodology employed so that the evidential foundation for the results obtained was clear. As a visual appendix to the report, the team also revisited the film material gathered during the data collection stage in order to re-edit a longer compilation film that gave an engaging overview of the project's results.

Unlike the individual Design Documentaries produced from the ethnographic immersions, each of which focused on a particular behaviour which had been observed, the compilation film could move a step further and be constructed around the actual insights or opportunities that had been identified across participants and locations. This provided an innovative, engaging and genuinely empathic link to the evidence upon which the results are based.

Communicating results to the wider client organisation

Once completed, the ultimate goal of the project was to provide a final account of the results to a wide range of international stakeholders. This was achieved in part via a debrief presentation delivered simultaneously to a high number of employees on six locations around the globe in a teleconference supported by visual materials such as the poster and several films including the compilation film in a presentation deck of several slides. Presenting the results in this visual way allowed us to introduce a large audience to the work. Integrating the film material, meanwhile, provided a much more empathic link to the evidential foundation of the work, the stories of the individual participants, than is possible from a written account alone.

The final presentation was well received within the client organisation. It opened the design research process up to a wide audience, whilst the videos allowed the insights gathered to be communicated in a highly engaging manner. The compilation film, meanwhile, was later used in several management meetings higher up in the organisation, effectively communicating the headline findings in a way that helped them to empathise with their customers. These results bear witness to the benefits of developing an agile approach to design research that can fluidly adapt and respond to the needs of an organisation that are bound to change all the time.

Long-term value of the design research results and materials

The project documentation beyond the report and the compilation film consisted of a set of research materials, which supported the client team in a number of activities later on in different ways. First, the documentation of the User Experience Labs provided a breakdown of feedback on the service concept that could later be cross-referenced against both consumer profiles and locations. This feedback covered purpose, style and functionality of the prototypes that had been introduced, and was elicited using bespoke design research materials, which could also be used in similar future sessions around the world.

The final delivery for the project included a repository of all edited video material and a range of tool templates, which could be used by the client team to repeat the analysis workshop internally, with a variety of different teams. This meant the project delivered both effective immediate results and reusable assets and methods for future follow-up activities. Moreover, as a result of the close collaboration between STBY, REACH partners and the client team throughout the project, the client team also felt confident and motivated to continue the work with the materials delivered.

Conclusions

This case study demonstrates that design research works well in environments and situations where great flexibility of both the team of design researchers and the methods and approach taken is required. Such situations are typical when companies innovate in a design-driven way (e.g. Verganti, 2009) with multidisciplinary teams using agile approaches (e.g. Ries, 2011). Research into people's practices and motivations has to be truly integrated with the overall design and development process to be beneficial to such teams, and design research has developed approaches and methods to do so. Some key characteristics of design research in this respect, as illustrated by this case study, are:

Close collaboration between the design researchers from the consultancy and the core team at the client company is crucial. From the detailing of the design research plan once the project as been commissioned, to recruiting the participants, to making the interview guide for the fieldwork, and so on, many factors have to be taken into account together to make sure the approach, the methods and the results will fit with what the internal team in the client company needs. Constant interpretation is needed, taking into account not only the company cultures but also the cultures of the participants in such international design research. Here, language issues, local cultural factors, location problems and last-minute adjustments to the sample each presented their own challenges to this project that could only be resolved in close collaboration between the client and consultant teams. Indeed, the design research plan itself had to be flexible to be ready for such adjustments, and therefore contained guidelines rather than a set of rules to follow for the design researchers in the different locations on the globe. These guidelines covered each step in the proposed process, outlining both the activities to be undertaken and the intended outputs of each of these stages, but left ample room for appropriation to local circumstances and customs too.

Moreover, involving the client team in fieldwork and early analysis also has the advantage that the flexibility in the approach can be used to keep focusing the design research as it unfolds. This of course also allows unexpected findings to become part of the results, which is particularly valuable in innovation, as 'unknown unknowns' may lead to whole new directions for products and services.

Finally, design research tends to give extra attention to the communication of its results. Design skills are crucial to the ways these results are expressed and used, be it as inspiration by design teams or evidence by strategy teams and much more. This makes design research into an investment that will give many returns in the future, on practical and strategic levels throughout an organisation, as indeed happened in the global technology company that commissioned this particular case study.

Notes

1 An Anglo Dutch consultancy doing design research for service innovation. See www.stby.eu for more information.
2 A global network of (in 2013) 12 consultancies around the globe who collaborate in international design research projects. See www.globaldesignresearch.com for more information.
3 A consultancy focused on understanding the future through design. See www.summn.com for more information.
4 A consultancy focused on design and research for healthcare. See www.fuelfor.net for more information.

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STREETSTARTERS
Catalysing social cohesion at street level

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Introduction

The assumed decline of social cohesion in many cities of the industrialised world poses challenges for the future. As we strive to build resilient communities in order to face current and future challenges, many envisioned solutions depend on the quality of our social tissue. It forms an important foundation as such. This case study of the Streetstarters project carried out in Antwerp (Belgium) aims to describe a participatory, design-driven approach aimed at developing a toolkit in order to enhance social cohesion at street level. In order to go beyond the many already existing street-related activities organised by local authorities or neighbourhood committees, we challenged ourselves to design an attractive product, service and experience that would stimulate people to engage in dialogue or a social activity. As such we aimed for a solution that would invite rather than force people to participate. In order to achieve this, we initiated a participatory process between two design agencies and neighbourhood inhabitants, actively involving them as stakeholders in the creation of concepts. The design process consisted of six steps, i.e. context analysis/observation, cultural probing, concept development, stakeholder involvement, concept refinement and prototyping, implementation and evaluation. In this chapter, attention will be paid to both process and result.

Social cohesion

"Streets and their sidewalks, the main public places of a city, are its most vital organs"
Jacobs, 1961: 37

In recent years, social relationships have become increasingly complex, dynamic and multi-dimensional and perhaps even more volatile. Particularly in cities, where ever more people from different cultures and of all generations live in ever more rapidly changing neighbourhoods. Also, new media and communication technologies have altered the way people live and work and have made them less dependent on proximity-based relationships. Increasing individualisation and virtualisation in general leave the impression that ties between neighbours and fellow citizens in many cities of the industrialised world have become weaker in the past years (Bauman, 2000). It should hence come as no surprise that today many people experience a lack of social commitment and sense of togetherness in the areas in which they live (Tassinari and Baerten, 2011). At the same time the need for greater autonomy and self-reliance at the local level rises, caused, for example, by a decrease of government involvement (e.g. the economic crisis). In Flanders (Belgium), researchers describe an evolution from a more or less uniform value system to a pluralist system in terms of ideology, political affiliation and personal lifestyle. Social cohesion is shown to be in decline (Peters and Debosscher, 2006: 22). In that respect, it is believed that any investment to build a stronger social tissue locally, for example through increased local interdependence, mutual comprehension, shared values and common goals, is bound to lead to societal improvement (De Boer and Van der Lans, 2011).

Social cohesion is considered one of the essential ingredients of a healthy, resilient society. Sociologists describe it as 'stickiness, or adhesiveness', as that which leads to coherence in a society, as that which creates 'community' (Peters and Debosscher, 2006). As the cohesion within a community grows, so does the potency of the community, which enhances their ability to tackle challenges. Any means or event that stimulates or intensifies the interaction and the dialogue between people positively contributes to the formation and the strengthening of a healthy social tissue (Blokland, 2006).

Background to a design challenge

In the Streetstarters project, the studio for futures exploration, Pantopicon, and creative agency, Studio Dott, dedicated themselves to the question of whether and how it would be possible to contribute to the strengthening of social cohesion at street level by means of a design intervention. The team at Pantopicon has a strong background in explorative, participatory research and concept generation. These skills are complemented with Studio Dott's experience in product development, visualisation and prototyping.

From the onset of the project, the team was aware that its solution would need to go beyond the various already existing street-related activities organised by local authorities and neighbourhood committees. They set out to design a low threshold, attractive product, service or experience that would stimulate people to engage with one another. The city of Antwerp served as the physical backdrop against which the project was developed.

In order to be specific in our objectives and to ensure the manageability and feasibility of the project, the notion of social cohesion was narrowed down to one of its key components, i.e. to 'small, volatile encounters', e.g. a nod, a greeting or the exchange of a few words between passers-by. Throughout her career, the well-known urban sociologist Jane Jacobs repeatedly emphasised the importance of this almost imperceptibly moving past each other in an urban context.

Sociological research points out that it is not the strong ties we have with family, friends and colleagues, but rather the volatile, one-off encounters we have in public spaces which shape our experiences and our feelings (both positive and negative) regarding the city's social tissue in a major way (Blokland, 2006: 10). Also in the Flemish-Dutch context the importance of small encounters is being confirmed by Soenen (2006, 2009), who claims that small encounters play a significant role in defining the sense and feel of a city.

In 2006 the Flemish Minority Centre presented the simple but effective observation that if one wants people to engage with one another, they first need to know each other (Peters and Debosscher, 2006). In this case it is not about people knowing each other well, but about the development of a certain basic knowledge about fellow citizens' personalities and their daily behaviours. This notion of familiarity is reminiscent of what Stanley Milgram calls familiar strangers, i.e. individuals (neighbours) that one recognises by their regular patterns and activities, but with whom one does not necessarily interact directly (Milgram, 1977).

Considering small encounters as a fundamental step in catalysing further interaction between people living near each other – thus weaving social tissue – Pantopicon and Studio Dott considered it as their main challenge to come up with a participatory design-driven process leading to an intervention triggering and stimulating simple encounters between people living in each other's immediate surroundings.

This endeavour, which was called Streetstarters (*Straatstarters* in Dutch), eventually led to Museum In Our Street (MIOS), a self-explanatory toolkit designed to invite and stimulate fellow inhabitants of a street (segment) to share something about themselves in a visual way, thereby providing a simple basis for further neighbour-interaction. The toolkit includes various design touch-points which together form a platform for communication, allowing people to participate to the degree they like – (pro)actively or reflectively. In this way, MIOS catalyses neighbourhood encounters, thereby enhancing the social tissue in a bottom-up fashion, organically driven by the people themselves.

Designing for social purposes

At the start of the project, there was a clear focus in terms of the topic area but there were few ideas of what the 'solution' to the problem could or should be like. Hence, a constructive approach was taken, positioning key stakeholders (i.e. street inhabitants) as the primary source of insight. Their insights would provide a source of inspiration for idea generation and concept design. The full process – from field research through concept design and testing – took about eight months.

A participatory process was designed, putting emphasis on various moments of interaction between the design agencies and neighbourhood inhabitants, hence actively involving them as key stakeholders in the creation of concepts. The process consisted of six steps:

1 Field research
2 Cultural probing
3 Concept creation
4 Concept testing and stakeholder reflection
5 Concept refinement and prototyping
6 Implementation and validation

Building on user-centred design methods (Sanders and Stappers, 2008) we created a process that is clearly design led. We started with an expert mindset performing observational research and developing cultural probes, and once a round of internal concept generation was finished, we made an effort to involve as many stakeholders as we could to reflect and react upon our proposals, to re-create these and to share their comments and reservations regarding these. The end result was again created internally, amongst experts, resulting in prototypes tested in several Antwerp streets. Each of the steps of this social design trajectory will be described briefly in the following paragraphs.

Field research

With the help of Opsinjoren, a local grassroots initiative supported by the city of Antwerp, focusing on neighbourhood initiatives, a selection of five streets was made to involve in the project. These streets have been chosen based on their mutual diversity (centre/periphery, uniform/mixed population, estimated value of real estate, presence of shops/no shops, etc.).

In order to grasp the physical context of the streets as well as to get a better grip on the notion of 'small encounters', field research was conducted. Initially this consisted of simple observations. The researchers positioned themselves as 'flies on the wall', trying to be as unobtrusively present as possible, while taking in the environment and observing the events taking place on the streets. Digital photography and notes were used in order to document the research, materials that afterwards served as a source of inspiration and reflection in discussions within the team as well as in encounters with inhabitants. These simple observations were followed by encounters with people on the streets, some casual, others directed (i.e. by knocking on doors). Subjects were asked about their experiences with regard to encounters and social contacts in their streets. This phase was communicated by means of a door-to-door distribution of information leaflets announcing the initiative and the presence of the team in the street, inviting people to join the conversation. People willing to participate were asked to place the leaflet behind their window (Figure 38.1). Each team member operating in the streets would also wear a badge featuring the project logo in order to be easily recognisable and approachable.

Cultural probing

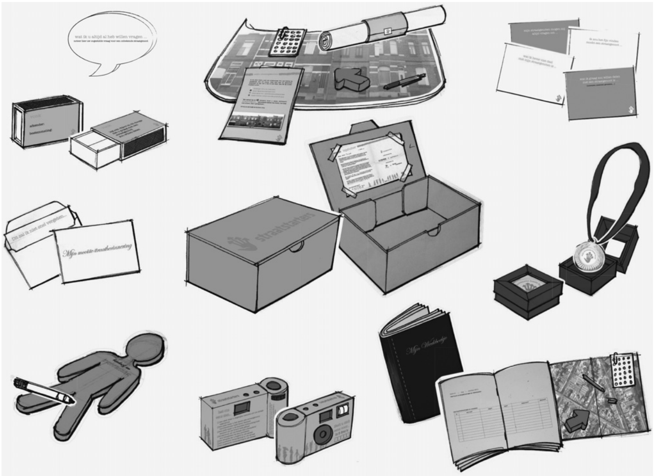
After the exploratory field research, three people in every street were invited to adopt a probe or interview kit. These kits (Figure 38.2), inspired by cultural probes (Gaver et al.,1999, 2004), are attractively 'packaged' and self-explanatory working materials which encourage respondents to perform certain tasks independently, thereby allowing researchers and designers to look and experience life 'through the eyes' of their subjects. The 15 probe kits that were distributed contained:

Figure 38.1 By placing the flyer stating "Ik start mee!" – meaning "I'll join" – behind their windows people expressed their willingness to share their experiences, which helped the project team to identify participants

- a disposable camera to take pictures of specific situations and capture neighbourhood encounters, memories, threats and annoyances;
- a diary to keep track of daily encounters, including a local street map in order to pinpoint encounters spatially;
- a cardboard figure of a person on which to write one's personal definition of a good and a bad neighbour;
- a medal which participants are supposed to hand over to the one person in their street whom they would consider the 'mayor of their street' (i.e. the person who through their presence or initiatives makes the street a 'community');
- a series of postcards to note: "*The best memory I have living in this street*"; "*What neighbours can always come to ask me*"; "*What I always wanted to know (but never dared to ask)*"; "*What I'd rather share/not share with my neighbours*"; "*What I would like other neighbours to do*"; and

- a detailed photo-montage of all the facades of houses in the street, on which one could place stickers on the houses of people one knows in their street. The colour of the sticker would correspond to how well one knows the other person (e.g. *We are friends* (green); *We know each other by name* (blue); *I have only a general impression of the person(s) living there* (yellow); *I don't have a clue who is/are living there* (red)).

Figure 38.2 Design of the probe kit and its contents



Probe kits are not an instrument to collect quantitative data, but a generative research tool[1] that allows design researchers to get a better understanding of the context, the experiences, the tacit knowledge and the latent needs of subjects.[2] The probes were designed in a way that these required repeated attention over a longer time span, nudging participants to reflect a little longer on them, and on their feelings and experiences regarding their neighbourhood. This approach gave the design team a more thorough understanding of the lives of their subjects, enabling the former to experience life through the senses and sensations of the latter without being present all the time.

Instead of having participants send the kits back by mail, they were interviewed using the collected material as a basis for conversation. Within the comfortable setting of their home,

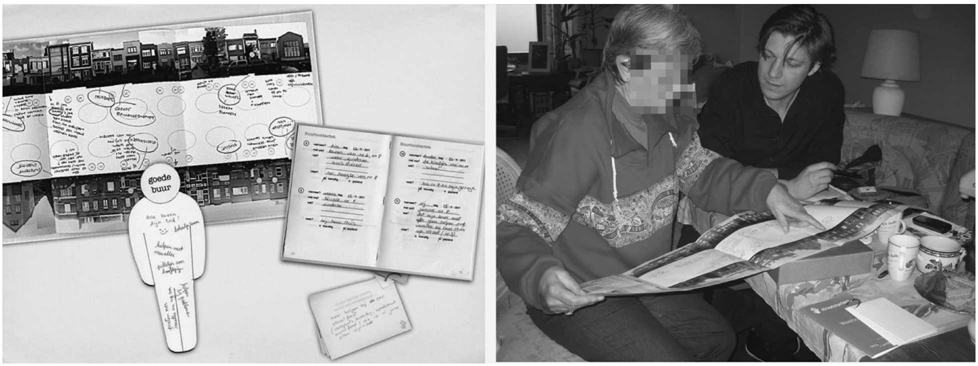


Figure 38.3 Returned probes (left) and interviews/conversations during the collection of the probe kits (right)

people would spontaneously share experiences and insights, often enriching the material further with anecdotes (Figure 38.3). The medals and the maps with the pictures of the facades in particular led to extremely useful insights. Through the medals, it became clear that in every street there was generally at least one person taking the lead in social activities (when asked, or on their own initiative). As a result, we found out that one lady received all the medals in her street. The streetview-like facades map – custom made for each participant's street – provided a particularly strong affordance for people to recount stories, most likely due to the immediate way in which people could recognise 'their' street and 'their' home making them feel addressed in a personal manner. Hence, not only did the map give us a more profound understanding of local social networks, the barriers (spatial, cultural, personality- and behaviour-wise, etc.) and the differences between generations, many also used the map to recount the history and the evolution of life in their street through time. It should be noted that some participants felt inhibited to take photos of personal surroundings, objects or people (family members, etc.) and would rather not share those.

Intermediary conclusions

From the field research and the probes we learned that mutual encounters and social contacts are most of the times invisible in streets. At the same time we found out that decorations on facades, accessibility of gardens and posters behind windows should be interpreted as forms of communication between inhabitants and their neighbours and passers-by. Both the topology of the street and the age group to which one belongs (and the extent to which it is represented in the street) have a major impact on the shape and the strength of the social networks that evolve within streets. Furthermore, it became clear that in order to establish first contact, people usually need a reason to actually go and speak to each other (e.g. an event, a child, a dog or a new car, a problem or a need). It was felt that once this threshold has been passed, further communication becomes a lot easier and also prejudice makes room for what one has in common with the other. Generational and cultural differences are not necessarily overcome, but sporadic, spontaneous dialogues facilitate the growth of mutual understanding and acceptance. Occasionally one notices intercultural and intergenerational exchange: locals who explain habits and rituals to newcomers, students that babysit the children of young parents, and elderly assisting younger neighbours with the installation of heating or electricity systems, for example. In turn these elderly neighbours then receive assistance with administrative paperwork and the operation of their digital appliances, for example.

Clear commonalities were that in every street, quite a bit of personal matters were shared amongst inhabitants, while at the same time most people did not appear to have a clue of each other's professions or birthdays. Moreover, motivated by Flemish culture, the threshold to truly meet inside each other's homes appears relatively high compared to other cultures. Shared stories and gossip ('public secrets') serve as a binder, as a vehicle to underscore relationships and to express unwritten rules (as described by Elias and Scotson, 1994). Most streets involved did feature clearly identifiable individuals who take initiative and 'lead' others. Often, inhabitants made clear that it is nearly always the same individuals who take the initiative of organising street events, thereby playing a key role in neighbourhood contacts. Over time, permanent roles seem to have evolved among those who lead or organise and those who assist. Also climate was mentioned as a decisive factor in the amount of encounters 'on the street' (e.g. much less during winter months due to cold, shorter days, etc.).

These intermediate conclusions set the scene for further concept development. Based on the observations interviews and probe results, it became apparent that the end result ought to be inviting to people to participate yet not constricting them to do so. We decided that it should be a low-threshold, communal conversation starter of some form allowing participants to define the actual contents of conversation by themselves, not pushing them in a specific thematic direction or presenting them with fixed rules.

Concept creation

Based on the insights derived from the field research and the probes, the project team organised an internal brainstorm about possible interventions by which encounters and social contacts at street level could be stimulated. Dozens of seeds for ideas were envisioned which were clustered according to common characteristics. These were then clustered according to common characteristics, such as the inclusion or exclusion of digital technology, location specific ideas, reward systems, gaming ideas, social media inspired ideas, social signs and symbols, etc. (Figure 38.4).

Both Studio Dott and Pantopicon strongly believe in the value of participatory and co-creative design, involving the widest possible range of stakeholders in the development of new and innovative products and services. Yet given the limited scope and time-span of this project, a pragmatic approach was taken: to create a level playing field amongst participants (e.g. avoiding them having to start to envision their own solutions from a blank sheet) and to narrow down the solution space to the most promising ideas, the team opted for an intermediate form of co-creation by using the concepts developed in-house, translated into storyboards or customer journeys[3] as a starting point for discussion with the inhabitants. They would lay the basis for reflection and serve as a springboard for further discussion on the distinct approaches towards the establishment or enhancement of the local social tissue that they embodied. As such, the representations functioned as a seeding bed for further tweaking by a target group of inhabitants.

The creation of the concepts as storyboards and customer journeys was a balancing effort in terms of being concrete enough to understand the storyline, but at the same time to stay on a sufficiently abstract level in order to allow sufficient room for discussion, change and addition by respondents. The created storyboards were first and foremost conceived as tools for dialogue, rather than tools for visualisation in view of implementation. An example of such a storyboard can be found in Figure 38.5. It shows a concept in which any occupant or family member can create a profile of themselves on the facade of their house by using a wide range of window stickers (for example "here we love to play cards and to watch football matches"). In total, six storyboards were created, each integrating different results from the brainstorm session.

Figure 38.4 Internal brainstorm session

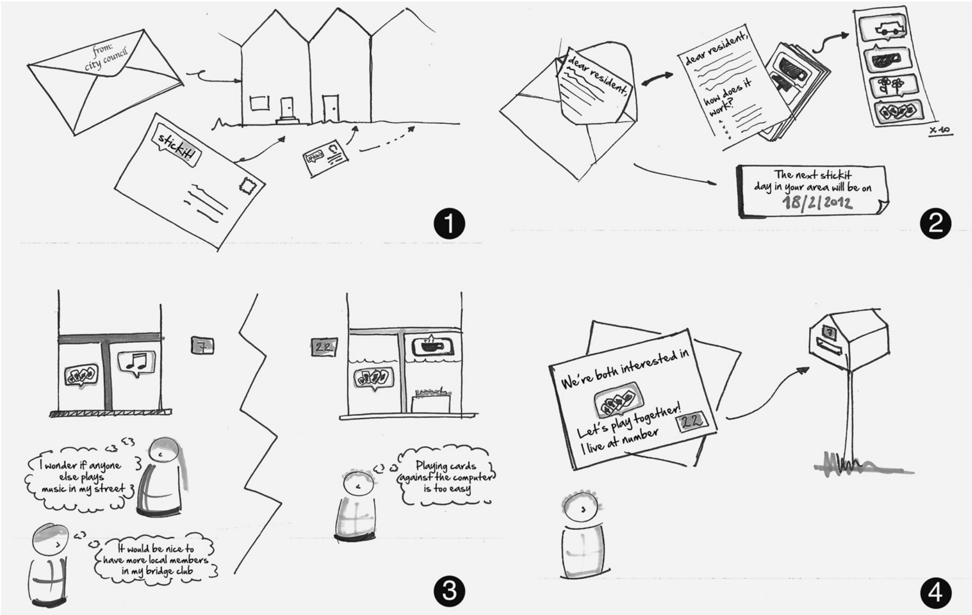


Figure 38.5 Step 1: Street inhabitants receive a pre-defined set of stickers by mail (top left); Step 2: Each kit contains a set of instructions, several stickers with icons and an announcement on which date(s) their street will be active (top right); Step 3: Neighbours place, according to their own interests, one or more stickers behind their window. By doing this, they express themselves in a very general level, thereby lowering the barrier to start a conversation (bottom left); Step 4: People can express common interests by posting cards in each other's mailboxes when the step to 'face-to-face' contact is still too big (bottom right)

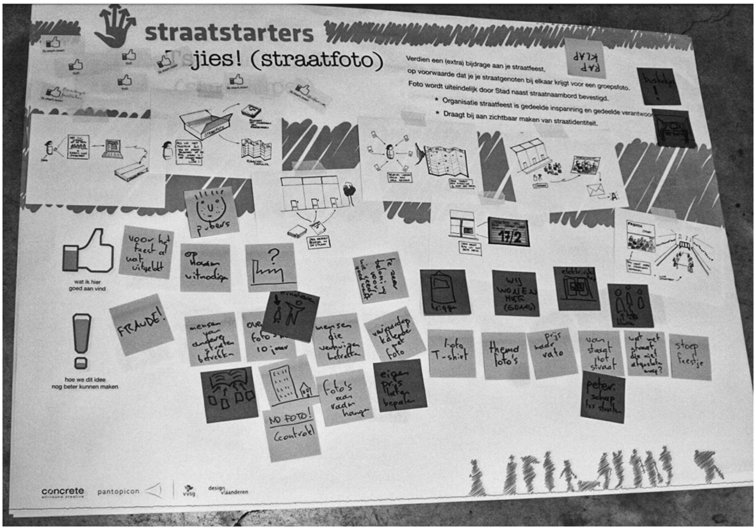


Figure 38.6 A total of 18 participants were divided into three smaller groups. Each group reflected on a storyboard in a constructive dialogue. Each storyboard was presented on a large sheet of paper (A0). Workshop participants could express what they liked about it and how the concept could be improved

This could trigger encounters, conversations or joint initiatives between inhabitants (i.e. to play cards together or to discuss football matters.

Concept testing and stakeholder reflection

The six storyboards were presented to a stakeholder group within the setting of an interactive workshop. The goal of this workshop was not to select one concept, but to figure out which concepts or conceptual elements were interesting to the target audience and worthwhile to further elaborate upon. Since the project's focus was on social encounters in an urban context, it was decided beforehand to assemble a very diverse group of stakeholders. Besides the collection of the reflections of a diverse group of inhabitants it was equally important to hear the opinion and to learn from the experiences of representatives of existing neighbourhood initiatives. Besides that, local policy makers were involved to get feedback on organisational and political levels. Opsinjoren assisted us in bringing together the group of respondents.

Eighteen people took part in the workshop, which started with an introduction of the topic and a brief overview of the conclusions that led us to create the first concepts. Afterwards the group was split into three smaller groups of four to six people. These were invited to join three different workshop facilitators, each of which introduced the groups to two storyboards and invited the participants to reflect upon and enhance the presented concepts (Figure 38.6).

In the setup of the workshop, close attention was paid to engaging people in a constructive dialogue instead of merely asking them for their opinions or comments. People were asked how they would improve the concept thereby triggering them to think critically as well as creatively.

Once all groups had had the opportunity to discuss each of the concepts, each participant was given two stickers to vote on the proposals by means of answering two questions: "*Which is your favourite concept?*" and "*In which initiative would you personally take part?*". The total amount of stickers affixed to each concept description sheet gave an indication of the overall popularity and potential of the respective concept or part of its features. The workshop concluded with a wrap up of each of the concepts and the improvements proposed during the course of the evening.

Concept refinement and prototyping

After the workshop session with stakeholders, the concepts scoring highest in the stakeholder voting appeared to be those that offered an open platform function allowing people to be creative in the use of the concept. For example, the window sticker concept mentioned before was received rather positively. It is an example of leaving the end result open, but providing some sort of guidance for creation. This adds to our previous observations and conclusions resulting in the final concept, a set of tools (a kit) that allows people to publicly share something about themselves with others living in their street. By doing so, a local 'street museum'-kit, which we called Museum In Our Street (MIOS), is created which provides citizens with conversation starters.

As is elaborated in Figure 38.7, MIOS consists, among others, of tape to construct a picture frame behind one's window, a suction cup to help display objects in the frame, cards to provide the exhibition with a description and others to start communications with neighbours, and 'like-stickers' to express one's appreciation for what other neighbours are showing. MIOS allows a variety of ways to participate. For instance (as experience has shown), some people actually craft artifacts specifically for the occasion, while others show holiday pictures or drawings of their children. Other people might decide not to display anything at all, but they could still participate by expressing their interest in the work of others or by just passively getting to know their neighbours better. By doing so, they may become triggered to participate more actively later on. Using the provided cards, people can choose to communicate via indirect contact at first.

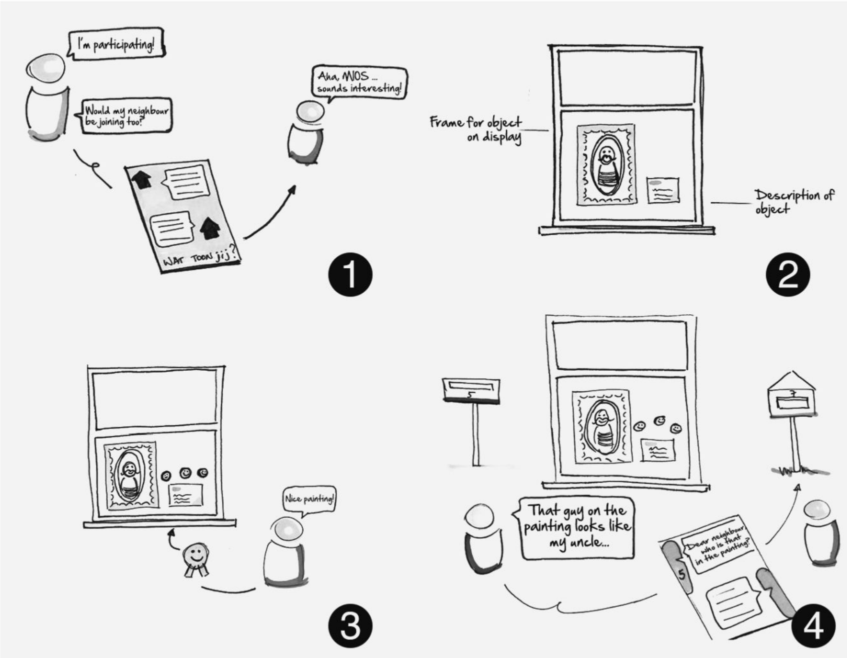


Figure 38.7 Step 1: The kit includes cards to motivate others and create a buzz in the street; Step 2: Those who decide to participate are invited to use the provided material to create a frame, place an object inside it and stick a description next to it (top); Step 3: People can respond to their neighbour's showcase by using appreciation stickers on their windows; Step 4: Additional cards are provided to enable participants to further engage in dialogue with those neighbours with whom they share a common interest or by whose contribution they are triggered to start a conversation (bottom)

Figure 38.8 Finalised 'Museum In Our Street' kits including picture frame tape, appreciation stickers, an object description, a suction cup to attach objects to a window and communication cards

This lowers the threshold for them to engage with each other socially, but it does not exclude traditional ways of communication (ringing at someone's door for example) to still take place alongside the provided tools.

Implementation and validation

The final step in the design process was to develop a prototype of the final concept and to validate it in a real world context. A visual identity for the project was created.

Ideally a pilot test would have been set up first, in which the concept could be tested within a small group of people using a low fidelity mock up of the kit. Due to budget constraints, however, it was clear early on in the process that there would be little to no space for iterative testing. Therefore the choice was made to immediately roll out a few dozens kits to be tested on a larger scale. During the design of the final MIOS materials, we had to take into account that the provided materials would need to stick to people's windows, withstand weather conditions, yet be easily removable and leave as few marks as possible once removed. Therefore a careful analysis of adhesive, printable foils was undertaken in order to make sure no damage would be done to people's property during testing (Figure 38.8).

Two trials have been completed in the city of Antwerp. The pictures shown in Figure 38.9 illustrate typical results, which can impossibly do justice to the wide variety of creative expressions we encountered. The first trials were organised by assigning key individuals in a street the task of distributing the kits and motivating fellow street inhabitants to participate. From interviews with these people we learnt that as soon as the first 'museums' started to appear in the streets, more people became interested and started to look for ways in which they could join in.

The evaluation of the first trials was done at a social event that took place in the street. During this event, a wide variety of participants were interviewed using semi-structured conversations. The insights that emerged from the interviews brought forward several conclusions regarding the approach and the end result. Some highlights of these were:

- It is crucial to identify people already fulfilling key roles in streets or that have the skills and willingness to do so as entry points to the local community. In the most practical terms such as distributing the various kits as well as the explanation that went along with them, they are of great value. They often set the example: when they participate others generally

Figure 38.9 Two examples of MIOS in use during testing. The family in the left-hand picture re-used the box provided with the kit to create a 'cabinet' to make a display case of drawings and small objects

follow. We learnt that a step-by-step approach in which first the most active people are involved, followed by those showing natural enthusiasm, including local 'role models', works well. This does need time, which should be taken into account when planning a MIOS project.

- One can never have enough 'like'-stickers in the MIOS kits. People like to pay compliments to one another. Children, followed by adults, love to make a tour in the street and place stickers on the windows as signs of appreciation.
- The cards to stimulate further communication proved superfluous in the first tests, as people felt they did not need them. They provide an extra possibility, an extra tool to nudge others to participate, yet can be considered just-in-case add-ons. Possibly, leaving space on the 'like' stickers to add a short message, could serve a similar purpose.

Conclusions and discussion

The envisioned result of the social design project Streetstarters was twofold:

(i) to create a low cost design intervention to catalyse social encounters at street level; and
(ii) to develop and to make use of a design-driven, participatory process to come to this result, but which at the same time could inspire other municipalities to follow the example of Streetstarters (as a workable process for design for social innovation).

Both aims have been achieved. MIOS as a product fulfils the constraints set in the beginning and has attracted significant attention from municipalities and individuals after it was presented at the annual conference of Flemish cities and municipalities (VVSG Trefdag, 2012). Studio Dott and Pantopicon have since presented the project to several interested parties. MIOS has in the meantime been used during the Flanders District of Creativity's Week of Creativity in Turnhout, Belgium (November, 2012). Beside that, MIOS has been awarded with a Henry Van De Velde Label and a Core 77 Design Award.

The intervention

In the streets in which MIOS has been deployed it has clearly had an impact on the amount and nature of simple encounters between people living in each other's immediate surroundings. We witnessed everything from simple conversations to more profound connections being made through MIOS, e.g. one passer-by got into a conversation about instruments on display and, consequently, ended up as a musician in the orchestra of the exhibitor. In general, the impact could at least be noticed during and shortly after the exhibition period. Further research would be needed in order to understand longer lasting effects. The street exhibitions did not only serve as a catalyst for conversation between exhibitors and spectators. Also amongst mutual spectators there has been quite some interaction: sometimes ephemeral, between accidental passers-by, sometimes more debate-like, amongst family members or groups of neighbours making their rounds as curators along everything displayed. In the days prior to the street exhibitions one could notice an increased degree of interaction between neighbours as well. As it was expected, it is crucial to identify people already fulfilling key roles in streets or with the skills and willingness to do so as entry points to the local community. When they participate, others generally follow, thereby setting the example. It turns out that even these frontrunners, when carrying some MIOS kits to distribute, were stimulated to put a little more effort in starting a conversation with neighbours to whom they usually barely speak. However, it should be noted that we have witnessed that a street representative who lacked the time to properly engage her neighbours failed to properly start a MIOS project.

In general, we were pleasantly surprised to notice that the exhibitors were much more expressive than expected, which could be an indication of a clear need for a motive for conversation among the neighbours.

The process

The intensive observation and conversation techniques that we have used in our analysis have helped us to come to insights that have proved to be much richer than those that we had taken from the literature available to us. Not only have these tools allowed us to get a stronger grasp of the phenomenon of 'social encounters' in the specific context of the neighbourhoods in Antwerp, our visibility and intensive presence in the selected streets have provided us with privileged access to the experiences and the context of the inhabitants. Besides that, we can assert that the project and its theme as such – social encounters – became a subject of conversations between inhabitants as well. By making use of the self-explanatory probe kits and by organising reflection sessions we have been able to gain additional insights into neighbourhood dynamics. Not only did we gain a better understanding of the experiences and specific (latent) wishes, needs and ideas of our target audience, which through the use of these specific tools could engage simultaneously as both co-creators and test-audience for our shared ideas. This enhanced the participatory character of the social design project. By rendering the input of street inhabitants visible and tangible we allowed designers and a wider stakeholder community to mutually build upon a common ground.

During the process we were well aware that the level of involving the target audience could have been a lot higher. Since this project needed to deliver a tangible end result within a certain timeframe and a certain budget, we had to carefully evaluate at which points stakeholders could be involved. A very important, and often somewhat neglected, element that made this project possible within the tight budget was the involvement of a partner (the city of Antwerp) who could give us access to their existing network of stakeholders. Last but not least: while a strong bond with participants is essential to any user-driven design research to build capacity for eventual results, it should be noted that strong involvement of designers could be time consuming.

Streetstarters can be considered a success both in terms of process and result. First and foremost it provides another illustration of the value of design in tackling societal challenges. Furthermore, MIOS has been released as a creative commons project and is hence available to any 'street' or city willing to invest in enhancing their social tissue. Yet aside from MIOS as a result, the design research and participatory process, as such, has equally shown its value and can be considered generic to a certain extent. It facilitated a clearer mapping of the problem space, allowed various valuable design insights to rise to the surface, all while involving key stakeholders in the issue at hand. Through the process they were given a voice and were enabled to render tangible their tacit, often latent, needs.

Acknowledgements

The Streetstarters project originates from an open call by Design Flanders and the Flemish Association of Cities and Municipalities. Both organisations were funding "a social design project in collaboration with a Flemish municipality". The project partners Studio Dott (formerly known as Concrete) and Pantopicon, both located in Antwerp, chose to collaborate with the city of Antwerp (Belgium).

Notes

1 "With generative techniques, participants are guided in small steps to constructing and expressing deeper levels of knowledge about their experiences. In this way it is possible to get access to a hidden world of user experience, and thereby build a better understanding of it, which can then be used for design purposes" (Sleeswijk Visser et al., 2005: 122).
2 "Probes are collections of evocative tasks meant to elicit inspirational responses from people – not so much comprehensive information about them, but fragmentary clues about their lives and thoughts" (Gaver et al., 2004: 53).
3 Visual representations of a concept that illustrate the envisioned product or service in a story-like way, showing how people interact with the concept in a certain context.

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39

THE 100-MILE SUIT PROJECT

Kelly Cobb

Introduction

Our clothing is our second skin, a pliable shelter. In contrast, the apparel and footwear industry is highly globalised with a supply chain that stretches around the world, almost completely disengaged from the consumer. The 100-Mile Suit – the result of a six-month design experiment that utilised a regional supply chain with the aim of reintegrating and reconnecting the wearer of clothes to local trades and economies – was intended to introduce a dialogue about resources and community, an attempt to unravel the disconnect of consumer to product. Originally developed as part of a museum exhibition focusing on local communities and collective gestures, the 100-Mile Suit project employed virtual spaces of blog and internet for collaborative dialogue as well as a physical museum as a production space during demonstrations akin to 'sheep to shawl' events. A regional garment supply chain was simulated, wherein the community could witness the process of making clothing, talk to the makers and touch the materials.

Why clothing?

Clothing functions as a cloth familiar. Psychologically, a garment is the wearer's pliable context, a tangible imprint of individual and relational identities. In contrast to the phenomenological relationship each of us develops as a wearer of clothing to our wardrobe is the role we play as consumers of clothing. The apparel and footwear industry is highly globalised – a complex system wherein designers of clothing are strategic problem solvers succeeding in co-opting the phenomenological power of our relationship to clothing with effective methods that disengage wearer from innate sensibilities. According to Bye, "Clothing and textile design has a long tradition in creative practice and apprenticeship, but due to the increasing complexity of our world there is a need to formally capture the knowledge of our field" (2010: 15). While the 100-Mile Suit project was initially positioned as an experiment based within design practice, the project offers meaningful insight into how research through design might be communicated.

The 100-Mile Suit was a durational clothing experiment that explored how design might inspire the reintegration and reconnection of the wearer of clothes to materials and processes as well as local trades and economies involved in the construction of a garment. The experiment combined traditional textile working processes, performance art, social media and potluck dinners as a form of social practice. The work did not exist as a static object, but instead manifested as a dynamic happening, reminiscent of demonstrations that occur at farm shows and regional/seasonal festivals. In terms of a design experiment, the context of traditional textile demonstration was transposed to contemporary art museum.

Intended to be the introduction of a dialogue about resources and community, the 100-Mile Suit was originally developed as part of a museum exhibition focusing on local communities and collective gestures, 'Locally Localized Gravity' held at the Philadelphia Institute of Contemporary Art (ICA) in Philadelphia, PA.

Both an exhibition and programme of events, 'Locally Localized Gravity' focused on the phenomenon of artists as producers. Artists ran exhibition spaces, organised music and performance events and published fanzines. Boosted by Philadelphia's vibrant arts scene with its do-it-yourself ethos, the exhibition also included artists from other cities, featuring over 100 total visual artists, musicians, performers, writers and other creators working in a participatory, communal and almost tribal space.

The 100-Mile Suit project utilised the museum galleries within the Philadelphia ICA as a production site during demonstrations where the community could witness a variety of processes utilised in garment-making (for example, brain tanning of deer hide, felting, weaving and spinning), talk to the makers and touch the materials. Twenty-three regional farmers, knitters, weavers and crafters worked over 506 collective hours to complete the suit.

This case study surveys the 100-Mile Suit project highlighting key questions and themes involved. This chapter chronicles the project via keystones and highlights text and image sampled from the companion project blog.

Background and context

The 100-Mile Suit was a project created while in residence as a guest designer in the 'Sweet Green Hangout', a satellite greenhouse exhibition space curated by Lure Projects and situated within the larger 'Locally Localized Gravity' event. The project's aim was to costume Aaron Igler, curator of Lure Projects, in an entire suit of clothing from materials and labour sources within 100 miles of Philadelphia.

Themes of duration and region of origin were parameters that shaped the project. Designers were keen to apply experiments similar in theme to Alisa Smith and James MacKinnon's 100-Mile Diet – a year-long project that required the couple to buy or gather their food and drink from within 100 miles of their apartment in Vancouver, British Columbia – to the tools and talents specific to a background and interest in apparel design. Viewed as a regional and temporal design exercise, this project adopted aspects from innovative system models engaged with in daily life. Aspects of engagement sourced from innovative models of transportation (car-share initiatives) and food (a community supported agriculture (CSA) programme) were adopted.

Preliminary experimentations with this theme were pedagogical in nature. The challenge was posed to textile science students at the University of Delaware to trace the sourcing of the clothing they were wearing. This proved problematic, and the experiment failed. The Philadelphia ICA exhibition seemed to be an ideal venue to frame a fiber-to-finish apparel design experiment. The 100-Mile Suit project commenced at the beginning of the Philadelphia ICA exhibition, and on the last day, the finished suit was worn by the curator.

Timeframe

The span of the project from design research phase through to final garment was six months, the length of the exhibition. The preliminary research was conducted during the first two months

(October–November) of the project and involved making initial contacts with local materials and artisans. During the third and fourth months (December–January) raw goods were processed. During the processing phase, a demonstration day was organised within the galleries of the Philadelphia ICA. The collaborators worked on-site during this day to process raw materials and commiserated as small cluster groups, each representing a line of production. The fifth month (February–March) marked the production phase of the project wherein collaborators constructed the product. There were several production clusters within the project that related back to a fiber and forward to a finished garment. During the final month (March) the ensemble was patterned, sewn and finished. The final suit was revealed during a closing event at the Philadelphia ICA.

Intended outcomes

According to Bye, "Research through practice is initiated based on a problem or question that is derived from practice" (Bye, 2010: 215). In this case, the 100-Mile Suit was primarily a literal examination of the question, 'Where did you get your outfit?'. The project adopted the production model of a fiber-to-finish demonstration to explore clothing design and development in a public arena wherein a regional clothing supply chain was made accessible for the public to witness, touch, participate in and communicate. In this way, the project harnessed the potential of parallel initiatives (such as the 100-Mile Diet, and akin to movements such as CSA, local car-share transport and creative collectives) in terms of shifting peoples' relationship to their clothing.

The 100-Mile Suit explored whether design (on a small scale) could be used to mend one's relationship with clothing. Is it possible in this day and age to make local clothing, asking one to imagine a transformed relationship of wearer to garment, and what would that look like? Might a regional clothing supply chain exist that actually functions and is accessible (and interact-able) to the public? As a clothing collaborative working together might it be possible to weave the complexity of connection that exists within a supply chain into a social textile that could be visualised and shared?

The outcomes of this project – the suit itself, academic writing and a video animation – exist as tactile signatures of a design conversation mapping labour and raw material, bringing performance art sensibilities to an every-day object as a symbol of connection.

Fashion is a social tool: communicating collaborative design

Fashion culture has long been associated with issues involving labour and collective identities. Pre-industrial textile production was comprised of annual cycles and rituals of collective labour that existed on a domestic scale. Inherent in the transformation of unprocessed fiber to finished garment were interactions that linked fiber to the human body, and labourer to the wearer of clothing, as well as makers to each other. The process of transforming fiber is inherently collaborative.

Within the process of design, the 100-Mile Suit employed traditional textile processes such as spinning, dyeing, weaving and knitting to construct the textile and garment. The notion of textile construction was also employed as a figurative gesture with the notion that the textile connects one to its origins sympathetically and through the senses. In this way, textile processes were adapted as a system of collective interaction.

According to curator and textile theorist Lydia Matthews:

> by making 100-Mile suit's activities into an occasion for regenerating traditional heritage, bringing it into contact with the most advanced technological and organiza-

> tional possibilities, encouraging barter exchanges and gifting, Cobb and her team of co-producers turned the project into the seed of a new local culture and economic model.
>
> *Matthews, 2009: 13–14*

Where did you get your outfit? Communicating a regional clothing supply chain

In an interview with Laura Sansone, designer of the Textile Lab, she speaks of the textile apparel supply chain from a community perspective. Similar to Textile Lab, thinking about the supply chain in terms of regionalism and transparency is a key aspect of the 100-Mile Suit:

> I think of the socioeconomic aspects of sustainability, and how to enrich communities through material production. Also, looking at who is making the work and where the materials originate. It's really about designing with transparency, about realizing the interconnectedness of products and systems, and finding alternatives to commercial production. I think one way to do that is to think about things in a decentralized way, in a way that's more local, so that communities are more in control of production and consumption.
>
> *Mae, 2012*

The 100-Mile Suit made use of both virtual and physical sites of production. A blog served simultaneously as a mode of communication and archive for the project while the physical

Figure 39.1 100-Mile Suit (demo ay), 2007

Source: Photograph courtesy of author

museum space accommodated a functioning, tactile and accessible regional clothing supply chain.

Sites of production: internet and blog

The internet was utilised as the primary means of material, labour and information sourcing. Search engines provided a functional means to uncover a wealth of regional resources. Sites such as trade forums and enthusiast blogs were key in terms of connecting with crafters, artists and farmers to form a micro-regional textile and apparel supply chain.

Lydia Matthews, a theorist who has written about this project, describes this method of communication aptly:

> Through intensive internet research, [Cobb] found the sheep on Ewe can Do it Farm who provided the wool, spinners, dyers and weavers like the artist Mary Smull to transform it into cloth, leather makers and cobblers, knitters, hunters who could transform animal horns into buttons—all of whom were willing to participate in the project, many meeting one another for the first time.
>
> *Matthews, 2009: 13–14*

According to Bye, "An empirical approach that uses design practice and the resulting designs as the source of data requires a transparent record of the design activity from the designer" (Bye, 2010: 16). The100-Mile Suit project blog was utilised by the 23 collaborators to share knowledge about their material processes as well as connect with people in their production

Figure 39.2 100-Mile Suit (production cluster: Shirt), 2007

Source: Photograph Aaron Igler

clusters. Production cluster is a term I created to describe satellite supply chains that existed for each garment (for example, the 100-Mile Shirt production cluster: Sheep: Sunny; Spinner: Judi; Weaver: Mary; Garment Design: Annie; Bone buttons: Michelle; Wearer: Aaron). Excerpts from the project blog are shared in the report section of this case study.

Sites of production: the museum space

100-Mile Suit collaborators utilised the physical space of the Philadelphia ICA as a base of operations and production site. The demonstrations included many of the crafters working on the project. In the sunny environs of the 'Sweet Green Hangout', the public was able to experience first-hand many of the processes being employed in the development of the 100-Mile Suit, including discussions on the brain tanning of deer hides, wool spinning, loom weaving and hand felting. The demonstrations provided an opportunity for collaborators to connect face to face, to begin processing materials and strategise the fiber-to-finish assembly for each individual garment.

Report on the 100-Mile project via blog: process diary and archive

The following part of the chapter chronicles research and development of the making of the 100-Mile Suit. The process of connection, production and construction was captured in the form of a blog diary and is shared here in diaristic form.

The connection phase

After visiting the Duchess County Sheep and Wool Festival, the largest festival of its kind on the east coast of the United States, in late October, and finding few resources of regionally processed wool, I utilised the internet as my primary means of material and labour sourcing. I had amazing success in connecting with crafters, artists and farmers.

I emailed the New Jersey, Maryland and Pennsylvania Sheep Breeders associations. Toni Kellers of the Pennsylvania Sheep Breeders Association replied and connected me with two Avid spinners from an active community of regional farmer/crafters, and this is how I met Marlene Halstead and Judi Lerphaupt.

Heather House of the Pennsylvania Association for Sustainable Agriculture was a great help and led me to her boyfriend, who in turn introduced me to his brain-tanning teacher, wilderness expert Andrew Twele of Maryland. I posted a call for a shoemaker on an online Cordwainers forum called the "Crispin Colloquy". Marie Wigglesworth (a fitting name) of Hatboro, PA contacted me via this forum.

Subsequently, I found enthusiastic spinners Rachel Zakaiasen, Nichole Wolverton and Caroline Maw-Deis by posting on sites such as Philadelphia Knitting Meetup Group, Craigslist as well as connections made through local yarn stores Loop and Sophie's.

Ewe Can Do It Farms was the first farm I visited. There, Judi Lerhaupt runs a small Shetland operation near Newtown in Bucks County, PA. Judi is a speech pathologist and is in her third year of a five year low-residency master spinner programme at Haliburton School in Ontario. Her sheep, Magic, provided the grey wool for the felted jacket.

Blog post by designer Kelly Cobb, dated 17/1/07:

> I visited Toni Kellers today at the Shepard's Croft farm near Quakertown. Toni raises Cheviots. Brown and creamy colored fleeces she hails as a spinner's dream. American Miniature Cheviot Sheep originated in the Cheviot Hills between England and Scotland. They are white or black, with small heads and erect, pointed ears. They lamb easily. Their fleeces provide a medium wool with a distinctive helical crimp and a long staple, perfect for hand spinning. Shetland sheep came to the US from Scotland. They are known for the fine neck fleece that provides the wool for "wedding ring shawls" that is so fine that it can be drawn through a wedding ring. They are hardy little sheep favorable to hand spinners because of the variety of coloration inherent in their fleece. Toni suggested we visit her neighbor Karen at Sheep Shelter farm right around the corner. Karen had a pot of soup and a kitchen full of friends. We visited her Karakul sheep. There were newborns in the barn, small, curly and black.

The design process (process is the product)

During the demo day at the Philadelphia ICA on 27 January 2007, the 100-Mile Suit collaborators utilised the physical space of the ICA and the 'Sweet Green Hangout', the Lure Project's Greenhouse exhibition space, as a base of operations. The demo day included many of the crafters working on the project. In the sunny environs of the 'Sweet Green Hangout', the public was able to experience first-hand many of the processes being employed in the development of the suit, including discussions and demonstrations on the brain tanning of deer hides, wool spinning, loom weaving and hand felting. The demo day provided an opportunity for collaborators to connect face to face, to begin processing materials and strategise the fiber-to-finish assembly for each individual garment.

Figure 39.3 100-Mile Suit (spinning, tanning, weaving), 2007

Source: Photograph courtesy of author

Blog post by designer Kelly Cobb, dated 27/1/07:

> We had a core of 5 spinners present for the Demo Day. Each spinner brought her own wheel. Judi and Toni brought large baskets of fleece. In the adjacent greenhouse Andrew Twele set up a fresh hide to skin. A table was set up for felting and in the far end of the greenhouse was Mary and her loom.

Blog post by tanner Andrew Twele, dated 20/1/07:

> Buckskin is the softest, most supple types of leather available. In fact it feels more like a fabric than it does a leather (technically speaking, it is not a leather). A very small percentage of deer skins are considered 'garment quality.' That is you will always find a couple bullet or arrow holes and some knife marks from skinning. But I hand select my skins to minimize such defects. But I think the resulting repair stitches (which are part of my process) add character.

Blog post by designer Kelly Cobb, dated 07/2/07:

> Roughly 8 percent of the essential suit materials (thread, shoe soles, the combing process for some of the wool) is outside of our margin of 100 miles and will need to be dyed yellow-yellow being a signifier of being outside the margins.

Blog post from spinner Mac, dated 26/1/07:

> Kelly has two skeins of sock yarn I spun up for you yesterday – I think there's about 170 yards. Today I spun up another 170 yards. Aaron wears a size 11.5 shoe. As you might imagine, 340 yards of sock weight might be stretching it for a good pair of socks.

Blog post from spinner Marlene, dated: 30/1/07:

> I have a bobbin filled & will take it off to measure today. The white I sent was an example of worsted prepared & worsted spun yarn. It is combed lock by lock in order to spin in the grease as it was grown. As far as I know there is no mill in the USA producing worsted prep (top or sliver) for personal use. It must be done by hand which I do as a demo of colonial spinning.

Blog post from weaver Mary, dated 29/1/07:

> Judi and Toni will be spinning the shirt yarn. I need a grand total of 2400 yards – and that's just using your yarn as weft! Marlene, I will need 2880 yards of the same weight you sent us in your samples. I believe we are going a little darker with the pants than the shirt, so I think the gray (Thunder the sheep) is probably best.

Limitations and opportunities

At the inception of this project I asked: "is it possible to design a full garment sourced locally?". My answer is, given the timeframe of the 100-Mile Suit project: "No".

Lydia Matthews, in her discussion of the100-Mile Suit articulates the limitation/opportunity of such a project: "and OK – never mind that it didn't fit – this is a proposal, not a glamorous finished product! It is iterative and meant to be improved, expanded, multiplied" (Matthews, 2009: 13–14).

Indeed, the project has been adopted, has been improved and multiplied. I am regularly contacted by designers, researchers, educators and artists requesting to adopt the project idea or simply and to 'run' with their own versions of a 100-Mile Suit project or wishing to access the project as a teaching tool in a classroom situation. Some examples of projects that have linked to the 100-Mile Suit site are:

Rebecca Burgess and **The Fibershed Project**: Focused in the Northern California area of the United States, 2010. The Fibershed Project sought to put a face on the bioregional clothing movement, through a wardrobe that will be filled with functional and beautiful designs that speak the intricate language of the landscape, and reflect a balanced and healthy relationship with the earth's ecosystems. The goal was to use one year as a period for research and design, as well as a year to garner publicity for the local, green and healthy clothing movement. As of 2013, Rebecca is working as a restoration educator researching the harvesting of colour from natural materials.

Huantian Cao and **Twenty Miles from Field to Fashion**: Localised production of textiles and accessories in collaboration with Christine Howard, Karen Piro, Hillary Tattersall and John Frett, University of Delaware, United States, 2011. This project involved the design and development of a line of garments and accessories using fibers and dyes harvested from the agriculture college in our university and ranches within a 20-mile radius of the campus of the University of Delaware. Most recently, the research team has received a grant to experiment with sustainable forms of leather tanning.

Laura Sansone and **HouseWear**, 2012: HouseWear is a design studio and research lab for handmade textile production. Their materials are sourced from regional farms and they enlist local factories, guilds and co-operatives in the manufacturing of textiles. They use natural dyes and organic fibers so all materials are recyclable and compostable throughout the production process. Laura currently conducts The Micro Textile Lab. Situated within the greenmarkets of New York City, the lab aims to teach people natural dyeing, spinning and weaving techniques.

Feedback

Participant observations pointed to the personal and professional value of this collaboration as stated in feedback generated from a post-project survey and interviews with participants and audience members. (Audience/Participant reflecting on her experience of the demonstrations via the project blog: "Wow! seeing the process and labor that went into this suit makes the end product seem that much more amazing, and really brings home the underlying concept.") Feedback from participants indicated the importance and relevance of the project. (Collaborator and master spinner Judi Lehrhaupt reflecting on her experience: "This project helped me to put the world in perspective yet again. We take too much for granted, and our young people would benefit from learning the truth about where their clothing and food come from.")

How realistic or fundamental is it to attempt to source clothing locally? After all, people have been trading raw materials across the globe for thousands of years. In 2013 it is ambitious and commendable as an exercise although not possible at the scale and price point consumers are comfortable with. This is due to the fact that (in the United States) we lack a textile manufacturing infrastructure, as it was dismantled and exported in the 1980s. We lack a youth population who are being trained in skilled labour, and who see a life of factory work as a positive and fulfilling career.

More important than the true lack of a contemporary regional textile supply chain is the aspect of the project as communicator, and how the process of making a suit invited dialogue, reflection and connection with what I called earlier the most immediate of daily interactions – that of the wearers relationship to their clothing. In writing about the project, textile blogger Kristen Hughes reflected on the significance of the blog, she states:

> the blog records correspondence between the suppliers, craftsmen, and organizer. You hear ideas in their own voices and get a sense of the process. Coordination of the work seems to have been as much of an accomplishment as production of the suit was.
>
> *Hughes, 2011*

The 100-Mile Suit allowed the participants at the ICA – not just collaborators – to make a connection to garments/garment making.

Outcomes and conclusions

Themes of duration, production, process and collectivity shaped this project. Outcomes were determined by the unique relationship between collaborators and project-situational design parameters. Originally developed as part of the 'Locally Localized Gravity' exhibition at the Institute of Contemporary Art, Philadelphia, PA, a project abstract was presented at the College Art Association Conference in Dallas, TX, and the final garment display was exhibited in Ethics+Aesthetics at the Pratt Manhattan Museum. The Strands of Production video animation (available for viewing at the following link: www.garmentresearch.org/wpress/?page_id=157) visually conveys the production clusters, putting a face on the clothing supply chain of each garment.

The 100-Mile Suit project explored how design might inspire the reconnection of the user of products to the materials, trades and economies involved in its construction. Demystifying the complex system involved in the production of products used on a daily basis is a goal of many contemporary design projects. Among them, designer Thom Twaits traces material through the supply chain globally in an attempt to make an electric toaster, from scratch, in The Toaster Project. The Happy Meal Project is a durational photographic essay, conducted by photographer Sallie Davies, that chronicles the decomposition of a popular fast food children's meal. The lack of visual decomposition of the mass-market hamburger and serving of French fry that emerges after 1,000 days is compelling and calls into question the origin, quality and health of the food product.

The 100-Mile Suit was a small-scale study of a regional apparel supply chain; however, large scale apparel companies are also addressing issues of transparency in innovative ways that link user to product. The Footprint Chronicles, launched in 2011 by Patagonia, is an interactive map that examines Patagonia's life and habits as a company. The goal is to use transparency about their supply chain to help in reducing adverse social and environmental impacts – and on an industrial scale. Track My Tee is an interactive website that chronicles the journey and environmental impact of a t-shirt, from cottonseed to consumer.

The 100-Mile Suit project model is being expanded into a National Collection. The *National Costume Collection* is a series of regional garments constructed in local artisan workshops around

Figure 39.4 100-Mile Suit (materials, exhibition shot, detail), 2007

Source: Photograph Aaron Igler

the country. The shared mission of the artisan workshops is to experience first-hand the creative, social and environmental conditions under which a fashion ensemble is created. The project deliverables include up to 50 garments, described as tactile signatures. Similar to the 100-Mile Suit project, an interactive website would chronicle the process paying key interest in the process as a form of intangible heritage. This website would include a map that links to an archive of process. The collection would travel and be exhibited in an effort to raise awareness and demystify the textile and apparel supply chain.

In the production of the 100-Mile Suit, the connection to material, maker and wearer of clothing was made tangible. This project employed textile techniques both metaphorically and physically to map how a garment is made, therefore communicating dynamic collective systems of interaction that exist between designers, makers and materials within the space of production. The suit and ancillary outcomes reflect an honest dialogue that develops between individuals – a tactile signature of a collective gesture at a specific moment in time.

According to Fiber theorist Judith Leeman:

> Contemporary incarnations of fiber work explore repetition and durational labor at the intersection of handicraft work and contemporary art and performance, endeavoring to investigate and expose the gesture of handicraft as a radical reassertion of agency and restoration of integrity.
>
> *Leeman, 2007*

On the whole, the 100-Mile Suit communicated a strong conceptual commitment to identifying and integrating the creative and material resources of the Philadelphia region. By proposing to fabricate a performative outfit assembled exclusively from local resources, the project challenged the viewer to reconsider the nature of the garment, fabrication and function alike.

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CELEBRATING THE PLURALITY OF DESIGN RESEARCH

Paul A. Rodgers and Joyce Yee

In recent years, there have been increasingly lively debates about design research. Much has been written and discussed about how we undertake it, how we define it, what methods we use, how we disseminate it, how we evaluate it, and much more. These debates are not new. Fifteen years ago Susan Roth (1999) in her *Design Issues* paper entitled, "The State of Design Research", claimed in her opening sentence that: "Design research is an activity in search of a definition" (Roth, 1999: 18). Roth described design research as an activity that relied upon and exploited a range of research methods and applications in both design practice and education, noting that the state of design research at that time was broad, ranging from the simple process of examining existing products in the marketplace to the more complex process of analysing social, cultural and psychological factors associated with new product design, development and use.

Similarly, in the same issue of *Design Issues*, Nigel Cross (1999) highlighted the wide-ranging nature of design research by claiming: "Design research is alive and well, and living in an increasing number of places" (Cross, 1999: 5). Cross went on to list the evidence for this diversity in design research as the growth of research-based journals over a period of ten to fifteen years which included learned journals such as *Design Studies* (launched in 1979), *Design Issues* (1984), the *Journal of Design History* (1988), *Research in Engineering Design* (1989), *Languages of Design* (1992), and others in other languages, such as *Temes de Disseny* (1986) and *Form Diskurs* (1996). Cross also highlighted the publication of design-oriented research in a wide range of journals concerned with subjects such as artificial intelligence, human–computer interaction, and others. He claimed that: "Compared with the academic design scene in the 1970s, we now have a rich culture in which to grow our design research seedlings" (Cross, 1999: 5). Of course, there are now many more design journals in circulation than there were in 1999.

More recently, over the course of the last ten to fifteen years, there has been a significant increase throughout the world in interest in the subject and value of design research. For instance, the number of design doctorates awarded in the UK alone in the last 20 years has more than doubled (Fisher et al., 2006). Moreover, the emergence of a number of major international conferences dedicated to doctoral research in design and related subjects (Buchanan et al., 1988; Durling and Friedman, 2000; Durling and Sugiyama, 2003) reflects this growing interest in the nature of design research in general and the design doctorate in particular (Durling, 2000).

Also interesting in these design research debates are the robust disputes around research methods. These often territorial engagements appear to have missed the general understanding within disciplinary scholarship that any discipline having robust discussions about research methods is a discipline in crisis (Law and Urry, 2004). This point is also made by Cross (2001) when he reminds us of the concerns every 40 years or so in design research. He points out the issues in the 1920s where the search focused on developing scientific design products and then again in the 1960s when the concern shifted to finding a scientific design process. Perhaps it is no coincidence that during the start of the 2000s another crisis about the development and usage of appropriate research methods and approaches in design has resurfaced.

Much of design research in recent past years has had a fascination with producing objective and rational pieces of work and as such this has led to notions of 'scientising' design. Today, however, we can see strong evidence of design research emerging from the clutches of this fascination with the rational and the measurable to a situation where a greater emphasis is placed on the more socio-cultural aspects of design and the greater context-dependency of knowledge that is produced. These new forms of design research do not wish to drive further divisions or engender clear splits between science and design, but rather wish to cultivate a more harmonious convergence of scientific and designerly approaches to research. As we move rapidly towards the second decade of the twenty-first century, we need to find new ways in design research where we acknowledge variety, where we enrich different ways of thinking, creating, cooperating and investigating design and how it can be best used in our increasingly complex world.

In short, if *The Routledge Companion to Design Research* has one message it is that we should celebrate the plurality of design research and embrace the generous, inclusive, explorative, serious, creative, critical, participative and inquisitive attitudes that prevail in contemporary design research.

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