

Advances in Environment,
Behavior, and Design

VOLUME 4

Toward the Integration of Theory,
Methods, Research, and Utilization

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Toward the Integration of Theory,
Methods, Research, and Utilization

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Preface

This fourth volume in the *Advances in Environment, Behavior, and Design* series continues the intent of earlier volumes by exploring new directions in the multidisciplinary environment–behavior (EB or EBS) field. The series is organized around a framework of theory, methods, research, and utilization that some say has defined the field for the past 15 years. This fourth volume is devoted to chapters that explore the integration of theory, quantitative and qualitative research, and utilization in policy, planning, and architecture.

The authors selected for this volume exemplify the multidisciplinary character of the field—they have been selected from architecture, environmental psychology, environmental studies, housing research, landscape architecture, social anthropology, social ecology, urban design, and urban planning; from academe and practice; and from Australia, Europe, and North America.

HISTORY OF THE *ADVANCES* SERIES

The idea for the series emerged in 1983 at meetings of the Board of Directors of the Environmental Design Research Association (EDRA). Several publishers were contacted about the possibility of an EDRA *Annual Review*. Eliot Werner at Plenum Press expressed great interest but suggested that an *Advances* series would be more appropriate since publication could be tied to a less specific timetable.

EDRA, Plenum, and the editors signed a contract in June 1984 for three volumes, with an open door for oral agreements between Plenum and the editors after that time. Four volumes have been published (Volume 1, 1987; Volume 2, 1989; Volume 3, 1991; and the current Volume 4), each containing 10 to 12 chapters.

Series Editors. Ervin Zube and Gary Moore launched the series. After Volume 3, Erv Zube resigned in order to devote more time to research on

landscape management (see the Preface to Volume 3, 1991). With the concurrence of the board, Robert Marans joined Gary Moore as coeditor for Volume 4.

Editorial Philosophy and Content. From the beginning, the idea of the series has been to produce volumes that would summarize, critically analyze, and synthesize major domains of EB research and professional utilization. The series has tried to emphasize state-of-the-art contributions from leading scholars in the broad array of disciplines contributing to environment, behavior, and design. It has attempted to balance—and in the current volume, to show integrations among—theory, methods, research, and utilization.

Each volume has attempted to highlight the most important advances in the field since the publication of the *Handbook of Environmental Psychology* (though published in 1987, the same year as the first *Advances*, it was begun considerably earlier) and since the publication of the previous *Advances*. The series has aspired to extend the *Handbook* and to produce an archive of the most important advances in the field.

Relation to EDRA and IAPS Conferences. As the series evolved, ideas for new chapters were examined in a series of symposia at EDRA conferences in North America and at IAPS (International Association for People–Environment Studies) conferences in Europe. The best contributions have appeared subsequently as chapters.

Critical Review. Critical review of the series has been very supportive. Academic and professional colleagues in the United States, Canada, Europe, Asia, and Australia have responded enthusiastically. The series is now on the shelves of leading academics throughout much of the industrialized world, and it is used widely in various architecture, environmental psychology, and social ecology undergraduate and graduate programs.

Reviews of individual volumes and of the series have appeared in a variety of academic and professional journals, including *Contemporary Sociology*, *Environment and Behavior*, the *Journal of Environmental Psychology*, and the *Journal of Architecture and Planning Research*. The most comprehensive review appeared in the August 1995 issue of the American Psychological Association's *Contemporary Psychology*.

End of the Series. The editors would have loved to see the series continue, but think it best to end with this volume. At the time the current editors were agreeing to Volume 4, Eliot Werner suggested that we all take a long look at the series in comparison to other ways in which we might more productively spend our time. While this particular series has come full circle, it is our firm belief that EDRA in North America and IAPS in Europe may well wish to continue being a part of active partnerships with major pub-

lishers to ensure a steady stream of handbooks and advances-type series in the field. Meanwhile both senior editors are moving on to new and challenging intellectual pursuits in the field.

The series has come full circle, starting with chapters on the endpoints of the epistemological continuum—radical phenomenology and radical empiricism—and ending with chapters that we hope point the way to new integrations across theories, research, methods, and utilization.

ACKNOWLEDGMENTS

In the preparation of Volume 4, we were assisted by many people. We would like to thank Robert Bechtel, Michael Brill, Kimberly Devlin, Mark Francis, Tommy Garling, Linda Groat, Stephen Kaplan, Powell Lawton, William Michelson, Rudolf Moos, George Peterson, Amos Rapoport, Andrew Seidel, Seymour Wapner, and Ervin Zube for reviewing and offering valuable comments on chapter drafts.

We extend our appreciation to EDRA and its various Boards of Directors and Publications Committees for a close and fruitful working partnership. The series would not have existed were it not for your cooperation.

We would like to extend a special thanks to our International Editorial Advisory Board (see the earlier series page), whose members have worked with us over the years, offering advice on the series as a whole and on topics and potential authors, and reviewing drafts of all chapters.

And we would like to thank Eliot Werner, our executive editor, and the very able staff at Plenum Press for all their advice and assistance.

We have enjoyed working with all of you—authors, reviewers, Advisory Board, EDRA, and Plenum Press—the series has benefited from your many efforts.

GARY T. MOORE
ERVIN H. ZUBE
ROBERT W. MARANS



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**Toward the Integration of Theory,
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Toward Environment– Behavior Theories of the Middle Range

I. THEIR STRUCTURE AND RELATION
TO NORMATIVE DESIGN THEORIES

GARY T. MOORE

The purpose of this chapter is to examine several epistemological questions underlying the nature of theory in the environment–behavior (EB) and design fields.¹ Among these questions are: What is an EB theory, or, said differently, what are the necessary and sufficient conditions for something to be called a theory? What is the form and scope of different things that purport to be theories dealing with EB relations? What are the similarities and differences between EB theories and design theories, and is it possible to integrate theories linking environment, behavior, and design?²

¹In their very influential chapter on world views, Altman and Rogoff (1987) refer to the discipline as “environmental psychology.” The more general term “environment and behavior” encompasses environmental psychology, behavioral and social geography, environmental sociology, human factors, social and behavioral factors in architecture, and urban social planning. The range of theories discussed in this chapter will pertain not only to those in environmental *psychology* but also to those in the broader environment, behavior, and design field.
²These questions have been examined in a graduate seminar “Theories of Environment–Behavior Relations,” which I offered between 1983 and 1997 at the University of Wisconsin–Mil-

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THE NATURE OF THEORY

Science, the philosophy of science, and theory are concerned with the progressive improvement of human understanding of nature. The process of scientific inquiry includes the formulation of researchable questions, analysis of metaphysical presuppositions, research design, various methodological procedures of data collection and analysis, and the development of explanations for observed regularities in nature.

The question of this chapter is: What role do theories play in the progressive improvement of the understanding of nature and of the EB portion of nature in particular? The ontological subquestion about the nature of theory is: What kinds of entities and elements can properly figure in theories, and what is their role in the overall articulation and understanding of nature?

It is not the purpose of this chapter to explore all or even most of the issues about theory in our field. This would be an impossible task. Rather, I would like to adopt an idea attributed to the physicist Hildebrand, given in his 1973 commencement address at the University of Chicago and paraphrased later by Westheimer (1992): "We need to teach enough so that our students are able to cope with the books that have yet to be written (and the ones that exist but have not yet been read), with the economic principles that have not yet been formulated, and of course with the science that has yet to be discovered" (p. 38, his addition). Similarly, we need to address those issues that set the basis for understanding and developing theories of environment and behavior and for understanding their relation to knowledge and to policy, planning, and design, in preparation for those issues that are yet to be considered and those theories that are yet to be conceptualized.

HISTORICAL CONTEXT

Fields advance through research focused on the development and testing of theories and through investigations exploring fundamental issues.

waukee. The seminar explored the epistemology of theories, a range of EB theories, the relation between EB and design theories, and strategies for theory development. The latest syllabus for the seminar is available from the author. The ideas in this chapter have also been influenced by a series of symposia on theory organized with Ervin Zube, Robert Marans, and Linda Groat at Environmental Design Research Association (EDRA) conferences (Atlanta, 1986; Ottawa, 1987; Oaxtepec, 1991) and with Dries van Wagenberg at the International Association for People–Environment Studies conference (IAPS) (Delft, 1988). Other theory papers from these symposia have been published in earlier volumes in this series—Seamon (1987) on phenomenology, Winnett (1987) on empiricist theories, Kaminski (1989) on ecological theories, Lawrence (1989) on structural theories, and Groat and Déspres (1991) and Lang (1991) on EB/design theories. As this is the last volume in this series, it seemed an opportune time to reexamine and integrate some of the issues raised by these works and to try to put the question of theories of EB relations in a larger context.

The first attempts to move beyond traditional mythologies to a rational account of nature began during medieval periods with Ionian and Italian philosophers' rival discourses on natural philosophy.

The later philosophies of Plato and Aristotle rested on a mixture of ontological, epistemological, and empirical considerations (Toulmin, 1995). Plato believed, for example, that only a physical theory built on a numerical and geometrical framework could reveal the permanent structures and relationships behind the flux of phenomena in nature. Aristotle, being more interested in marine biology than in Plato's planetary astronomy, developed a very different scientific basis for theory. For Aristotle, the ultimate elements of nature were entities recognizable within the familiar sequences of empirical experience.

Following from the intellectual Renaissance of the sixteenth and seventeenth centuries, Descartes and Bacon revisited parts of the Platonic–Aristotelian debate (cf. Blake, Ducasse, & Madden, 1960). Descartes (1941) focused upon the problem of constructing self-consistent and coherent deductive systems of theory, while Bacon (1620) relied on theories only insofar as they were derived from empirically observed facts. Theoretical propositions for Bacon were justified only if they were based on empirical phenomena. Descartes, on the other hand, set out to show how all of the familiar phenomena of physics could be accounted for by a single, fully comprehensive system of mathematical theory.

During the next 150 years, culminating in the writings of Newton (1687; cited in Blake et al., 1960), the new physical sciences were constructed. The form of the resulting theories, as pointed out by Toulmin (1995), was not exactly what Plato nor Aristotle, Descartes nor Bacon had foreseen, yet they were influenced heavily from both rationalist and empirical directions. The theory of motion and gravitation in Newton's *Principia* conformed in part to Descartes's recipe for explanation of phenomena by recourse to an abstract mathematical theory. But also influenced by Bacon, Newtonian mechanics made no pretense of trying to prove in advance of empirical evidence that any assumptions were self-evident and valid. In this way, Newton devised in practice what scientists and philosophers of science have since labelled the *hypothetical-deductive method*, a combination of rationalist hypothesis generation and empirical testing and corroboration.

Since that time, theories have borrowed both from Platonic abstract forms and from Aristotelian scientific methodology, from Cartesian comprehensive principles and from Baconian empirical induction. But since Newton, the proper *form* of a *theory* has been seen as a mathematical system in which particular empirical phenomena are explained by relating them deductively to a small number of *general principles and definitions*. We will come back to this point several times later in the discussion of theory and of explanatory theories.

Neither totally empiricist nor totally rationalist, Kant (1781; cited in

Hendel, 1953) came to the position that knowledge of nature is contained neither solely in sense experience nor in rationalist arguments (see Hendel's introduction to Cassirer, 1953; Bochenski, 1966). Kant argued that those engaged in science confer a structure on what is taken to be knowledge through the concepts, categories, and cognitive structures that are brought to the formation and interpretation of experience.

Kant argued a position quite different from either empiricism or rationalism. He started with a fundamental distinction between the *matter* or content, or knowledge (i.e., that which corresponds to sensation) and the *form* of knowledge (i.e., that which causes the matter to be arranged in a certain order). Reminiscent of empiricism, the matter of knowledge is given through experience, but, reminiscent of rationalism, the form of knowledge is given a priori. Knowledge of the world is thus the result of a synthesis that the subject "constructs out of the formless stuff of experience" (Bochenski, 1966, p. 4). The form of knowledge, therefore, is not influenced by the environment; it is constant and universal.

Kant's epistemology is in several ways similar to both the empiricist and rationalist philosophies, but as both of those schools had one crucial assumption in common that was not held by Kant, it would not be appropriate to see Kant's position, or that of the neo-Kantian philosophers and psychologists who followed him, as midway between the two. Whereas both empiricism and rationalism, and subsequently neopositivism and idealism, assumed that one can understand the ultimate nature of reality, Kant argued that, since there is no way for us to apprehend the nature of "reality" except through particular minds, it is impossible to completely separate the process of knowing from the resultant knowledge. Kant argued that there can be no complete understanding of truth in either sense or reason; thus, instead of knowledge ever representing exactly what is real, what we take to be real is a product of the act of knowing—a *construction of thought*. The interpretation of nature embodies certain necessary structures imposed by the character of mind and by the procedures of knowing working in concert with the *aliment*, or "food for thought," provided by the world.³

WHAT IS A THEORY? THE TWO ESSENCES OF THEORY

According to a source that seldom does us wrong, the *Oxford English Dictionary*, *theory* is a:

Scheme or system of ideas or statements held as an explanation or account of a group of facts or phenomena; a hypothesis that has been confirmed or established by observation or experiment, and is propounded or accepted as accounting for the known facts; a statement of what are held to be general laws, principles, or causes of something known or observed. (Vol. 2, p. 3284)

³This conceptualization, referred to as *constructivism*, has been developed in detail elsewhere (Moore & Golledge, 1976, Chapter 1, esp. pp. 11–16; based on Hendel, 1953; Piaget, 1970).

For Newton, a theory was a system in which particular empirical phenomena are explained by relation to a small number of general principles and definitions. This is a common theme in the discussion of theory. Theory is taken as an intellectual construction to explain observables. Sometimes theory takes the form of what will happen to A when a change occurs in B, that is, a theory of antecedents and consequences, but this is not a necessary condition. A theory is a set of assumptions, concepts, and statements relating various concepts and including intervening constructs and mediating variables. But always, however, theory relates to and invokes *abstract principles* that are themselves not observable, but are taken as accounting for or explaining some observable part of nature. Theory is not simply a redescription of nature, a summary description, or a conceptual framework into which assorted findings can be plugged. Theory is *explanatory*, accounting for and explaining why something appears the way it does or happens the way it does.

Toulmin (1953) observed that explanatory theory is a coherent set of explanations answering the “why” behind observable phenomena. Nash (1963) offered that it is an abstraction on the concrete that serves to explain or make intelligible the concrete by reference to more abstract principles. As an abstraction, it is therefore nondeducible from observables, and is itself nonobservable. As Lang (1987) has remarked, “Theory building involves more than describing the world. It involves explanation” (p. 13). It is an intellectual creation, an induction from particular observables. Ittelson (1989) suggested that a scientific theory is a system of assumptions, accepted principles, and rules of procedure devised to analyze, predict, or otherwise explain a specified set of phenomena.

A second critical ingredient for theories is that they must be in principle *testable*. I accept the Popperian notion (Popper, 1965; cf. also Platt, 1964) that for a theory to be a scientific theory, it must be testable; that is, it is not necessary that it has yet been tested, only that it is testable. Once formulated as an explanation for a body of known phenomena, it becomes a theory. It need not yet have been tested. But it must be testable in principle; it must be constructed and stated in such a way that it is open to empirical testing and possible falsification or corroboration. Popper makes an important point not only about testability, but also about falsifiability, that a theory should not only be testable but should also be stated in such a way to make it eminently falsifiable. Then, to the degree that subsequent tests are unable to falsify it, it may be said to be corroborated.

In a classic article on the nature of science in molecular biology, Platt (1964) makes the corollary argument, based on empirical observations, that fields that progressed most rapidly, like molecular biochemistry of the 1960s, did so because their theories were stated in such a way to invite test and refutation and, even more particularly, in such a way that a critical experiment could discount one of two competing theories to explain previous

findings in a type of chain whereby successive new theories were developed, critical experiments conducted, one discounted, a new one created to incorporate the new and old data, and so on.

Examples of explanatory, testable theories in different subdomains of investigation abound in the EB field. Consider Christaller's (1933, cited in Haggett, 1965) central place theory of human spatial allocation, Burgess's (1927) concentric zone theory of urban structure and urban growth, Lawton's (1975) theory of adaptation in the elderly, Cohen's (1978) theory of environmental overload, Seamon's (1980) theory of environmental experience, and Taylor's (1987) theory of crime and disorder, among others. Each of these is a theory, and an explanatory theory.

We may conclude that the two essential ingredients of a theory⁴ are explanation and testability and that there are many explanatory, testable theories in the EB field.

EXPLANATORY THEORY: NECESSARY AND SUFFICIENT CONDITIONS

If testability and explanatory power are the essences of theory, then what might be a more articulated list of defining characteristics of theory? Asked differently, what might be the necessary and sufficient conditions for something to be called a theory?

I believe that *theory* can be defined in terms of eight necessary and sufficient conditions or criteria:

1. a *domain* of study, that is, a clearly defined, articulated, and agreed-upon slice of the universe that has been the object of sustained study, what Nash (1963) termed "domain definition" or what Ittelson (1989) called a "specified set of phenomena" (e.g., children, youth, and environments; urban neighborhoods; or all EB relationships);
2. a large set of concrete *findings* about the phenomena within that domain of study, that is, patterns of observed regularities within that segment of nature;
3. a set of abstract *concepts* or *propositions* about those phenomena, the findings organized into concepts or constructs, sometimes called *primary variables* in the philosophy of science or *constructs* in contemporary research methodology, often in several layers of increasingly abstract secondary and tertiary propositions or constructs;
4. *logical connections* showing the interrelations among the constructs;

⁴This will later be referred to as an *explanatory* theory to differentiate this conceptualization from world views and other more abstract and far-reaching constructions and from design theories and other prescriptive manifestos for action.

5. a set of *conclusions* or *linkages* drawn from the propositions and their interconnections linking them to the known findings in empirical reality⁵;
6. a set of unquestioned *axioms* or assumptions and a set of *philosophical assumptions* or *presuppositions* underlying the theory;
7. one or more *abstract principles*, which themselves are neither observable nor directly testable, but which are used to account for, interpret, and *explain* the patterns of observed phenomena, concepts, and linkages within the domain⁶; and
8. the whole set of principles, constructs, logical connections, and linkages to empirical reality phrased in such a way that the theory is *testable in principle*.⁷

To avoid unintentional confusion, perhaps we need an adjective before the noun "theory." Consistent with its usage in the philosophy of science, theory as used in the research side of our field may be called *explanatory theory* (what Lang, 1987, called *positive theory*).

THE FORM AND SCOPE OF THEORIES

There are significant differences in the use of the word "theory" in EB research and design. The same word is used to refer to two quite different entities. Furthermore, what one author calls a "model" another calls a "theory." In 1983, in preparation for a graduate seminar on EB theory, I identified 13 theories of EB relations (cf. Moore, Rapoport, & Krause, 1994). One example was Rapoport's (1969; cf. also 1977) classic book *House Form and Culture*. But on reflection, we may ask if it was truly a *theory*. What were its propositions? Did it make logical, deductive predictions about housing that are testable? Or is Rapoport's early work better conceptualized as something other than an explanatory theory? Based on Rapoport's recent reflections,⁸ I think we would have to conclude that he doesn't consider this early work to be a theory. Similarly, how might one best conceptualize the work of Wap-

⁵Cf. LeShan and Margenau (1982) for a complete treatment of this theme. I am indebted to Professor Amos Rapoport for leading me to this source and for his own analysis of their writing.

⁶Ever since Newton (1687/1968; cited in Blake et al., 1960), a fundamental characteristic of theory has been the postulated existence of nonobservable abstract principles held to account for observable characteristics of nature.

⁷Following Popper's (1965) notions of the logic of scientific discovery, a critical characteristic of theory—his demarcation principle—is that it be testable in principle, not that it necessarily has yet been tested or corroborated, but that the theory is structured in such a way that it is open to empirical test and can be falsified or corroborated. For a wonderful treatment of testability, corroboration, and falsifiability in use, cf. Platt (1964).

⁸Seminars presented at the University of Wisconsin-Milwaukee up to and including spring 1996.

ner and colleagues—their organismic-developmental work? Some have referred to it as a “theory,” but the authors themselves refer to it as a “perspective” (Wapner, Kaplan, & Cohen, 1973) or an “approach” (Wapner, 1981).

What is the epistemology of all of these different things that might on first glance seem to be theories? Is it possible to array them in some logical system of different theoretical constructions?

FORM: WORLD VIEWS, FRAMEWORKS, MODELS, AND EXPLANATORY THEORIES

It seems to be possible to distinguish among four levels or types of theoretical constructions in the field.

World Views: Theoretical or Conceptual Orientations. World views or conceptual orientations (e.g., Altman & Rogoff, 1987) may be defined as broad conceptual approaches to a subject matter. They are ways of thinking that orient an investigator to look at a domain of phenomena in a particular way and to identify interesting lines of research based on that conceptualization.

Take, for example, Rapoport’s (1969, 1977) cross-cultural writings (see also Lawrence-Zúñiga, Chapter 2, this volume). When we look at this important body of work, we may conclude that it is a very powerful way of thinking about EB phenomena seen through a cultural and cross-cultural point of view. We may say that it is a pair of glasses through which one can view any and all EB phenomena. The signal strength of his work is, in my opinion, this cultural/cross-cultural orientation. For any researchable question that a student might raise, Rapoport can ask, “How might that vary cross-culturally?” or “Is that specific to one culture? How would it differ in a different culture, and why?” One of his most substantial books, *Human Aspects of Urban Form* (1977), has the subtitle *An Approach to Urban Form and Design*. Rapoport’s work is, of course, more than just an orientation. Following from that conceptual orientation, he has formulated a number of more specific concepts, like activity systems, cultural variability, cognitive schemata, environmental codes, cultural cues, filters, lifestyle, and noticeable differences that can be applied to a wide range of phenomena (Rapoport, 1977). But while unquestionably being a most important contribution to the EB field, it does not appear to have the articulated structure of an explanatory theory, that is, it does not have clearly articulated propositions, linkages from the propositions to empirical reality, and abstract explanatory principles. And while it spawns lines of investigation (clearly one of the advantages of a clear conceptual position), it is not obvious that it is testable, as would be required of an explanatory theory.

Other well-known conceptual orientations in our field include Wapner and colleagues’ organismic-developmental approach (Wapner et al., 1973), Altman and colleagues’ transactional approach (Altman, Werner, Oxley, & Haggard, 1987), and Craik’s personality orientation (1976; see Figure 1). The

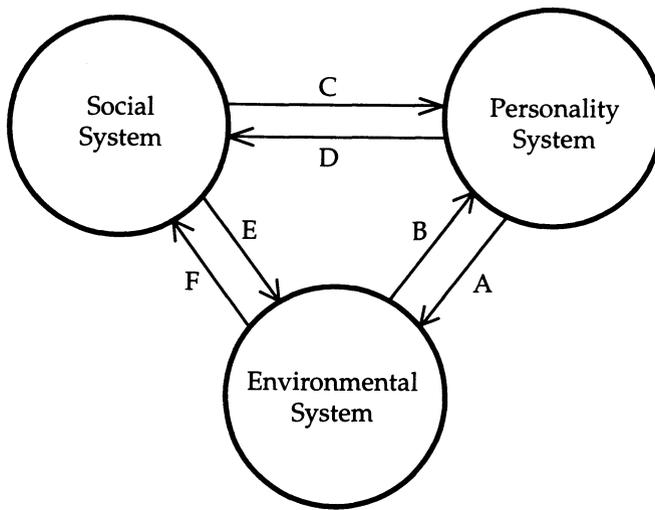


FIGURE 1. Craik's conceptualization of the personality orientation to EB research: The interplay of personal, societal, and environmental systems (after Craik, 1976, p. 73).

latter clearly argues for investigating the personality correlates of any and all EB phenomena and gives a diagrammatic representation of some possible linkages among theoretical constructs. But it doesn't suggest an explanation for these phenomena, and it is not clearly testable, though it does give a powerful way of thinking about EB phenomena through the eyes of a personality/environment conceptualization.

Let us look also at the developmental orientation to environment and behavior. As Werner (1957) pointed out many years ago, any phenomena may be looked at developmentally. One may always ask, "How does this phenomena change over time? How does it come into being? What are the major stages in its evolution or development?" While a developmental orientation might seem at first glance to be useful only for the description of phenomena changing over time—not a small task, as several authors have called for more attention to the concept of time in EB phenomena (e.g., Altman & Rogoff, 1987)—Werner showed that the essence of all forms of development is the differentiation and subordination of parts to the whole. He formalized this as the *orthogenetic principle*: Insofar as development occurs in a process under consideration, there is a progression from a state of relative globality and lack of differentiation to states of increasing differentiation, articulation, and hierarchic integration (Werner, 1957; see Figure 2). Development, thus defined, is not limited to processes changing over time, but may also be used for the conceptual or structural ordering of contemporaneous systems. The more differentiated and hierarchically integrated a system is in the relations between its parts and between means and ends, the

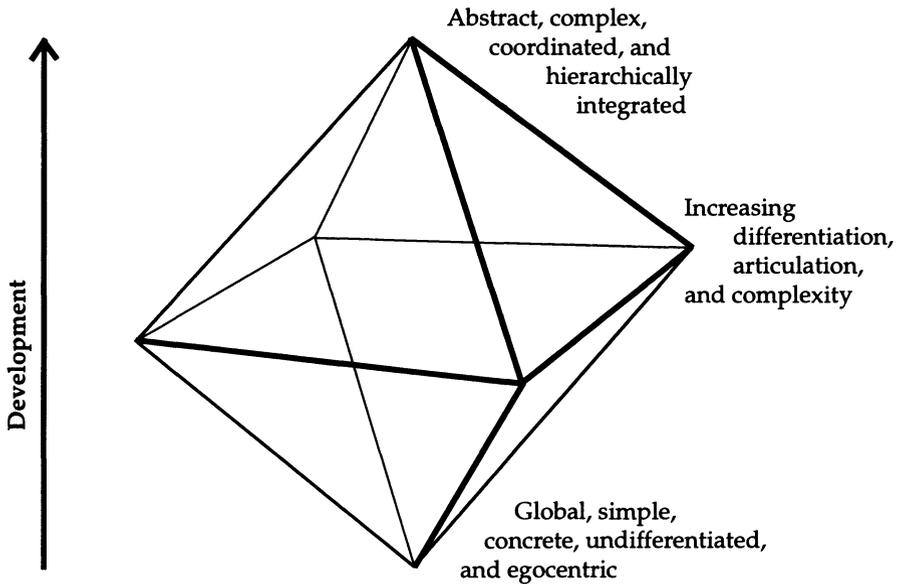


FIGURE 2. Schematic diagram of the orthogenetic principle of development.

more highly developed it may be said to be. If one system is more differentiated and hierarchically integrated than another, it is structurally more developed than the other. If a single system is increasing in differentiation and hierarchic integration, it may be said to be developing (Wapner, Cirillo, & Baker, 1971). Thus development, defined in this comparative manner, is a set of conceptual glasses. They can be put on whenever and wherever one is observing some slice of nature. We can and may always ask, "How is this system developing? How does it come into being? What are its major stages?" or, given two contemporaneous systems, "How do they differ structurally and developmentally?" Greater use of a structural–developmental conceptual orientation might lead to an ability to grapple with time and change in EB relationships.

While some conceptual orientations have and may lead to more specific explanatory theories, a large part of the theoretical work in the EB field to date consists of general orientations. "We have," to quote the sociologist Merton, "many concepts, but few confirmed theories; many points of view, but few theorems" (1957, p. 9).

Frameworks. Next in specificity, frameworks describe the relations among existing entities in a given domain. A framework goes beyond an orientation in that it provides a systematic organization to data about different ways people and environments interact. The first example of a systemat-

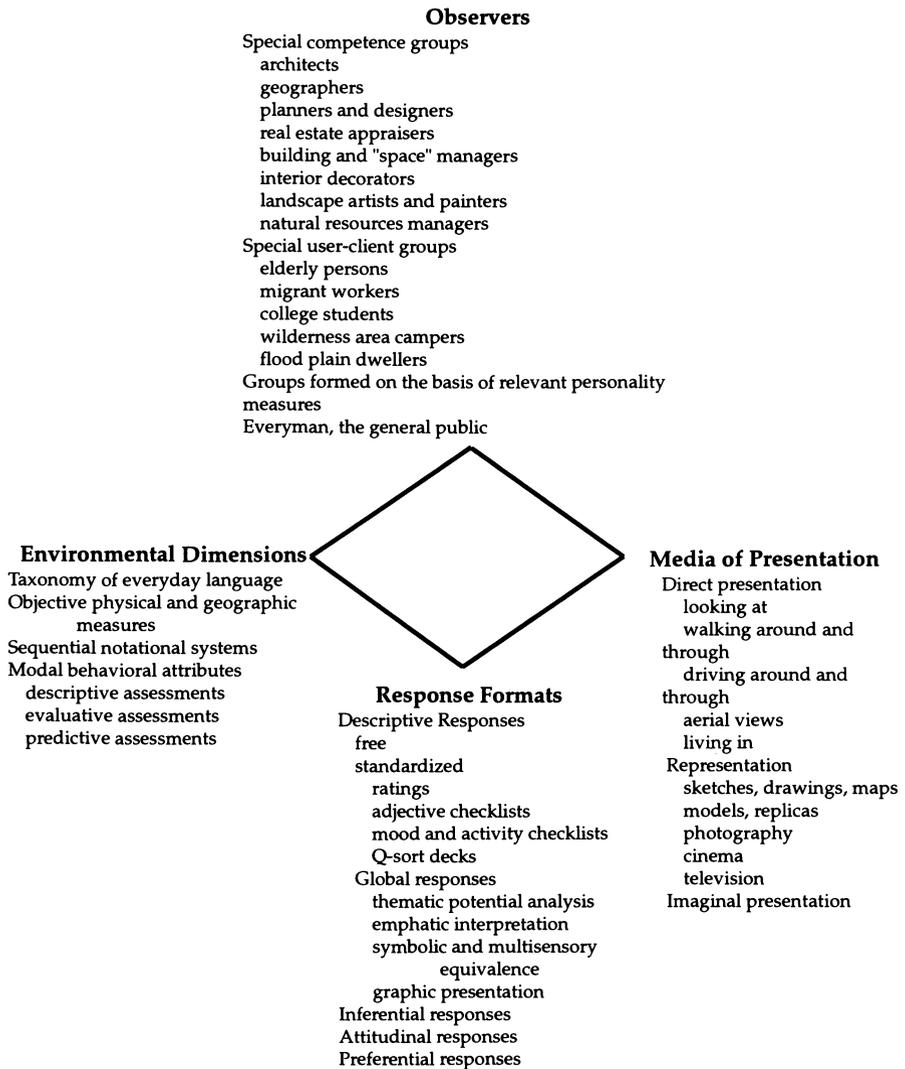


FIGURE 3. Craik's conceptual framework for research on the comprehension of the everyday physical environment (after Craik, 1970, p. 67).

ic framework in EB research was Craik's (1968, 1970) framework for environmental assessments. The framework followed from the personality orientation adopted in Craik's work. Data were organized in terms of observers, environmental displays, response formats, and media of presentation (see Figure 3).

An attempt at a comprehensive framework for the EB field was suggested in some of my earlier writings (Moore, Tuttle, & Howell, 1985; cf.

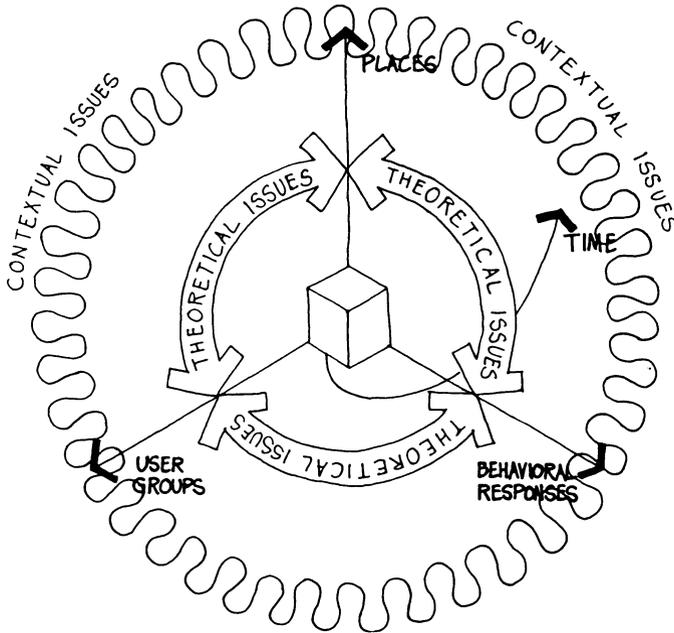


FIGURE 4. Four interacting dimensions for the analysis of EB phenomena: places, user groups, sociobehavioral phenomena, and time, all embedded in a context of political-economic issues and explained by explanatory theories for particular subdomains.

Kaminski, 1989). It is composed of four principle subdomains: (1) *places*—elements at different scales (room, apartment, house, housing estate, neighborhood, city, region); (2) *user groups*—types of people defined by certain enduring characteristics (age, gender, cultural group, etc.); (3) *sociobehavioral responses*—types of sociobehavioral phenomena produced by each of the user groups in each of the place types (internal physiological responses, psychological responses, external social responses, etc.); and (4) *time*—the dynamic interaction of these first three dimensions over time, events that change over time, and adaptation (see Figure 4). Each dimension indicates a subdomain of research interest and sustained work in the field (e.g., on housing, on the elderly, on privacy). As Kaminski (1989) pointed out, each dimension may also suggest specific lines of inquiry and investigatory operations, like choosing the set “room / infant / internal physiological response” might suggest a question such as: “How do an infant’s physiological responses change if the infant is transferred from a familiar to an unfamiliar room?” The extension of these subdomains in time, and especially their being embedded in a historical sociocultural change context, can result in further enrichment of the questioning. As Kaminski further argued, this structuring strategy may not only stimulate and facilitate new empirical

approaches, but may also help the researcher detect gaps and blanks in the research landscape and envisage and frame new empirical approaches.⁹

Often, in preparation for preliminary comprehensive exams, our doctoral students organize elaborate frameworks to systematically compare and contrast different studies and findings in the domain of their research interest. While these frameworks are incredibly helpful, and are conceptual, they are more than conceptual orientations but are far from explanatory theories (see, for example, the conceptual framework for research on residential satisfaction of Chinese elderly by C.-J. Yang in Figure 5).

Models. There is controversy over the epistemic status of models. Nash (1963), for example, argues that models are analogies in simpler terms than a theory, a concrete embodiment of a theory, and that they stand between theories and observations of reality.

There are iconic, analogic, and symbolic models; static and dynamic models; and formal / conceptual models. In architectural design, models are static, iconic representations of some portion of the real world. Architects also use dynamic, symbolic models, as in computer models of energy use in buildings. In planning, a model is often a dynamic simulation of events in the real world. It is based on descriptions of variables and incorporates statements about the presumed dynamic relations among variables. In each of these cases, however, models provide abstractions of real-world events; they may be used to predict future events given certain parameters, but they do not necessarily explain those events in a larger theoretical system.

We may say, therefore, that *models* (often called *conceptual models*) articulate the dynamic mechanisms among organized bodies of findings. They may be considered part of the operationalization of theories. They show us *how* a domain of phenomena work, without explaining *why* it works this way. That is, models are descriptive articulations of the dynamic relations among variables and constructs. They can predict future events, but they are not explanatory, that is, they do not call upon higher-order abstract concepts and principles to *explain* the phenomena.

Examples of conceptual models in EB research include Marans's (1976) model of residential environmental quality, Altman's (1975) privacy regulation model, Carp's (1987) congruence model of environment and aging, Baum and Paulus's (1987) crowding stress model, and Taylor's (1987) model of disorder and territoriality, among others. Interestingly, Taylor refers to his model as depicting two processes involving insiders and outsiders and as depicting how the two processes might work over time (p. 960; see Figure 6). In a similar vein, we recently put forth a mediational–interactional model of

⁹Kaminski's (1989) chapter also compares the contrasting frameworks and conceptualizations of Barker's ecobehavioral and Gibson's ecological optical approach. See also Heft (Chapter 3, this volume).

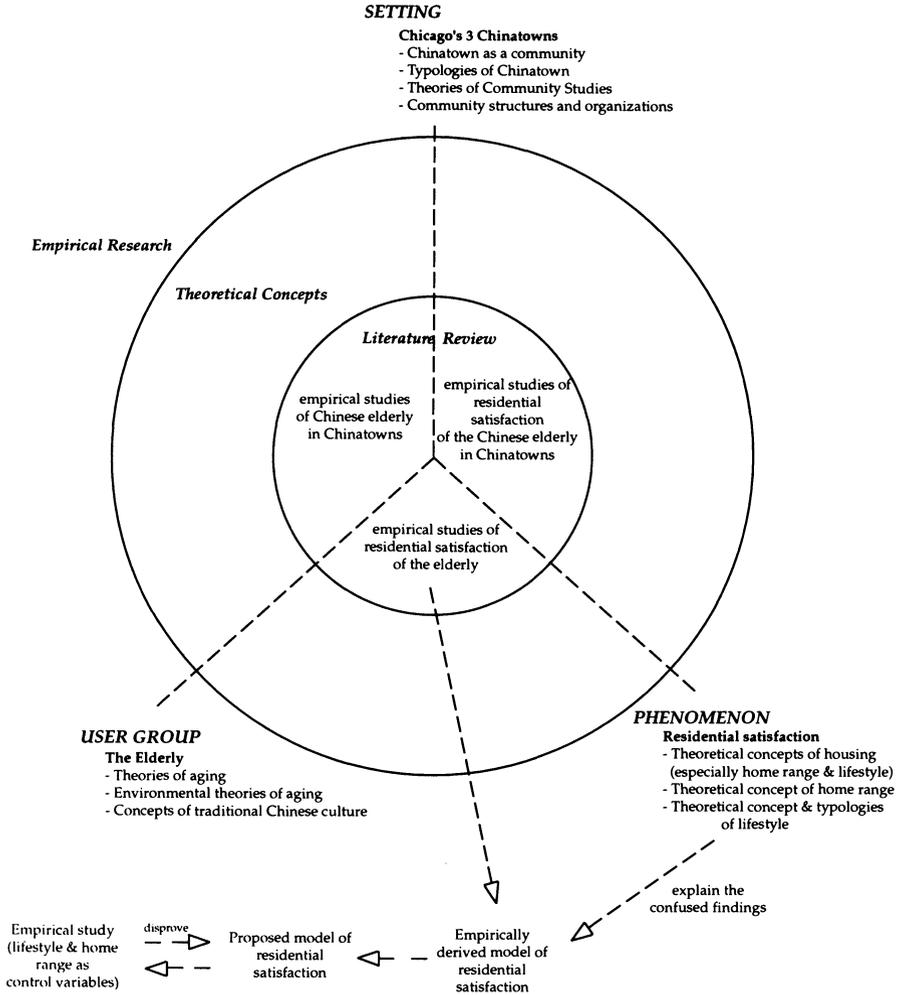


FIGURE 5. Conceptual framework for research on the residential satisfaction/dissatisfaction of Chinese elderly by C.-J. Yang, University of Wisconsin–Milwaukee.

physical environmental and other factors affecting educational outcomes, both achievement and prosocial behavior (Moore & Lackney, 1993; see Figure 7).

Explanatory Theories. Finally, explanatory theories, as defined earlier, are systematic and testable constellations of concepts explaining aspects of behavior in relation to aspects of environments. Explanatory theories attempt to explain why a set of observable phenomena behaves in the way it does by recourse to more abstract concepts and principles. There are many examples of explanatory theories for different EB domains. One of the clearest exam-

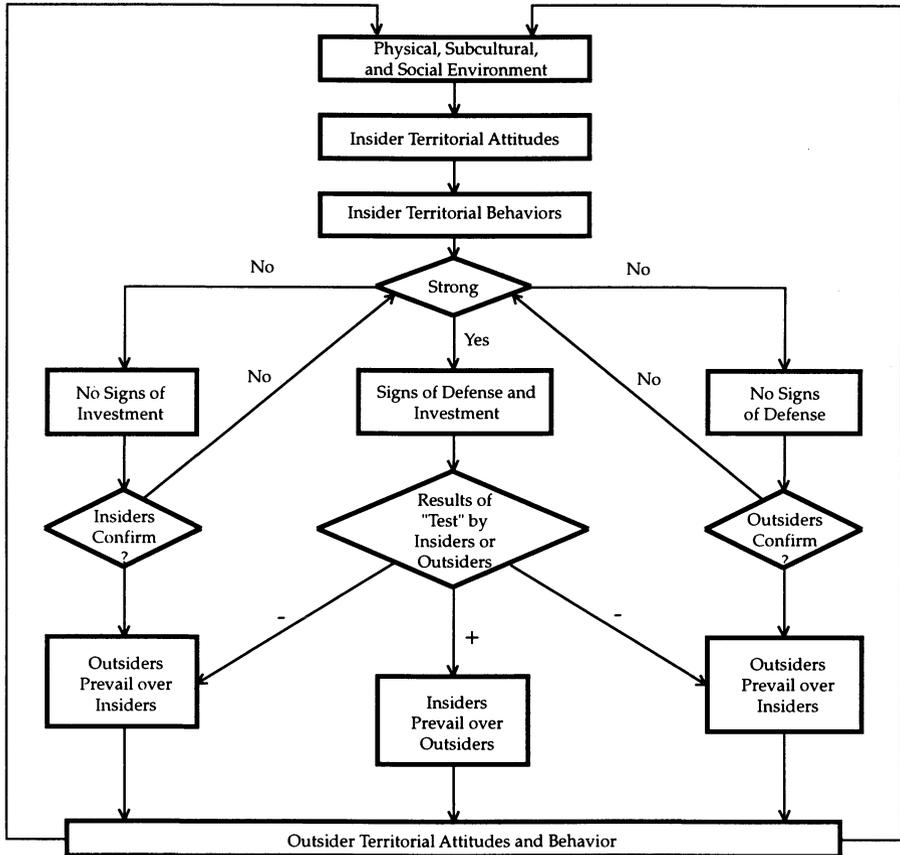


FIGURE 6. Taylor’s model of the role of territorial signs and communications as part of disorder and territoriality (after Taylor, 1987, p. 960).

ples is Lawton and Nahemow’s (1973) theory of competence, environmental press, and the adaptation of older people (see Figure 8). This theory not only summarizes phenomena and provides a framework but also describes the dynamic relations among variables and constructs (e.g., the results of individual competency declining faster than environmental press) and offers an *explanation* for this phenomena by recourse to two abstract principles—adaptation level and optimal discrepancy.

Taking these four types of theoretical entities together,¹⁰ we may develop a system for ordering world views through explanatory theories. In 1985

¹⁰The reader will notice that I have not discussed various paradigms for the field. Accepting Kuhn’s (1962 / 1970) treatment of paradigms, there can be only one operational paradigm in a field at any given time. The environment, behavior, and design field may still be in a pre-paradigmatic stage, with various theoretical orientations (interactionalism, transactionalism, phenomenology, structuralism, etc.) all vying for paradigmatic status.

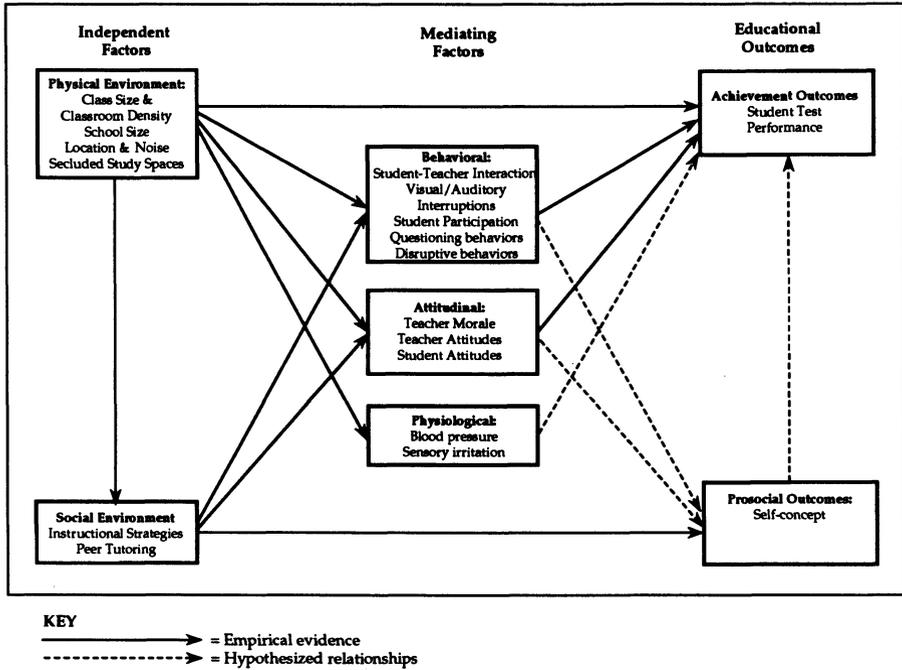


FIGURE 7. A mediational-interactive model of physical environmental and other factors affecting educational outcomes (from Moore & Lackney, 1993, p. 110).

I suggested a boxcar sequence, with arrows between them (Moore et al., 1985). On reflection, the arrows were ambiguous (did they mean cause and effect, a temporal sequence, or something else?). And the boxcar sequence was mistaken—the four different entities have very different domains. It now appears that the four entities are in a type of nested hierarchy (see Figure 9). For any explanatory theory, there can be one or more dynamic, iconic, or symbolic models. Similarly, any one or more models may dynamically describe portions of the data in a domain sketched out and systematized by a framework. And several frameworks, for different domains of study (e.g., aging or children and the environment), may derive from the same world view (e.g., interactionism or structuralism).

SCOPE: BIG *T* GRAND THEORIES, LITTLE *t* THEORIES, AND THEORIES OF MIDDLE RANGE

EB theories differ among themselves not only in terms of the *form* of the theory but also in terms of what we may call the *scope* of the theory. Following Merton (1957), theories differ in terms of the breadth of phenomena they

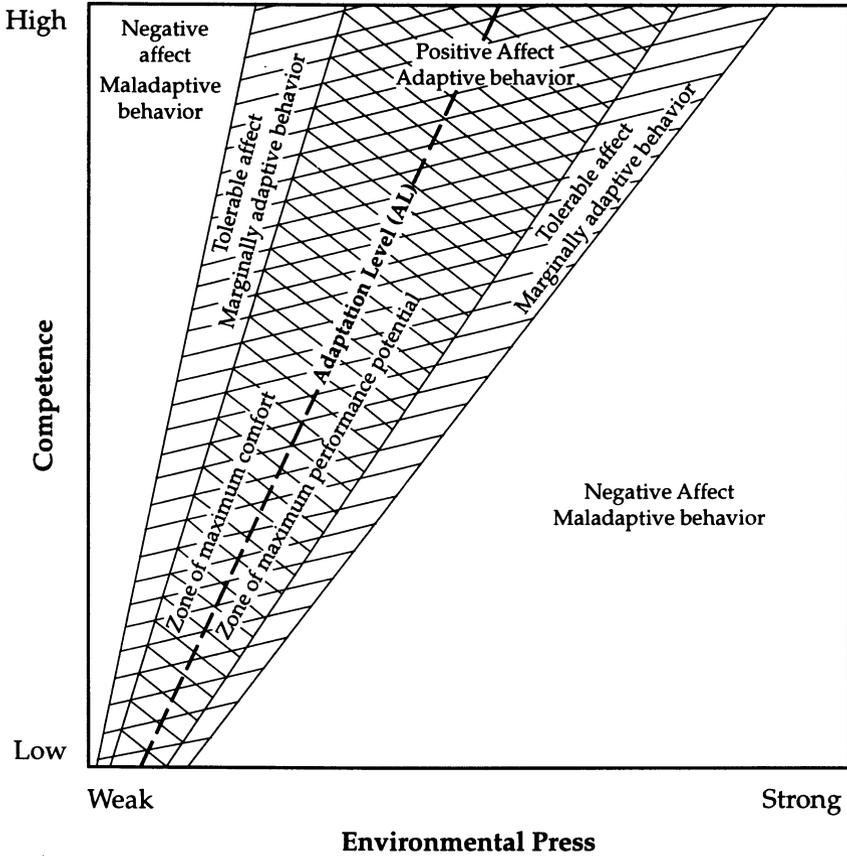


FIGURE 8. Lawton’s theory of competence, environmental press, and the adaptation of older people (after Lawton, 1975, p. 12).

are meant to cover and explain, that is, how narrow or wide a swath the theory cuts through a field.

In 1972, in a graduate seminar at Clark University, Terhune (1972) presented the notion of the relative *scope* of theories. He identified five related issues: “(1) theory or no theory at all (or, theory vs. fact-finding)?; (2) if theory, big or little in scope?; (3) if theory, low order or high order (i.e., close to data or high in abstraction)?; (4) if theory, what kind—explanation or description (or is all theory explanation)?; and (5) if theory, when—can we begin formulation now, or must we wait until we have more empirical support?” (p. 1).¹¹

¹¹I am indebted to Professor Kenneth Terhune’s seminar at Clark University in the early 1970s for the basic ideas behind the notion of the *scope* of theories.

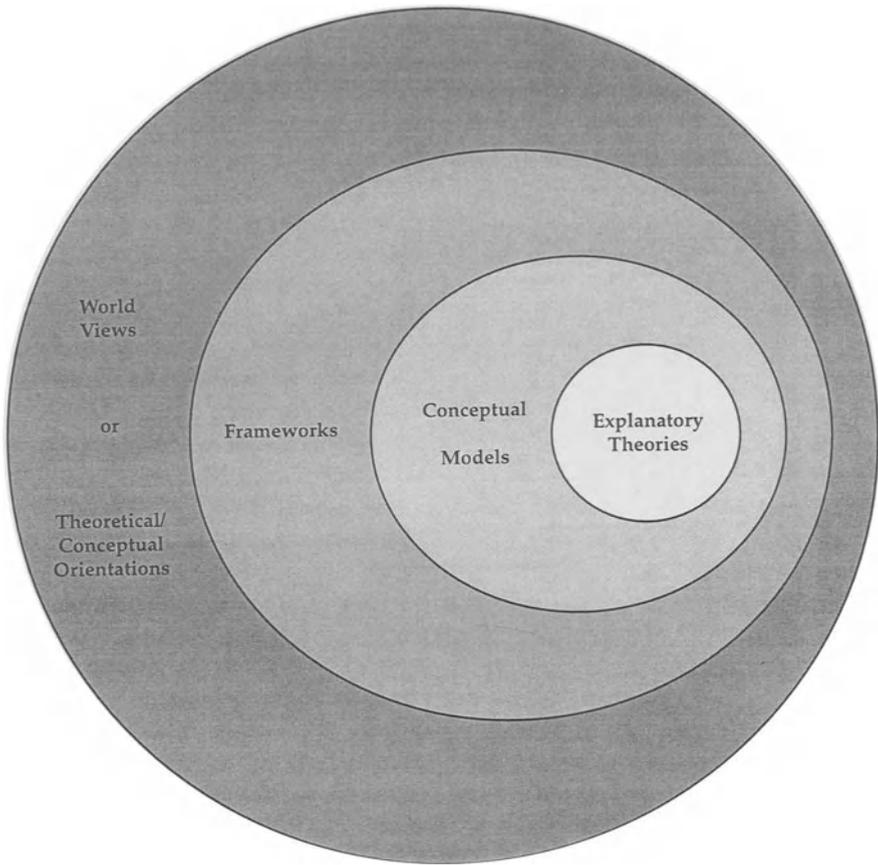


FIGURE 9. A conceptual system for ordering world views, frameworks, models, and explanatory theories.

Big T or Grand Theories. What we may term big *T* theories are what Merton (1957) called *grand theories*. They are intended to account for a wide range of data across several substantive subdomains of a field. Examples include, for other fields, Newton's theory of mechanics, the theory of relativity, probability theory, behaviorist learning theory, or location theory. One of the biggest of the big *T* theories—and somewhat related to the EB field—is Parsons's (1959) theory of social action.

Parsons attempted to make his theory of action cover four interrelated subsystems pertaining to physiological aspects of the organism, personality, the social system, and the cultural system. The theory covered a tremendous range of subject matter, from that normally studied by physiological psychologists through sociology to social anthropology. What Parsons sought in

the social action theory was a set of postulates and definitions of fundamental variables that are common to all the specified subsystems. Parsons ambitiously stated that the theory was to cover the full range within the subsystems. Various existing, smaller theories were used to build Parsons's grand theory—theories of perception, learning theory, psychoanalytic theory, economic theory, and political science theory. He compared his attempt to that of Newton's grand theory of mechanics, which applied to falling apples as well as to the motions of planets.

Arguments for high-level theories often emanate from Whitehead (1919/1964), who expressed the idea of the continuity of the whole empirical world, or from Von Bertalanffy (1968), who argued for a general systems theory. Both emphasized the special power inherent in a well-integrated theoretical system. In psychology, even back as far as the early 1950s, both Krech (1949–50) and MacKinnon (1953) argued that psychology only had a collection of discontinuous, unrelated "theorettes." Both felt that theorizing should go upward, connecting and integrating lower-order theories (often developed in isolation of each other, none of which encompasses or accounts for the other) toward the establishment of a *higher-order, integrative theory*.

Low-Level, Little t Theories. Little *t* theories are coherent and explicit theories that do not attempt to stretch beyond the substantive subdomain of phenomena from which they are developed. Each accounts for a limited body of data, for a limited domain of observed regularities in nature and a limited though clearly specified set of phenomena. Examples in the EB arena include Gibson's (1979) ecological theory of visual perception (cf. Krampen, 1991), Ittelson's (1970) transactional theory of environmental perception, Neisser's (1976) constructivist theory of cognitive maps (cf. Garling & Gollidge, 1989), Lawton's (1975) adaptation level theory of aging and the environment, or Lawrence's (1989) structural theory of homes, among others. These theories are generally limited to the subject areas that they cover (though some, like Lawton's, can be generalized to other domains, with some changes of terms), and so they would be considered less than "big" theories.

Arguments for low-level, little *t* theories usually relate to the need for careful observation and "fact-finding" over theorizing, claiming that the field, or particular subdomains, are not sufficiently data rich for the beginnings of broader theory. If the phenomena have not been observed carefully, and described in some systematic ways (e.g., through conceptualizations and frameworks), there is nothing yet to explain. Systematic observation and systematization of the data collected must always precede explanatory theory. It might even be said that the greater our success in discovering empirical laws, the less the need for theory. MacKinnon (1953) argued for the transformation of hypothetical constructs into intervening variables. People arguing for low-level theories quite intimate and close to the data often decry the

incredible abstraction of many higher-order theories that seem to pertain to philosophy more than they do to any observed constellation of phenomena.

Theories of the Middle Range. To mediate the dilemma between theory and data, between grand theories and blind data gathering, Merton (1957) advocated theories of the middle range intermediate to working hypotheses and all-inclusive master conceptual schemes. Merton cautioned against overreliance on both minor working hypotheses and grand theories, the latter of which he termed "all inclusive speculations":

I assume that the search for a total system of sociological theory, in which all manner of observations promptly find their preordained place, has the same large challenge and the same small promise as those all-encompassing philosophical systems which have fallen into deserved disuse. There are some who talk as though they expect, here and now, formulation of *the* sociological theory adequate to encompass vast ranges of precisely observed details of social behavior and fruitful enough to direct the attention of thousands of research workers to pertinent problems of empirical research. This I take to be a premature and apocalyptic belief. We are not ready. The preparatory work has not been done. (p. 16)

If true for all of sociology in the late 1950s, after 50 years of sustained development and the opening of academic sociology departments in almost every university and college in the land, Merton's statement is even more applicable for the EB field, a much, much younger field than sociology with very few formal academic programs.

ENVIRONMENT AND BEHAVIOR THEORIES

Having looked at the nature of theory and the form and scope of different types of theoretical constructions, where does the environment, behavior, and design field sit? What types of theories have been developed and tested?

Since the late 1960s, different forms of "theories" have been presented in the EB literature. Individual theories were published as early as 1968 (e.g., Barker's 1968 ecological theory of behavior settings). Three symposia at Environmental Design Research Association (EDRA) meetings in the early 1970s compared theories in different domains of EB research (Altman, 1973; Chase, 1973; Moore, 1972). Themes running through these early symposia included desires to *systematize findings*, *reveal patterns*, and *explain sets of EB phenomena*.

Ten years later, in preparation for the first offering of my graduate seminar on theories in 1983, it was possible to discern many different theoretical constructions for different subdomains of EB relations. A list of theoretical constructions at that time included Altman's (1975) theory of environmental privacy, Barker's (1968) ecological theory, Cohen's (1978) en-

environmental overload theory, Craik's (1968, 1970) personality approach to environmental assessment, Hart and Moore's (1973) structural–developmental theory of environmental cognition, Ittelson's (1970) transactional theory of perception, Lawton and Nahemow's (1973) adaptation-level theory of aging and the environment, Marans's (1976) model of residential satisfaction, Michelson's (1977) choice theory of residential satisfaction, Rapoport's (1969) cultural orientation to housing, Seamon's (1980) phenomenological approach to environmental experience, Stokols's (1979) congruence theory of environmental stress, Studer's (1970) behavior-contingent theory, Wapner, Kaplan, and Cohen's (1973) organismic-developmental perspective of environmental adaptation, and Wohlwill's (1966) adaptation-level theory. Undoubtedly there were others even in the early 1980s. Many others have emerged in the field since then.

The question now is: What types of theoretical constructions are represented here in terms of not only content or domain of EB findings but also in the *form* and the *scope* of the theoretical construction?

THE FORM OF DIFFERENT EB THEORIES

Regarding the form of different theoretical constructions, as suggested earlier, certain of these theoretical constructions—like Rapoport's (1969, 1977) approach, Seamon's (1980, 1987) writings on phenomenology, and Wapner et al.'s (1973) organismic-developmental perspective or approach to EB phenomena—are perhaps best understood as *conceptual or theoretical orientations* emanating from well-established broader, philosophical *world views*.

Other of these theoretical constructions—like Craik's (1968, 1970) personality/environment-based framework for data on environmental assessment—are best conceptualized as organizing *frameworks*.

Still others—like Marans's (1976) model of residential satisfaction—may be best conceptualized as dynamic but descriptive *models*.

Finally, a number of these early theoretical constructions—like Barker's (1968) ecological theory of behavior settings, Cohen's (1978) environmental theory of environmental overload, Michelson's (1977) choice theory of residential satisfaction, perhaps our own (Hart & Moore, 1973; Moore, 1976) structural–developmental theory of environmental cognition, and especially Lawton's (1975; Lawton & Nahemow, 1973) theory of competence, environmental press, and the adaptation of older people—are perhaps best conceptualized as *explanatory theories of the middle range*.

THE SCOPE OF EB MODELS AND THEORIES

It is also the case that EB frameworks, models, and theories differ in degree of coverage, or *scope*. Some explanatory theories are very broad,

almost in the tradition of what Merton called “grand theories.” The clearest example is likely Barker’s (1968) ecological theory, which has been suggested by some to be the first or closest approximation in our field to an all-encompassing theory of environment and behavior.

Some theories are extremely limited in scope, being more akin to everyday working hypotheses for specific sub-subdomains of investigation. Alexander, Ishikawa, and Silverstein’s (1977) *pattern language*, and other pattern languages for more delimited domains (e.g., Moore, 1993, for child care centers, or Moore & Lackney, 1993, for elementary schools), have been taken as a series of little *t* working hypotheses rather than a full-blown explanatory theory.

The vast majority of theoretical constructions in the EB field, however, are nice examples of either models or explanatory theories of the middle range. Altman’s (1975) theory of privacy, personal space, territoriality, and crowding is a clear exemplar of a middle-range explanatory theory, as is Ittleson’s (1970) transactional theory of environmental perception, Lawton’s (1975) theory of aging and the environment, and Taylor’s (1987) environmental disorder theory of delinquency, crime, and the fear of crime.

ARE THERE DIFFERENT TYPES OF THEORIES? WHITHER DESIGN THEORIES?

Do all theories fit the earlier definition? Do all things that are called theories have the eight defining characteristics of explanatory theories (pp. 6–7)? One way to examine this question is to consider what are called *design theories* in the architectural literature and in the academies. How might we conceptualize them? Despite the fact that they are called “theories,” are they really theories? What are the similarities and differences between explanatory theories and design theories?

We may imbed this discussion in a more general discussion of new developments in architectural research and how we might conceptualize architectural research. Architectural research can be rather parsimoniously conceptualized, in the language of Vitruvius, architect to Caesar Augustus 2000 years ago, as investigating the three essential characteristics of buildings and of architecture: *firmitas* (firmness), *utilitas* (commodity), and *venustas* (delight). Around these Vitruvius constructed what many take as the first theory of architecture. In terms of the three principle domains of architectural research, we know them as *technical research*, *sociobehavioral research*, and *aesthetic-formal research* (Moore, 1979). Each of these three primary types of architecture research comes from a different intellectual tradition—the engineering tradition, the social science tradition, and the art history and humanities tradition. As is shown later, what are called architectural or design theories tend to come from the third of these traditions—*aesthetic-*

formal research, with its epistemology in art history, architectural history, and the humanities in general.

PROGRAMS AND MANIFESTOS

Given these multiple approaches to architecture and architectural research, how might we conceptualize the greatly influential writings of Le Corbusier in *Vers une Architecture/Toward a New Architecture* (1923), wherein he propounded a new aesthetic: "Architecture is the masterly, correct and magnificent play of masses brought together in light" (p. 31)? His writings include several important concepts, among them mass, surface, plan, regulating lines, contour, and profile. The correct alignment of these concepts, Le Corbusier believed, leads to beautiful and functionally appropriate buildings.

Or, how might we conceptualize Wright's organic architecture (1960), wherein he espoused the very powerful notions of a free spatial flow between various dwelling areas and the organic development of buildings on geometric-shaped floor plans?

Consider also Gropius's various Bauhaus manifestos and his later book, *The Scope of Total Architecture* (1962). Gropius and the Bauhaus argued that objects are defined by their inner nature and by the means of production. Good design, they held, was an integration of utility, durability, and economy of means.

Many other influential architects and architectural writers of the 1920s and 1930s put forward other principles of good architecture. Other examples include the De Stijl manifesto, Mies van der Rohe's working theses, Le Corbusier's guiding principles for town planning, the CIAM (Congress Internationale d'Architecture Moderne) declarations, the Athens Charter of 1933, Yona Friedman's "ten principles of space town planning," and many others (cf. Conrads, 1970). Conrads (1970) later called all of these writings "programs and manifestos" for twentieth-century architecture in his book of the same title.¹² Our question, then, is: Are these "programs and manifestos" in praxis the equivalent of theories in science?

Many other writings from the design disciplines are considered to be "theories"; are taught, for example, in universities under the title "History,

¹²A thoughtful reader of a draft of this chapter, Kyriaki Tsoukala, has raised the question (personal communications, comments on a draft April 1995; and letter to G. T. Moore, October 1995) whether all these theories can be classified in the same category of "programs and manifestos." She observed that this chapter poses questions around the concept of theory and tries to find a typology of positions that have appeared in EB studies and in architecture. The criteria for theories in the research side of the EB field, she submits, are clearer than the criteria for design theories. She suggests, as one example, that one might better use the term "doctrine" concerning Broadbent's positions, rather than principles, program, or manifesto. Much more needs to be done to clarify the role and status of the plethora of positions currently referred to as "architectural theories" in the academies and in the design literature.

Theory, and Criticism" or "Architectural Theory"; and are published with such titles or subtitles in books by major architectural publishing houses or in journals like the *Journal of Architectural Education*. Take, for example, the theory of complexity and contradiction of Venturi (1966) based on a reading of architectural history, or the more recent architectural theories like those of Bonta (1979) in *Architecture and Its Interpretation* based on structuralism, of Norberg-Schultz (1971) in *Existence, Space, and Architecture* based on phenomenology, or of Broadbent (1973) in *Design in Architecture* or Jencks (1977) in *The Language of Post-Modern Architecture* based on semiotics. In departments of architecture, these have always been called "theories," but are they?

At first blush, these architectural theories certainly seem very different from scientific, explanatory theories. If they are theories, in what way are they theories? And if they are theories, are they akin to the theories of science, or are they different in structure and intent? I will argue that they are theories (*design theories*) and that they are similar in structure (with one critical exception) but very different in intent from *scientific* theories.

NORMATIVE DESIGN THEORIES: PRINCIPLES TO BE FOLLOWED

A second type of "theory" is defined in the *Oxford English Dictionary*. In addition to the earlier explanatory meaning, theory, it counsels, may also be a "conception or mental scheme of something to be done, or of the method of doing it; a systematic statement of rules or principles to be followed" (Vol. 2, p. 3284).

McCleary¹³ offered a similar keyword definition of "theory" drawn from Bacon's distinction between theory and practice, between the speculative and the practical. Theory, he argued, can be conceived of as a "scheme of ideas which explains practice." But, McCleary continued, "theory in this important sense is always in active relation to practice; an interaction between things done, things observed, and (systematic) explanation of these." This allows a distinction between this second type of theory (that which is proposed) and practice (that which is done). Following from Bacon's distinction between theory and practice, theory in this second sense is a doctrine or ideology, a largely programmatic idea of how things *ought* to be done.

In agreement with Lynch (see his discussion of three normative theories in *A Theory of Good City Form*, 1981), Lang (*Creating Architectural Theory*, 1987), McCleary, and others, it seems reasonable that we call this second type of theory *normative* or *prescriptive* theory.

Normative design theory, then, is a scheme of ideas, concepts, or logically linked axioms and / or principles that relate to observable phenomena and whose application it is believed will accomplish implicitly or explicitly

¹³Peter McCleary, personal communication; letter to G. T. Moore, August 1984. I am indebted to Professor McCleary for bringing some order to the consideration of design theories.

stated desirable and laudable objectives. Manifestos and programs of action may thus be seen to be normative design theories, as each has a system of logically linked principles whose application is intended to accomplish some desirable and laudable objective(s).

Design theories have, for the most part, the same underlying structure as scientific theories. Like scientific theories, design theories¹⁴ (1) pertain to a some *domain* of the universe (product design theories, architectural design theories, urban design theories, etc.). While they may not be based on (2) specific observations and observational terms, they do tend to have (3) a set of *propositions* or *principles* and, the best ones at least, (4) *logical connections* between the propositions or principles (e.g., the numbered propositions of the various CIAM Charters or the Team X Manifesto [Conrads, 1970]), and maybe (5) a set of *conclusions*, though not likely related to empirical reality. More than emanating from observations of nature, most design theories (6) are based on or outgrowths from some strongly held underlying *philosophical presuppositions* and / or *axioms*. Design theories, therefore, seem to have most of the same structure as scientific theories. Design theories pertain to buildings and other designed parts of the environment, while scientific theories pertain to studies and other collections of observed regularities in nature.

As discussed earlier, two fundamental characteristics of theory, perhaps even a demarkation between theory and nontheory, as proposed in the writings of Newton (1687), Popper (1965), and Platt (1964), among others, are the principles of (7) *explanation by recourse to a system of abstract principles* and (8) *testability*.

A theory is not a scientific theory if it is not explanatory, if it does not explain a domain of interrelated phenomena in nature by relating the observed phenomena to a small number of general, abstract principles that are themselves not observable, but are taken as accounting for or explaining that observed part of nature.

Similarly, a theory is not a scientific theory if it is not testable in principle. This does not imply that it necessarily has been tested or that it has been extensively corroborated (necessary for the evaluation of a *good* theory, but not for the simple identification that something *is* a theory), but simply and more fundamentally that it is testable *in principle*.

But then the question arises: Is this two-part principle of demarkation equally true for both positive scientific and normative design theories, or not? Do architectural theories explain, and are they testable? I will argue that the answer to both questions is a very qualified "yes," although with subtle and important differences from scientific theories.

First, how about explanation? It does not seem the case, as has been argued by Groat and Déspres (1991), that "EB theory can be equated with

¹⁴These numbered criteria refer to the list of numbered criteria for positive theories earlier in the chapter.

explanatory theory only if one adopts a narrow definition of what constitutes EB research" (p. 27). First, theory, while explaining the findings of research and suggesting new research directions to pursue, should not be confused with research. Research is inherently descriptive. It describes a portion of nature by recording the observed regularities in that segment of nature. It is the theory or interpretation that is explanatory, that gives meaning to the observed regularities. So are design theories explanatory?

It seems to me that normative design theory may also serve, in some soft way, to "explain" the observables in the domain of the theory. In their writings and their presentations to clients, architects "explain" or interpret their buildings and why they did what they did in designing a building in such and such a way by recourse to more abstract principles, which, when they are fully articulated and integrated, constitute a normative design theory (e.g., those mentioned earlier in the chapter). Thus a designer may explain some set of particular design decisions by offering that designing the building to visually fit the character of the site and the context of the community will lead to a more beautiful building that will be more appreciated by users and passers-by. There is certainly some empirical evidence for this point of view (e.g., Canter, 1972), but, more importantly for our current discussion, the designer is "explaining" some observables (particular characteristics of the design of the building) by recourse to more abstract principles (site and context). Put into a more systematic presentation, this would become the prescriptive or normative architectural theory of contextualism (cf., for example, Groat & Canter, 1979). Scientists also explain studies, and why the results are what they are, by recourse to more abstract principles, or explanatory theories. So while the details are different, the form or structure of the two types of theories do not seem to be very different.

Second, regarding testability, as Groat and Déspres (1991) have argued, while most architectural theorists have no interest in formally testing their ideas, it is possible to test design theories by deducing testable propositions from them that tie the theory to empirical reality:

Many proposals for design action found in architectural discourse—especially some of the most well-known statements of design philosophy—are essentially untestable. For example, the Renaissance-baroque view that architecture should adhere to the principles of beauty and harmony cannot be tested. Nor is it possible to test Le Corbusier's assertion of modernist dogma in his statement that the exterior should be "the result of the interior" (1946, p. 11) . . . We can say that while it is not feasible to test a belief in beauty, it is possible to test whether the use of Renaissance-baroque principles of hierarchical ordering actually produce buildings that are interpreted as beautiful by a given set of people. Similarly, while it may not be possible to test the value of functional expression, it is, in fact, possible to test whether buildings composed in that way are actually interpreted in terms of either their functional components or their function as a whole. Put another way, many of the design principles described in architectural discourse constitute implicit hypotheses . . . Despite the fact that most architectural theorists

have not been particularly inclined to test theory, many architectural "theories" are, indeed, "testable in principle." (pp. 28–29)

In addition to this empirical possibility, design theories are also "testable" in another, softer way. While scientific theories are, and must be, testable in relation to empirical reality, design theories are "testable" in relation to practice, to professional acceptance, and to longevity. So EB and some design theories share the testability-in-principle criterion and in some cases are actually tested.

Having said this, however, it must be added that while explanatory theories are also, and must be, testable in relation to empirical reality, design theories can be transformed to become testable. But, as we see from the collections of design theories in Conrads (1970), design theories need not be testable to be well-established programs and manifestos, and are most often not testable nor in any way tested. While some can be transformed into a language that permits testing, this is most often not the interest of the theorist.

To summarize their similarities, both EB and design theories seem to be, for the most part, structurally the same, albeit with subtle but important distinctions between how design theories explain and whether or not they are testable versus how scientific theories explain and are testable.

There is one remaining distinction regarding the intent of the two types of theories, despite Groat and Déspres's (1991) efforts to try to wash out any distinctions between architectural theory and scientific theory. The real demarcation between these two types of theories seems to be that whereas scientific theories have *explanation* as their sine qua non, design theories have *prescription* as their sine qua non (cf. Lang, 1987, 1991; Lesnikowski, 1987). This is not a criticism of either type of theory. The intention of scientific theories is not to be practical and prescriptive, any more than it is the intent of design theories to be explanatory and empirically testable. Each have their own reasons for being. Design theories have, as we have seen, much the same structure as scientific theories, but with a *very* different intent—whereas scientific theories are meant to explain and are intentionally structured in such a way as to make them testable and to encourage their test, design theories are meant to prescribe principles that, if followed, it is believed will lead to good design or some other desirable and laudable objectives.

IMPLICATIONS FOR FUTURE THEORY, METHODS, RESEARCH, AND UTILIZATION

POSSIBLE LINKAGES BETWEEN EB AND DESIGN THEORIES

Given the similarity in form or structure, yet the different in intent, we may pose some questions for debate, among them: Is it desirable and, if so,

possible to link EB theory to design theory, and what are some of the possible linkages or ways they might be linked?

First a comment on whether or not it is desirable to try to link EB and design theories. For a very long time, it has seemed to me that it is very desirable for our work to contribute both to theory and to praxis, and that the best research in our field contributes both to general knowledge and to practical utilization in environmental problem solving. While traditional approaches to science differentiate between basic research, applied research, and development (R&D), it appears that for the EB/design field, with one leg firmly in the academic arena and one in the professional coliseum, the distinctions become fuzzy, or at least the best work contributes both east and west, both to fundamental understandings and theory and to practical applications and environmental interventions.

There appear to be three ways to link EB and design theories, as shown in Figure 10.¹⁵ But before focusing on theory-to-theory connections, let's look at some of the other connections in the illustration. Looking horizontally across the upper half of the illustration, the domain of substantive work—positive EB research in the upper left quadrant and normative design practice in the upper right quadrant—there are two linkages: design guidelines based on EB research, and postoccupancy evaluation studies to test architectural or other designs through empirical research. Looking at the diagram vertically—first on the left side, the domain of environment and behavior—we see two more linkages: the inductive development of theory to explain patterns of findings from research, and the deductive testing, refutation, or corroboration of theory through research. On the right half—the domain of design—we see yet two more linkages: the development of design theory based on practice, and the use of design theory in practice. But none of these six linkages yet addresses the question of whether or not it is possible to link EB and design theory.

EB Research Can Inform Design Theory. The first, shall we say, less expected linkage between EB and design domains has been characterized by Lang in his various writings as “the positive basis of normative theory” (see especially Lang, 1991). The subtitle of his 1987 book, and the thrust of that book, is the EB basis of design theory, grounding a new era of design theory on the findings of EB research. Referring to Figure 10, Lang's suggestion for “Design theory from an environment and behavior perspective” (1991) may be seen as going from upper right to lower left, from substantive EB research to the development of normative design theory. Lang makes an im-

¹⁵An earlier and different version of this diagram was produced by Lang (1987, 1991) as a “model of design theory.” The present diagram, while influenced by Lang's, incorporates substantive EB research and professional design practice to show a wider range of linkages between what some think of as disparate “fields.”

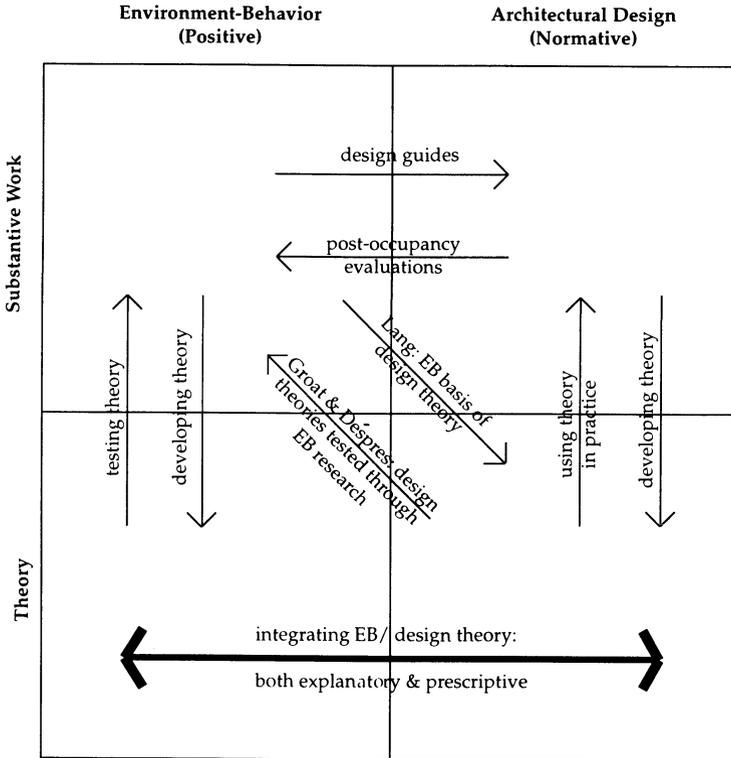


FIGURE 10. Possible linkages between scientific and design theories.

portant contribution to the field by examining a variety of ways in which *EB research* can contribute to the more rigorous development of *design theory*.

While this is a significant conceptual advance to our field, and our thinking, Lang’s concept does not link theory to theory. Nowhere does he discuss the EB theories of Lawton (1975) on aging and the environment, Cohen (1978) on stress and the environment, our own (Moore, 1976, 1987b) on cognitive development and the environment, among others.

Design Theory Can Raise EB Research Questions. Conversely, the second new and different linkage can be characterized as “principles of design embody implicit hypotheses.” It is dealt with by Groat and Déspres (1991). As have many people before them, they argue that design theory can raise important research questions not dealt with critically in the field. They identify a number of design-theoretic issues needing EB research attention along the principles of style, composition, type, morphology, and place. In this sense, Groat and Déspres argue that design theories are empirically testable. Again using the present illustration, Groat and Déspres’s “Significance of

architectural theory for environmental design research" (1991) may be seen as going in the opposite direction from Lang, from lower right to upper left, from *normative design theory* to their test through substantive *EB research* investigations.

But it is not clear that by deducing one principle from a design "theory" (their examples are world views like the Renaissance–Baroque tradition) and conducting some research on it, no matter how valuable the research, that this is a *test* of the "theory" of the Renaissance–Baroque tradition.

This takes us to a third position, an attempt at a conceptual level of integration between design and EB theories, that is, between theory and theory.

Some EB Theories and Some Design Theories Can Be Integrated, Are Explanatory, and Are Testable. Some normative theories (let's not characterize them as "design" or "EB" for the moment) are built not only on testable propositions, but also, more fundamentally, on other testable and tested explanatory theories. Simultaneously, they have implications for conceptualizing good design leading to desirable and laudable objectives. In this case, the two types of theory—positive and normative theory—become unified.

Some examples to which we might point are the ecological competency/press theory of Lawton (1975), the contradiction and complexity theory of Venturi (1966), the pattern language theory of Alexander and colleagues (Alexander et al., 1977), and, outside our field, even the genetic epistemological theory of Piaget (1950, 1970). Each is both a prescriptive/normative theory (making strong normative statements about the way in which some part of the world *should* be) and an explanatory/scientific theory (explaining *why* the EB relationships on which they focus occur as they do).

While it is true that the architectural implications of these theories are certainly not very carefully or fully drawn out, the germs are there for further development.

Lawton's (1975) theory is first and foremost a scientific/explanatory theory to account for a range of phenomena linking declining competencies in older people with the press of the sociophysical environment as regulated by each person's adaptation level. But Lawton has also developed the concept of "the pacer," the normative concept that the press of the environment should be such that older people are maintained in the zone of "maximum performance potential" (see Figure 8, this chapter). Many other implications can be derived from the theory. In fact, it has been used as the underpinning for part of a very influential and award-winning congregate housing project for older people in Massachusetts (Morton, 1981).

Venturi's (1966) theory of complexity and contradiction in architecture is another example of an integrative theory, but with more emphasis on the design side. Though starting with what he called "a gentle manifesto"—that

he likes complexity and contradiction in architecture, the richness and ambiguity of modern experience—he searches long and hard for evidence to sustain or contradict this personal preference. Sometimes we think of design theories as personal and egocentric, scientific theories as objective. Nothing could be further from the truth. As Kuhn (1962/1970) and many other philosophers of science have pointed out, scientific theories, while being open to rigorous and disconfirming test, are often framed initially around the predilections and beliefs of their authors (see also the constructivism of Dewey & Bentley, 1949; Hendel, 1953; Piaget, 1950, 1970). The main difference between the test of Venturi's theory and most, shall we say, orthodox tests in the environment and behavior field is that Venturi tested his theory against the findings of generations of art and architectural history (compare, for instance, the roughly contemporaneous paper by Rapoport & Hawkes, 1970, "The Perception of Urban Complexity," which concludes, on the basis of social science literature, with a set of propositions quite consistent with Venturi's theory).

Alexander and colleagues (Alexander, 1979, 1993; Alexander et al., 1977; Alexander, Neis, Anninou, & King, 1987; cf. Viladas & Fisher, 1986) have put forward several powerful design theories based on a variety of sources. Whereas *A Pattern Language* (1977) is a provocative collection of patterns, *The Timeless Way of Building* (1979) is an integrated design theory based on the search for the timeless qualities of great buildings. *A New Theory of Urban Design* (1987) is a theory of the wholeness of towns and cities articulated through seven interrelated principles: piecemeal growth, the growth of larger wholes, visions, positive urban space, layout of larger buildings, construction, and the formation of centers. Alexander's latest writings, *The Nature of Order* (1993), is a comprehensive theory, even an attempt at a paradigm, for understanding the life in and of buildings and environments. His theories—the ideas and the principles—have been characterized as theories of harmony and wholeness (Viladas & Fisher, 1986). They are both theories of good design and theories of behavior/environment congruence in different domains—building design, urban design, and so on; they are both normative and, although not tested through the methods of science, are eminently testable.

Piaget may also be seen as espousing both an explanatory and a normative theory. Perhaps most accurately said, while the main theory is explanatory, important side-runners are major normative theories in their own rights but are intimately tied to the explanatory theory. The explanatory theory—the theory of the origins of intelligence, of the genesis of epistemology—clearly falls into the positive theoretical orientation and is one of the most significant theories of our times. But early in its development, it spawned his *Science of Education and the Psychology of the Child* (1971), a book specifically treating the educational implications of this monumental theory of the development of intelligence. The educational theory is phrased in

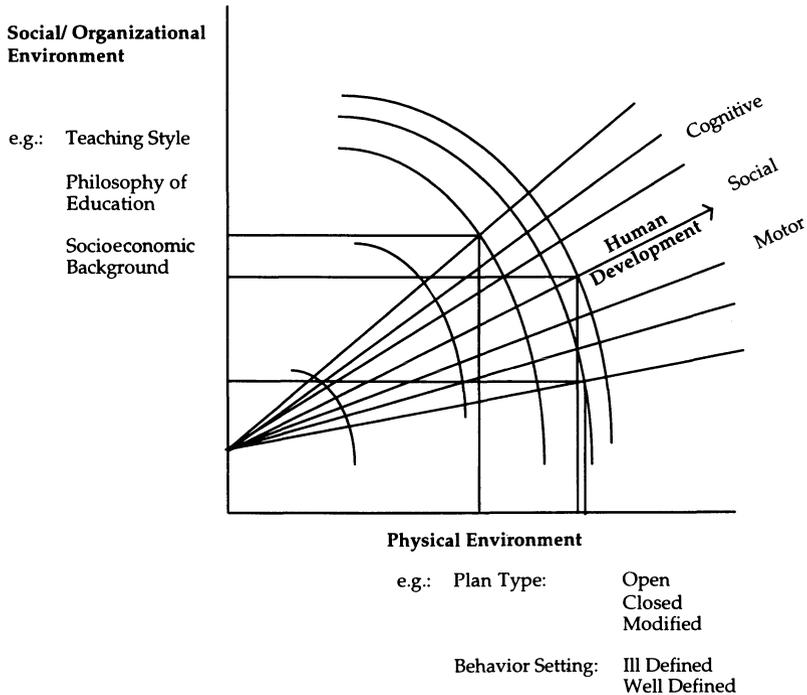


FIGURE 11. An interactional theory of human development and the environment: cognitive, social, and motor development as a function of particular attributes of socio-organizational and physical environments. The diagram suggests (in general terms) how cognitive, social, and motor development (e.g., the development of exploratory behavior or of social cooperation skills) are a function of and may be explained by the interaction of attributes of the physical environment (e.g., modified-open-plan child care centers) with attributes of the socio-organizational world (e.g., child-centered teaching styles). The diagram also shows implications for environmental design, by suggesting (also in general terms) how policy, planning, or design changes in the physical environment (e.g., moving from a closed-plan facility to a modified-open-plan facility) alone or in interaction with changes in the socio-organizational environment (e.g., changing from curriculum-centered to child-centered teaching approaches) would be predicted to lead to greater opportunities for development.

terms of a number of principles: the active organism, interaction with the environment, the roles of action and play in the construction of knowledge, and the role of reflective abstraction (cf. review in Moore, 1971).

For some time I have been working on a book on children's environments that includes a theory of this type, an attempt at a theory of the relations between children and the designed environment, which hopefully will be equally explanatory and normative (see Figure 11). It is based on the two major cognitive developmental theories of our time (Piaget, 1970; Werner, 1957) and on design research explorations resulting in a set of widely adopted design patterns and guidelines (Moore, Lane, Hill, Cohen, &

McGinty, 1994; Moore, 1993). It is *explanatory* in that it can be used to help explain a number of child–environment findings, for example, about social and cognitive behavior in childcare centers (Moore, 1987b), the development of environmental cognition (Hart & Moore, 1973; Moore, 1976), and other child–environment interactions. It is also *normative* in that it shows how development can result from the implementation of particular design principles and spatial qualities of behavior settings.

ANALYSIS, EVALUATION, AND THE CONSTRUCTION OF FRAMEWORKS OF THEORIES

In this brief chapter, there has been neither time nor space to treat a number of other issues deserving of attention. Three that concern me greatly and that have been dealt with at length in our graduate seminar, “Theories of Environment–Behavior Relations,” are: (1) How does one analyze an explanatory theory? (2) How does one evaluate a theory, both explanatory theories and design theories, and are the criteria for evaluation similar or different? and (3) Is it possible to develop a synthetic framework for organizing EB and design theories of the middle range?

With regard to the first issue, without having the space to develop the argument here, let me just say that it has appeared to my students and me that the best ways to *critically analyze* theories have to do with looking at them and articulating their underlying premises in terms of their ontology, epistemology, and methodology. This is being taken up in a forthcoming paper.

The issue of the *evaluation* of theories is quite different, for here we must find some criteria for the valuation of the relative *goodness* of competing theories. Again, without the space to develop the argument fully (the same forthcoming paper), it appears that 13 criteria are necessary and sufficient for the evaluation of EB theories.¹⁶ These criteria may be arranged into three major categories:

- *Theoretical critique*—the scope and structure of the theory including the specific criteria of:
 1. internal consistency
 2. subsumptive power or scope
 3. intertheory support
 4. value explicitness
 5. compatibility with well-grounded metaphysical beliefs
 6. parsimony or beauty

¹⁶This list of 13 criteria started with just 8 criteria for good EB theories, presented in my doctoral seminar on theories of EB relations in 1983. The criteria have been further developed and elaborated in collaboration with Professor Amos Rapoport and our students over the many years he has joined me for two sessions of the seminar. For a description of this seminar, see Moore, Rapoport, and Krauss (1994).

- *Empirical critique*—relation to known findings in the domain it purports to explain, including:
 7. empirical corroboration
 8. explanatory power, or explanatory predictive accuracy
 9. public discussion
 10. responsiveness or assimilation in the face of new empirical perturbations
 11. progress or accommodation
 12. heuristic power or fertility
- *Practical critique*—practical utility of the theory in environmental policy, planning, or design applications, including:
 13. ability to solve or be applied usefully to environmental problems.¹⁷

Of course the parallel question remains: How do we evaluate design theories? What criteria or critical questions are appropriate for assessing the relative value or worth of competing design theories?

Finally, regarding the development of comprehensive frameworks for theory—both explanatory and normative theories—there have been a great number of frameworks developed that have attempted to organize the available theories explaining parts of the EB nexus (e.g., chronologically, Rapoport, 1973; Moore & Golledge, 1976; Craik, 1977; Stokols, 1977; Catton & Dunlap, 1978; Gold & Goodey, 1983; Fisher, Bell, & Baum, 1984; Moore, 1986; Altman & Rogoff, 1987; and Moore, 1987a). Some, like the well-known and influential Altman and Rogoff framework or the earlier Moore and Golledge epistemological framework, are deductive, creating a framework from a small number of principles or dimensions. Others, like Rapoport's, Fisher et al.'s, and one proposed in Moore (1987a), are inductive, creating a framework from the discernible pattern among existing theories. While the former, deductive approaches omit several theories (e.g., the Altman & Rogoff framework has no place for the phenomenology of Seamon, 1987, or the structuralism of Lawrence, 1989), the latter, inductive approach, while including a wider range of the existing theories in the field, is not so elegant, diagrammable, or memorable. So the question arises: Is it possible to develop a more comprehensive framework that is both conceptually elegant and inclusive, one that includes both explanatory theories and normative theories?

SOME OF THE MANY REMAINING QUESTIONS ABOUT THEORY IN RELATION TO RESEARCH AND PRACTICE

Many other questions remain. Among them, other questions that might deserve our attention include:

¹⁷Two early versions of these criteria were presented as part of symposia on theory at IAPS and EDRA conferences (Moore, 1988, 1991).

- How fertile are current theories in environment and behavior and in EB/design, that is, how readily do they or can they lead to new lines of interesting research? What characteristics of theories make them more fertile and, shall we say, infertile?
- How useful are EB/design theories, and what might make them more useful in terms of application or utility to the disciplines and professions dealing with the natural and built environment?
- What types of theories, including new theories as yet undiscovered and as yet unconceptualized, are needed in the field? Perhaps Krech's (1949–50) and Merton's (1957) seemingly ancient advice is still sage for environment and behavior. The EB field now has many volumes of data-rich studies including but not limited to close to 30 volumes of EDRA and 15 volumes of International Association for People–Environment Studies (IAPS) proceedings, the 1600-page *Handbook of Environmental Psychology*, almost 30 years of the journal *Environment and Behavior* and 15 years of the *Journal of Environmental Psychology*, a dozen volumes in Altman's *Human Behavior and Environment* series, and now four volumes in this *Advances* series. Conceivably the time is ripe for the development of the construction and test of theories of the middle range, working upward from more particular, little *t* theories toward middle-range integrative theories, toward the unification of principles. Perhaps also, following Krech, we ought to shelve some existing theories—certainly the larger all-inclusive speculations—for the moment and make a completely fresh examination of the categories of EB knowledge. What do we know? What are the phenomena that are common to large swaths of environment and behavior relatedness? What are the truly EB concepts, concepts that speak to the unique qualities of the EB nexus? The first task may be one of description and reclassification of existing knowledge. Then fundamental and new concepts, laws, and theories of the middle range might emerge from this newly examined and newly organized data.

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Studying Culture and History in Exotic Places and at Home

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Studies of culture and history, although never central to environment-behavior (EB) research, have long enjoyed a place in a field largely influenced by environmental psychology. Considerations of culture, perhaps the broadest of all frameworks for examining human behavior, have been a significant area of continuous investigation, however, while historical approaches have traditionally been only a minor aspect of the work. This chapter critically examines a selected sample of cultural and historical studies from the perspective of an anthropologist working in the EB field and outlines major contributions to the study of culture-environment relations.

The study of culture is important to EB research because it (1) broadens an otherwise individualistic perspective emphasized in psychology to focus on collective processes, (2) generally emphasizes questions of environmental meaning that may also encompass patterns of behavior, and (3) is inherently holistic and explores the organization and integration of beliefs and action into a patterned whole. The multiplicity of uses to which the culture concept has been put, however, has resulted in some ambiguity about definition and

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theory. These assumptions and tacit understandings, embedded in research strategies, are worth exploring and making explicit to further research in the field. This chapter will consider some of the definitional, methodological, and theoretical problems associated with the concept of culture; outline some of the major thematic issues addressed in culture–environment studies; review some early approaches and later specific applications; discuss culture/history and history/culture studies; and conclude with some recommendations about where the field might next proceed.

GENERAL COMMENTS ON CULTURAL DEFINITIONS, THEORIES, AND METHODS

Outside the EB field, and especially in anthropology, the concept of *culture* has been the topic of extended discussions. Although culture is often taken to mean a complex, integrated whole of shared, learned behaviors and ideas, not all necessarily “rational,” there exists no agreed-upon single definition of the term. Some who have borrowed the concept or applied it to EB research claim the concept to be too broad (Rapoport, 1990a) or vague (Kent, 1990) to be of use and urge a detailed elaboration of constituent elements such as technology, economics, sociopolitical complexity, symbolism, and world view. Anthropological discussions have traditionally used culture in two ways: to identify a group of people who share certain customs, beliefs, and values in common or to account for the acquired knowledge human groups use to adapt to their environment. In the former, culture describes a distinct pattern of beliefs, activities, and things; it considers tangible attributes characteristic of a group of people, often considered “exotic,” such as the Japanese, Yoruba, and Maori. The second definition emphasizes the integration of a broad range of less visible characteristics such as shared knowledge, ideas, skills, values, and institutions humans acquire as members of a social group and collectively use to survive.

Theoretical dichotomies also characterize cultural studies that seek to explain, on the one hand, distinct cultural behaviors and artifacts by shared ideas and values, or, on the other, beliefs and values specific to a group by their material conditions of life. Thus, the former idealist approaches tend to stress cognitive, expressive, symbolic, or normative explanations while the latter materialist orientations emphasize patterns of action, social organization, or the material basis of life as explanatory variables (Harris, 1968). Similarly, the investigation of culture has been marked by two broadly distinct methodological approaches. One stresses cross-cultural comparisons to test theoretical formulations about culture; these strive to explain the variation of particular cultural forms as a function of one or more specific causal variables. The other emphasizes ethnography, the sustained written, holistic account of a particular society, which also creates the cultural data upon

which comparative evaluations are made. Ethnographic descriptions, however, are not created in a theoretical vacuum; they are tacitly or explicitly organized and written as a demonstration of theoretical propositions expressed in the holistic integration of belief and practice systems in a society. The subjects of ethnographic description have traditionally included small-scale, often "exotic," societies of simple technologies; data are usually collected through techniques of participant observation in which the researcher lives for an extended period of time with the "natives." In part because these investigations are usually of short duration, descriptions are typically synchronic and have tended to suggest that cultures are homogeneous in character, slow to change, tradition bound, and rigid, with their members adhering in almost blind obedience to rules and customs.

In recent years, definitional and theoretical formulations have undergone a steady transformation. A synthesis of dichotomous definitions of culture now links an "ideational" order of ideals and principles with a "phenomenal" order of patterns of action and observable qualities of the social group (Goodenough, 1964). Idea, belief, and value structures are expressed in the material systems of artifacts and the built environment and in patterns of social behavior. This definition of culture emphasizes the acquired knowledge used by members of a group to *interpret* and *generate* appropriate behavior. Rather than consisting of things, culture is seen as the organization of things, the shared mental constructs used to produce behavior and fabricate the material world (Goodenough, 1957). Although this generative definition of culture emphasizes ideational aspects, it also includes their observable social and material products and the activities associated with their production.

Theoretical developments in the anthropological literature have increasingly emphasized the generative definition of culture that integrates idea and action and have also begun to question timeless, homogeneous, and static characterizations of nonliterate societies. Interpretive theories of culture, for example, expand on the contextual exploration of the relationship between ideational and phenomenal orders while focusing on cultural meaning. They examine the logic of connections between the complexity of beliefs and practices that give rise to cultural configurations understood as observable products or attributes of a group. These approaches are more concerned with the organization of diversity in thought and action within cultures than with the homogenization of differences (Geertz, 1973). They are also concerned with cultural change, not so much as a result of exogenous forces moving cultures from one state to another, but as a function of the complexity of mechanisms internal to the workings of the culture itself that generate new forms over time. Related development in social theory also includes incorporating ideology and practice. Recent contributions have identified internal sociocultural principles that predispose cultures to change, such as habitus (Bourdieu, 1977) and structuration (Giddens, 1984).

These theories postulate the generation of cultural forms through cumulative individual interactions with the social and material environments. The production and reproduction of cultural forms are situated in time and space, making the study of history and spatial relations an essential focus.

CULTURE-ENVIRONMENT APPROACHES

If culture-environment studies, as a subdomain of EB studies, are concerned with understanding human interactions with the built environment in order to better satisfy human needs through design, what kinds of knowledge can researchers expect from investigations of culture? In many ways, culture-environment investigations have paralleled anthropological developments in definition, theory, and methodology. Early flirtations with broad cross-cultural comparisons explored issues central to interests in psychology or architectural design, often seeking to legitimize those approaches, and included some attempts to establish as universal certain behaviors or attributes of built forms. Comparative studies tended to simplify "culture" to one or more variables as a way to test theories that focused on the instrumental, or need-serving, aspects of cultural phenomena. Because few, if any, culture-environment studies existed, early investigations utilized secondary ethnographic sources written by anthropologists and others. More recently, attention has begun to shift to questions of environmental *meaning* and *values* explored through symbolic and value systems. The focus on expressive, often seemingly nonrational, interactions with the environment has invited interest in exploring the complexity of interactions of belief and practice with the environment in more holistic studies. Chambers and Low (1989) note four recent theoretical orientations to culture-environment processes that seem productive in this regard, including a focus on patterns of social behavior and their organizing rules, cognitive structures as templates for cultural ideas, symbolic processes and structures, and more interpretive understandings that combine critical and historical approaches.

One cultural theme central to EB research implicitly addressed in the study of cultural systems is the notion of *congruence*, which postulates a fundamental fit between built forms and human needs. Although this concept operates as a major assumption in environmental psychology models, in "cultural" terms congruence suggests that since users and makers of built forms in small-scale societies are ostensibly the same, or at least directly and closely associated, forms should consequently fit users' needs, uses, and meanings more closely than in our own society, where the built environment is created by specialists. This approach assumes homologies on several levels such that behavior patterns and meaning systems correspond to each other and that these, in turn, are congruent with built forms. The idea that nonliterate societies are relatively homogeneous, and that the natives stead-

fastly adhere to tradition, has often been used to support congruence notions. Although this view may be simplistic, it constitutes a major assumption upon which the search for cultural universals of built form and related behaviors is based.

Because of the complex nature of systems of belief and practice, and their interrelationships, it is not surprising that the asserted fit between sociocultural and built forms has not always been found. Researchers have attributed discrepancies to sociocultural changes that precede and cause a "lag" in the development of corresponding material forms. Of course, there is no necessary reason why changes in built form cannot precede sociocultural changes as well; built forms may be products or stimuli of change. In either case, different cultural phenomena have different rates of change. The "lag" explanation for the lack of congruence seems to raise some important questions. While sociocultural change may create a lag, it is not clear under what conditions built forms would "catch up" with sociocultural processes and the lag would disappear or, if, as many would argue, change is ongoing, how a new congruent condition could be identified. That is, if change is a continual process, at what point does a new "tradition" or congruent relation get established and fixed, and how do we know it?

The key problem with the congruency hypothesis does not lie in varying degrees of homogeneity or rates of change, but in the very assumption that cultural systems of beliefs and practices themselves are internally consistent. More often researchers find conflicts, inconsistencies, anomalies, and contradictions within cultural systems that make the identification of congruent built forms extremely difficult. The problem lies in identifying which symbolic meaning or behavioral need in a system full of contradictions is congruent with architectural form. Interpretive views of culture identify many levels of diverse meanings and actions, many of which are based on inherent ideological contradictions, and work out the logic that connects them. This view sees diversity and change as central features of culture and the built environment as only one of its many cultural expressions.

The tendency to conceptualize congruence in other cultures can also be partly traced to a fascination with the "exotic," or any group considered substantially different from ourselves. This bias has been explored in anthropological research (Marcus & Fischer, 1986), and similar concerns have been expressed in culture-environment studies (Alsayyad, 1989; King, 1980). As noted, ethnographic characterizations have tended to portray exotic cultures as self-contained, monolithic, and relatively static with their members tied to tradition and holding to seemingly irrational beliefs and values. These perspectives have often been the products of the short-term synchronic studies, which tend to freeze cultures for the moment in exaggerated ethnographic permanence of "traditionalism." In the absence of documented histories or long-term studies of exotic cultures, change must necessarily seem very slow and relatively minute. Further, as a result of implicitly comparing exotic

peoples with our own mental, normative, and moral capabilities, many of these studies tend to oversimplify descriptions of customs or dwell on the seemingly nonrational side of culture.

In anthropology, as well as in other disciplines, this exaggerated "otherness" has been increasingly questioned. Marcus and Fischer (1986) outlined a number of strategies to revise interpretive anthropology by including the voice of the ethnographer in ethnography and incorporating historical perspectives into cultural studies. Indeed, they claim that this focus on cultural critique has shifted much of our original fascination with exotic peoples to subjects closer to home. These perspectives have already begun to affect culture–environment studies as researchers begin to apply cultural theories to the study of our own environmental behaviors and meanings. Inevitably, adhering to the view of the exotic "traditional" society in culture–environment research distorts and inhibits the development of theories that can explain phenomena in more than one type of society.

EARLY INFLUENCES ON CULTURE–ENVIRONMENT STUDIES

The search for "cultural" perspectives in EB research begins with considering a variety of contributions, many of which have not treated the concept of culture explicitly or defined it consistently. The earliest influences, which date to the 1960s, include studies of tacit behavioral or cognitive patterns, holistic interpretive essays, and ethnographic descriptions; investigations of the problems of culture contact and change; and inquiry into meaning and value systems.

One of the earliest and best-known anthropological examples is Edward T. Hall's (1966) work on *proxemics*, the study of the human use of space "as a specialized elaboration of culture" (p. 1). Hall employed a communication model to identify the spatial dimensions of nonverbal behavior that convey social meanings. He postulated that humans are enclosed in a bubble of spatial hierarchies that regulate contact in social situations. Specific interpersonal distances characterized by behavior patterns ranging from informal and intimate to formal and public are learned as a feature of culture. The meaning of these spatial dimensions, however, is largely tacit, and actors generally become aware of the boundaries of personal space only when they are violated. The importance of Hall's work was to show how the same interpersonal distances could mean different things in different cultures and that there was tremendous variability that could ultimately contribute to our understanding of density, privacy, and crowding across cultures. Ironically, continued interest in Hall's work has occurred principally outside anthropology (Aiello & Thompson, 1980). Proxemics research has, however, become a staple ingredient in discussions of "spatial behavior" in the EB literature (e.g., Altman, 1975), but presumably because it had little to do with

“fixed feature space” of the built environment, it has found little specific application in cultural aspects of design research.

Another early exploration of tacit aspects of culture–environment relations was the cognitive mapping technique popularized by Lynch (1960), which identifies salient shared perceptions and understandings of a place by eliciting graphic and verbal descriptions from users. Lynch’s concern with the imageability of cities led him to develop a procedure that systematically discovers collective meaning and makes patterns of tacit knowledge explicit. The cognitive mapping strategy has been employed by various EB researchers interested in environmental knowledge (Downs & Stea, 1973; Moore & Golledge, 1976; Saarinen, 1973).

Early interpretive explorations of environmental meaning approached from historical, comparative cosmological, and phenomenological perspectives may be considered “cultural” in retrospect even though specific discussions of the culture concept was largely absent. Jackson (1970), on the meaning of the North American landscape, and Relph (1976), who explored the concept of “place” and the lack of it, have become classics in the culture–environment field, as have the more individualistic and phenomenological essays of Bachelard (1969) and Cooper (1974b) on the symbolic meaning of the house. Synthetic cross-cultural discussions based on secondary ethnographic accounts and culture theory are found in Tuan (1974, 1977) and Norberg-Schulz (1965), who focus on universal symbolic meanings to articulate design positions.

Some early community studies conducted in the United States qualify as ethnographies of collective human interactions with the built environment and, in particular, the physical formulation of community. Classic studies by Gans (1962, 1967) and Suttles (1968) are two such contributions; Cooper’s extensive evaluation of Easter Hill Village (1974a) could be taken as an example of EB ethnography. Fried and Gleicher’s (1976) study of forced urban relocation revealed the detrimental effects of planning policy on low-income communities that does not take into account the diversity of environmental meanings and value systems when instigating change. In another study of relocation in a London community, Young and Willmott (1957) examined effects of spatial reorganization on gender and kinship relations.

Early culture–environment studies of “exotic” peoples included ethnographic description and analysis, as well as investigations aimed at improving the built environments in developing countries. Descriptive studies in rural settings and among “tribal” peoples have included both original ethnographic field studies and essays drawn from secondary sources (Oliver, 1969, 1971, 1975; Prussin, 1969). Research aimed at recommending improvements to the built environment has included an emphasis on understanding both local culture and the political, economic, and social context of communities. The contributions by architects and planners have principally

examined problems in housing urban immigrants in Latin America cities (Alexander, Angel, Coffin, Hirshen, & Ishikawa, 1971; Peattie, 1968; Turner, 1976) and finding appropriate housing strategies among rural dwellers in Egypt (Fathy, 1973). Among a more "exotic" subculture of the Navajo in the United States, the work of Sadalla, Snyder, and Stea (1976) demonstrated the utility of research for achieving housing satisfaction. Zeisel's (1973) study of Puerto Rican families living in New York tenements also drew important recognition to subcultural differences in living patterns within our own society and provided a method for discovering and designing for those differences.

These early studies thus constitute an eclectic body of research on the topic of culture and set the themes of tacit patterns, the interpretation of meaning, and ethnography at home and in exotic cultures later pursued by culture–environment researchers. Missing from these works, however, is any sustained discussion of the culture concept or any comprehensive theoretical formulation of culture–environment relations.

EXPLICIT CULTURAL APPROACHES AND THE EXOTIC

Two names most associated with early culture–environment research are Amos Rapoport and Irwin Altman, who have contributed "frameworks" for incorporating theoretical approaches. Each initially relied on comparisons of exotic cultures and utilized secondary ethnographic materials to explore general theoretical perspectives that correspond to concerns in EB research. Both argue for an holistic interpretation and identify multiple factors that contribute to variations in built forms and behavioral patterns. Rapoport's focus on the form of the built environment is ultimately oriented toward improving design processes for ourselves and other cultures; Altman, however, endeavors to broaden the theoretical perspective for understanding spatial dimensions of human behavior grounded principally in environmental psychology.

AMOS RAPOPORT'S WORK ON BUILT FORM

In his seminal *House Form and Culture* (1969), Rapoport introduced the concept of culture into the EB literature. He identified extreme variation in house forms throughout the world, but argued against a single-cause explanation. Rather, house forms result from a whole range of sociocultural factors modified by climate, materials, construction methods, and technology. In this early work Rapoport began to develop an explanatory framework linking culture to the built environment, which he continues to explore through prolific writings. At least four important themes can be found in Rapoport's work: (1) an emphasis on activity systems or human behavior,

mediated by "meaning," which generate built forms; (2) a model of congruent relations linking idea and behavior systems to the built environment; (3) a choice model of design; and (4) potential variability of built form great enough across cultures to warrant exploration of each on its own.

Rapoport focuses on how culture and its constituent elements affect built forms as outcomes of process. Although the built environment is subsumed by culture, Rapoport does not generally treat form as an intrinsic part of culture but as a product of it. A "schema" orders both general and specific features of culture, an attribute of a group of people who share values, beliefs, and ideals transmitted to members through enculturation (1976, p. 26; 1980, p. 9; 1990a, p. 10). To counter the vagueness of the culture concept, Rapoport (1976) postulated a series of five successive levels of characteristics deemed "most useful" in examining relations with the built environment: world view, values, images, lifestyles, and activities. The criteria used to order the cultural levels in relation to the built environment are their observability and tangibility. The order postulates that the least concrete notions of world view, values, and images "lead to" lifestyles and activities that have the most direct and immediate linkages with the built environment (1976). The actual connections between levels, whether they are generative or inclusive, however, are not made clear. Further, the relationships Rapoport postulates are linear and unidirectional, thus ignoring the interactions among these cultural levels.

While Rapoport argues that cultural differences in activity and activity systems are the most important determinants of variation in built form (1976, p. 261), he does not intend to completely reduce culture to activities alone. Rather, he argues that meaning mediates the relation between built form and behavior. Rapoport focuses, however, on activity as the determinant of meaning and defines its four successive levels as description, mode of operation, associated activities, and meaning (1982, p. 15). Meaning is treated as a latent function of activity and therefore is derived from it. By implication meaning cannot stand on its own, nor does it seem to be generated from other meanings or meaning systems. Even in Rapoport's own schema of successive cultural levels he does not indicate how "world view" or "values," which are meaning systems themselves, are integrated with the latent functions of activities. Because these meanings are attached to and derived from activities, they are never shown to form a logical or coherent system of their own that may be used to generate as well as interpret environmental behavior or built form.

Rapoport's model also assumes correspondance or congruence between the less tangible aspects of culture, its world view and value system, and more observable activity patterns and built forms. The built environment represents the encoding of the schemata; members of the culture decode specific formal cues resulting in appropriate behavior. Rapoport uses this approach to describe how aspects of the built environment "communicate"

with the users who respond to cues by producing appropriate behavior (1990a, p. 12). The emphasis on the correspondance between cultural values, activity systems, and the built environment also appears in his model of design. "Natives" who design, build, and occupy their own constructions exercise choice constrained by limited alternatives (1977). The design and construction process is implicitly held to be a rational one that produces forms congruent with activity needs and their corresponding meanings.

In discussing how varying cultural needs can be addressed by designers, Rapoport (1976) employed a variant of the choice model linking ideals and images, values and behaviors to the physical environment the natives build. Rapoport's assumption that the natives achieve "congruence" between the built environment and their cultural needs also assumes there are no conflicting or contradictory needs. Since, in traditional cultures, there is ostensibly little or no discrepancy between the designer's and user's world views and value systems, congruence may be a relatively easy goal to reach. When the designer is a specialist, as in our own culture, however, major discrepancies in intentions and needs can create a lack of congruence in the built environment. Thus, Rapoport urges designers to become aware of the users' needs by investigating their culture and to design culture-supportive environments.

In looking for universal aspects of design, Rapoport argues that although the types of activities accommodated by the built environment are finite across cultures, the meanings attached to them and their forms are less limited. Because meanings and the built forms they generate can vary so widely, Rapoport (1980) suggests that the needs of each culture must be discovered anew since there is no way to predict in advance what particular built form-behavior configuration is appropriate. He suggests documenting cultural needs with a user group profile based on core lifestyle attributes and activities. Rapoport (1980) acknowledges that even if cultural needs are identified and culture-supportive environments built, perfect congruence can never occur because cultures change; he suggests that designers strive to create environments people can control and change themselves.

Rapoport's contribution to establishing the culture-environment field cannot be underestimated. He not only focused attention on this important area of research at the earliest formative period of the field, but has also consistently contributed to its development through comprehensive and encyclopedic reviews. His many books and articles constitute compendia of ideas useful in the design process. Rapoport is a master at incorporating and assimilating research perspectives and findings into his own cultural framework, especially noting how EB research on perception, cognition, and behavior is compatible. And, although Rapoport places emphasis on activity as the critical cultural influence on built form, he includes meaning as a derivative of action systems that also affects built form. Recently, Rapoport has shifted his interests to the historical and archaeological perspectives discussed later in this chapter.

IRWIN ALTMAN'S WORK ON SPATIAL DIMENSIONS OF BEHAVIOR

Another culture–environment researcher is psychologist Irwin Altman, who initially explored cultural variations in the spatial dimensions of individual behavior, but has recently begun to focus on meaning. In an early comparative study, Altman (1977) argued that privacy is a culturally universal process necessary for human survival, although cultures vary considerably in the degree and manner of expressing it. The definition of privacy Altman advanced emphasizes individual boundary maintenance behaviors; culturally distinct privacy patterns seem to result cumulatively from individual needs and behaviors. Altman found that privacy is expressed at least as often through verbal and nonverbal behaviors as through manipulating the physical environment. As an analytical construct, however, privacy has recently been questioned by Howell and Tentokali (1989), who argue that its individualistic focus, a Western orientation, may not be appropriate in the study of other cultures. Researchers may grant privacy and other individualistic behaviors too much importance in structuring spatial relations in some cultures in which the obligations for sociability are strong. Further, the meaning of “privacy,” if such a concept can be identified in other cultures, may not be the same as ours, as it does not stand alone but is associated with different symbolic and value systems.

In a later work, Altman and Chemers (1980) put forth their own “framework” for examining culture–environment relations that, like Rapoport, focuses on how human actions, especially the spatial dimensions of behaviors, mediate the relation between the broader concept of culture and the physical environment. Cross-cultural variations in the expression of ostensible universal behaviors such as personal space, privacy, reactions to crowding and density, and territoriality constitute the key linkages. Although Altman and Chemers’s model is similar to Rapoport’s in that world view, cognition, and environmental behaviors and processes combine to create environmental outcomes in the form of the built environment, their model is not linear but reciprocal, with the physical environment also having an effect on world view, cognition, and behavior.

In an exploration of other potential universal features of EB relations, Altman and Gauvain (1981) argued for a dialectical approach to study housing by focusing on the individual and society. A cross-cultural comparison of oppositional tensions between identity/communality and accessibility/inaccessibility found in house exteriors, transition areas, and interiors revealed a dynamic, unified system of relations. Their analysis focused on how houses are used expressively for ideational purposes *and* instrumentally for controlling overt behaviors, especially in relation to privacy. Altman and Gauvain noted, however, that there is no way to be certain that these are the appropriate or only oppositions to explore cross-culturally, nor is there any apparent way to measure these dimensions within and between cultures.

Altman and Rogoff's exploration of transactional theory (1987; Werner, Altman, & Oxley, 1985) attempts to address some of the messier contextual issues associated with culture. As portrayed by Altman and others, transactional theory is holistic in that it considers the individual in the environment as the unit of analysis. It also attempts to consider meaning as well as behavior, and it includes a temporal perspective as well as a spatial one. One feature distinguishing transactional theory from other psychological approaches is that it does not necessarily seek to establish universal principles, but is concerned with accounting for observed patterns by utilizing explanatory principles that emerge in each situation. As such, it moves away from Altman's earlier comparative approach and shares similarities with anthropological uses of ethnography and recent interpretive approaches. In fact, Altman and Rogoff (1987) find characteristics of transactional theories in many "cultural" approaches in the EB literature. In a recent collection coedited with Low (1992), Altman extended his cultural explorations to the topic of "place" and sought to discover how people "attach" themselves to places through meaning.

Each of these frameworks—Rapoport on built form and Altman on spatial dimensions of behavior—makes important assumptions in modelling human interactions with the environment. While both examine the relation of meaning to action, Rapoport considers meaning to mediate the relation between the physical environment and action, with the configuration and arrangement of physical spaces meant to accommodate human activity. Altman, however, seems to initially envision meaning and action as coequal in their interaction with the physical environment but has recently become more interested in meaning itself. Altman's model clearly portrays culture as an accumulation of characteristic patterns of behaviors and meanings derived from the individual level; cultural meaning as a collective process is not an integrated phenomena but is taken as a given. Rapoport, on the other hand, incorporates a collective model of culture but one that tends to be static, linear, and assumes homogeneity; in Rapoport, tradition exists as a social fact. Although both employ a congruence model, methodologically Rapoport seeks to locate universal aspects of design by contrasting secondary data from exotic cultures, while Altman shifts from cross-cultural comparisons to more holistic considerations that include views of ourselves.

SOME SPECIFIC APPLICATIONS OF CULTURAL THEORIES

While cross-cultural comparisons have been essential in carving out culture-environment research areas, the 1980s have also seen studies increasingly utilize particular cultural theories and/or ethnographic fieldwork to address particular cultural issues. Generally, the focus of these studies is a sustained investigation of a single culture or two cultures in

contact or a controlled comparison between two or more cultures. Most of the studies give as much if not more emphasis to questions of meaning as they do behavior, and, while some of studies focus on exotic cultures, others have explored subcultures in, or cultural aspects of, our own society.

Cross-cultural and cultural approaches to explaining mainstream EB concepts and theories, especially those with a behavioral emphasis, continue to receive attention. In a comparative study, Bechtel (1989) employed a behavior-setting method to investigate the differential influence of culture and environment on use patterns within the home in three different cultural settings: Alaska, historical Iran of the Shah's time, and Saudi Arabia. Brower (1980) explored territoriality and defensible space in residential neighborhoods by exploring personal and social meaning and identity and found significant cultural differences between classes. Howell and Tentokali (1989), as mentioned earlier, critically examined the "stock" EB concept of privacy, defined as control of information about the self, in relation to domestic roles and found it inappropriate for cross-cultural application. They argued that a concept of privacy based on Western patterns of socialization misplaces the locus of control in the individual rather than the group when it is used to study other cultures. In other words, seeking individual privacy in some cultures may not only be a social taboo but may also not even be considered a possible behavior.

More central, however, to current trends in culture-environment research is the theoretical exploration of meaning in built and natural environments, especially in "exotic cultures" using extended field research. These studies aim to demonstrate the integration of meaning and action, belief and social organization, in relation to the built environment by employing social symbolic, structuralist, and ritual theories. The built environment is taken to be the tangible expression of the hidden cultural order. While social symbolic theories emphasize how built forms communicate and represent social position, structuralist theories rely on finding homologies in the symbolic and social structures to explain built forms. Ritual theories explore how environmental meaning is activated through ritual practices. Symbolic studies, to the extent that they focus on exotic peoples, seek to make understandable seemingly irrational cultural practices and sometimes preserve distinctions between "traditional" and "modern" in dealing with sociocultural change. Challenges to these views, however, reveal the complexity of cultural forms in response to change and analyze the nonrational in our own culture.

A well-developed social symbolic thesis is found in Duncan (1981), who associates changing house forms with expressing social identity in India and Sri Lanka. He argued that as developing countries modernize, house forms that formerly expressed a collectivistic social identity based on closed social relations and a segregated division of labor give way to individualistic forms identified by high social mobility and open social groups. While Duncan

characterizes houses of the former as “containers of women,” the latter are seen as commodities and status symbols. In Vanuatu, Rodman (1985) also found individualistic identities expressed in changing residential forms but collectivistic identities in the relatively unchanging men’s houses, suggesting that changes may occur differentially or asymmetrically within a culture.

To explain the meaning of built forms, structuralist approaches reveal homologies between social–symbolic structures and spatial forms; they constitute a major anthropological approach (see Lawrence, 1989; Lawrence & Low, 1990). Classic examples include the often cited study of the Dogon house and settlement pattern by Griaule (1954) and Bourdieu’s (1973) analysis of the Kabyle house. Most studies in the culture–environment literature, however, seem to deal with built form as principally derived from cosmological structures and only secondarily associated with social structures. Further, they tend to examine societies as fixed in time, rather than as dynamic and changing. Studies of gardens (Johnson, 1988), houses (Khambatta, 1989), and cities (Peiper, 1975), for example, all concentrate on the direct expression in built form of cosmological or metaphysical structures that may or may not be grounded in a thorough analysis of social reality.

Other symbolic theoretical approaches focus on ritual interactions with the built environment. Saile (1985a) examined the meaning of home and house-building activities among Pueblo Indians of the Southwest; he employed symbolic theory to explain how ritual ceremonies transform inert materials of construction into a home, a living place, by locating it within the cosmos. Lawrence (1987) applied ritual theory in arguing that a North American “main street” acquires special meaning, aside from its instrumental functions, because of its association with an ephemeral community celebration. Prussin (1989) argued that the making and remaking of the nomadic home retraces Gabra cosmology and reinforces the normative structure of society.

Several studies explicitly dealing with symbolic theories of cultural meaning have applied their findings to design issues. Doxtater (1984) critically examined the utility of applying symbolic and ritual theory in explaining the “nondiscursive” meaning of the built environment and, in particular, contemporary design. Robinson (1989) developed an explicit cultural approach to understand design cues that signal different meanings in institutional settings and homes. She suggested that buildings perform a communicative function in society and that designers must understand not only which architectural cues to employ but what the cues mean to people who use the buildings. By analogy, Saile (1985b) drew on Pueblo examples of meaning of house forms to argue that designers must understand the culture of the users.

Phenomenologically oriented research is a tacitly cultural approach to the study of EB relations, although it generally eschews any association with

preconceived theoretical or conceptual ideas that bias observation (Seamon, 1979, 1987; Seamon and Mugerauer, 1985). Rather, EB relations are described in terms of the essential characteristics of experience, yet they presume to capture universal rather than culturally specific truths. In this sense, phenomenologists appear to replicate the holistic inductive descriptions of ethnography and tend toward interpretive explanations in the examination of multiple views of idea-behavior systems. Seamon's (1979) concept of place-ballet constitutes one important effort to develop a conceptual framework from these observations that link human action with the physical environment. His body-subject, time-space routines constitute a means to understand a place and conceptually overcome the fragmentation of modern life.

Dovey and Korosec-Serfaty each use an interpretive approach in applying the phenomenological concept of space appropriation to explore the meaning of home. Dovey's (1985a) exploration of homelessness argued that the commoditization of house form inhibits appropriation and negatively influences the meaning of the dwelling. Korosec-Serfaty (1985) explored the hidden personal meanings of the home associated with attics and cellars. Dovey (1985b) also explored the notion of authenticity of material artifacts, suggesting that the manipulation of meaning is the basis for fakery and deception about environmental forms. He drew on the legitimacy of the exotic Dogon culture to argue that authenticity of meaning must rest in process, which is largely cultural, and not the actual material form itself.

Several explorations of the meaning of place as informed discovery use a tacit notion of culture to investigate the logical interconnections of systems of meaning and patterns of action. Riley's (1985) work on cultural and vernacular landscapes viewed ordinary places as artifacts of American culture and, like Dovey, was later concerned (1987) with change in the quality and meaning as we substitute the traditional with commercial and self-consciously manufactured imitations. Threats to local definitions of place in a small town through increasing tourist and development activity led Hester (1985) to explore place meanings and describe their connection to local culture, a feature often missed by outsiders and planners. Brower (1988) also demonstrated cultural sensitivity in his study of North American urban residents' and outsiders' perceptions of place and the contribution of these to the quality of living in a place.

Anthropological studies of built environment issues at home include Perin's (1977) study of American land uses as a moral system expressing the larger social order. As an explicitly cultural approach to urban planning, Perin focused on the contradictions between ideas and practices, between value systems and the social order, that produce with regularities "problems" in the public domain (p. 163). She found that the organizing principles underlying the practice of private ownership of residential property constitute a value system, rules and hidden meanings that convey privileges on some and deprive others. In an ethnographic postoccupancy evaluation of

South Commons in Chicago, Pellow (1981) argued that congruence between the built environment and inhabitants' uses is essential to the success of a multiethnic, multiclass residential experiment. Her discussion of the numerous actors involved in producing the built environment, however, underscored the difficulty of attaining such a goal in complex urban society. Recently, Cooper and Rodman (1990) and Rodman and Cooper (1989) have begun examining Toronto housing cooperatives with a focus on conflicting resident values and their effects on community life.

Intensive ethnographic field methods are increasingly used to study built environment problems in rapidly changing exotic cultures; Hardie (1989) reviews some of these recent studies as they apply to housing. In addition, Hardie's (1985) study of Tswana housing patterns in South Africa developed the concept of expressive space—defined as relations between cosmology, social status, and spatial organization—to explore conflicts between the "traditional" house and new, colonially inspired housing. Hardie suggested that traditional cultural values and attitudes do not necessarily change in conformance with changes in physical forms. Larsson (1989), however, argued that more recent research among the Tswana shows that new ideas in the organization of spaces are invading the rural areas. Hardie and Hart (1989) also examined conflicting views of a South African housing program in which different attitudes by government sponsors and black tenants developed through long-term colonial relations threatened the success of the project. Using an ethnographic approach, Low (1988) has also considered the effects of differential government policies on house form in the post-earthquake rebuilding in Guatemala.

Although the variety of theoretical approaches and cultural topics is quite broad, not one synthetic theory emerges. Overall, there seems to be an increasing interest in meaning over behavior, and, although exotic cultures are still the principal subjects of much ethnographic inquiry, there are significant attempts to apply a cultural approach to design and planning issues at home. Inasmuch as the complex interactions of belief and value systems and behavioral patterns with the built environment are more completely described and interpreted, formal attention to the importance of history, historical methods, and the use of history as a critical approach to understand culture–environment relations is not included.

CULTURE AND HISTORY

The focus on exotic societies in cultural studies has largely predisposed researchers to an ahistorical perspective, and, although many have been concerned with social change, the fact that nonliterate societies lack written historical documents has inhibited inquiries. Ethnographers have, however, become increasingly aware of this omission and now consult accounts of

early contacts, colonial administration, and historical records belonging to the dominant civilization of which a local community might be a part. Many culture–environment researchers have employed historical materials as background in their studies, but aside from some transactionalist considerations of temporal processes (Altman & Gauvain, 1981; Werner et al., 1985), little explicit attention has been paid to the theoretical import of the issue. In particular, historical inquiries can address notions of congruence between cultural patterns and built forms. Some of the current thrusts in culture–environment research include social history coupled with ethnography, historical typological studies, and ethnoarchaeological approaches.

The most completely developed historical approach to culture–environment relations is that of Roderick Lawrence, who compared Australian and British homes and examined the evolution of Swiss public housing. Lawrence (1986), combining historical and archival methods of data collection and ethnographic field research in creating a typological database, reconstructs social history and applies anthropological theory to interpret changes in domestic forms in relation to social life. His theoretical approach draws on the structuralism articulated by Douglas's (1966) analysis of classificatory systems categorizing elements of social life in the domestic environment into oppositions such as clean/dirty, public/private, day/night, and front/back. R. Lawrence (1987) also adapted Bourdieu's analysis of the Kabyle house to look at the habitus, or cultural predispositions over time. The methods Lawrence utilizes thus combine cross-cultural and cross-temporal perspectives.

R. Lawrence (1987) compared the evolution of British workers' and Australian colonial houses, focusing on differences in the location and meaning of household spaces. He identified the locational significance of the kitchen in its original English configuration, which changed when it was exported to Australia. The English space accommodating cooking and eating functions also included bathing and laundry activities. In the Australian house, however, laundry and bathing facilities are clearly separated from the kitchen; the locational and behavioral patterns suggest an underlying conceptual pattern distinguishing washing activities from cooking and eating. Homologies in cognitive and behavioral patterns in relation to the built environment constitute the explanation of differences between the two cultures. In his study of the evolution of Swiss multiple family housing during the nineteenth century, Lawrence (1990) linked the creation of communal spaces to the gradual differentiation of public and private spaces resulting from changes in family and community organization.

Roderick Lawrence has contributed in significant ways to the research literature by moving beyond earlier "frameworks" for examining culture–environment relations to articulate a cultural theory of the built environment grounded in history. Structuralist interpretations of culture explain form by establishing underlying systems of rules and conventions that make meaning and action possible. The discovery of homologies between symbolic and

spatial orders makes the tacit structure lying beneath the surface obvious and explicit. By employing sustained historical techniques, Lawrence is able to critique the notion of congruence, arguing that "the relationship between habitat and resident is dynamic or changeable, and it includes factors which may remain unresolved over a relatively long period of time" (1987, p. 51). In his conception, however, the lack of fit is generally attributed to a temporal "lag."

Historical typologies have been used in a number of fields to explore changes in sociocultural relations and house form due to borrowing or designer innovation (Glassie, 1975; Jopling, 1988; Otterbein, 1975). In the culture-environment literature, Pavlides and Hesser (1986, 1989) examined three different periods of recent Greek history to explore types of vernacular houses on the island of Lesbos. The houses provide clues about changing relations of social status, gender roles, and the life cycle. Historically documented changes in house forms and the decreasing segregation of women are traced in the Islamic house in Iran (Mazumdar & Mazumdar, 1984) and in Zongo housing in Accra, Ghana (Pellow, 1988). Lawrence (1988) examined historical changes in house forms in an agrotown in southern Portugal and found not only significant shifts in gender relations in newer homes, but also changes in neighborhood sociability as well.

Some recent explorations of urban settings in complex societies have combined ethnographic field research with a historical approach. Holston (1989) argued for an anthropological critique, linking form to sociocultural meaning, of the modernist city of Brasilia. He employed figure-ground concepts to examine the shift in organization of architectural forms from pre-modernist urban settings to Brasilia. He suggested that the street, an important cultural element in Brazilian society, died under the modernist experiment. In her study of the main square in Malmo, Sweden, Korosec-Serfaty (1982) also combined field research with an historical perspective spanning three centuries to examine the evolution of uses and forms of public space. She concluded that concerns with formerly utilitarian functions have given way to contemporary initiatives to infuse life into the square; values about urban sociability lend themselves to "produced space" rather than take space as a given.

Historically oriented cultural interpretations of residential landscapes are found in Duncan and Duncan (1984), who draw on historical English images to compare elite U.S. and Canadian neighborhoods, and in Duncan's (1990) exploration of the royal capital of Kandy in Sri Lanka. Duncan followed Geertz (1973) in examining nineteenth-century texts and argued that the cultural meaning of the landscape is found in association with political and religious texts that form the basis of a competing discourse over the legitimate authority on kingship. Contested interpretations of texts provide for multiple and often contradictory meanings ascribed to the built environment. In a much more eclectic cultural examination of history, Lowenthal

(1985) explored the meaning of the past as it is represented, preserved, and reinterpreted in the material culture of the present. Historical explorations of culture–environment relations among exotic peoples have included some surveys of large geographic areas in native North American (Nabakov & Easton, 1989) and Islamic Africa (Prussin, 1986). More often, historical considerations have included discussions of the role of colonial contact and its effects on the built environment; many of these emphasize policy considerations within the context of colonial contact. Lang (1989) investigated colonialist housing policy in India to understand changes in “traditional” house forms and to recommend strategies for the design of culturally appropriate houses. The history of colonial influences on the form, function, and meaning of the built environment has been the subject of numerous studies in India (King, 1976; Lewandowski, 1980, 1984).

Another kind of historical emphasis in culture–environment research has recently been introduced by Rapoport (1990b), who is pursuing a long-term interest in historical precedents derived from archaeological and ethnoarchaeological work. Ethnoarchaeological studies utilize ethnographic field research in contemporary societies analogous to archaeological ones to test and increase the validity of inferences made from the archaeological record (Kent, 1984). Rapoport enthusiastically embraces ethnoarchaeology as a culture–environment research standard. In a staunchly “scientific” approach, Rapoport concentrates his argument on methodological issues involved in making inferences about sociocultural phenomena from the archaeological record and from existing but historically representative architectural examples. Rapoport’s case study is concerned with the design of pedestrian streets, which he argues should be adapted from principles of complexity found in preindustrial settlements (1990b, p. 287). He argues that complex physical designs stimulate human perceptual interest, which “supports” or is congruent with pedestrian activity. Rapoport outlines research by others as the primary evidence that features of the physical environment are empirically associated with specific aspects of pedestrian behavior. The bulk of the study compares urban street forms from different times and cultures to illustrate the principles of complexity that support pedestrian activity. Unlike ethnoarchaeological studies, no actual demonstration of the relationship between the principles found in his sample of built forms and pedestrian behavior is provided by Rapoport; the connection remains inferential. Rather, historical precedents seem to constitute a legitimate design resource regardless of their actual cultural meanings or uses; that they exist in so many places over so much time is taken by Rapoport to mean that they are “significant and important” (1990b, p. 460).

Some ethnoarchaeologists, such as Kent (1984, 1990), have been conducting field research on topics that parallel culture–environment research interests. Kent (1984) argued for a behaviorally based definition of spatial form termed “activity area” research. In comparing the way in which spaces

are partitioned and used in different cultures, Kent (1990) suggested that the increased specialized uses and numbers of discrete spaces in which activities are carried out corresponds to evolving sociopolitical complexity. Other archaeological studies seek to make inferences from the material remains of cultures by utilizing findings from the EB literature. Sanders (1990) interpreted the behavioral dimensions of territoriality, privacy, personal space, control, and communication from cues in prehistoric house forms on Crete. Given the current controversy regarding cross-cultural differences in the meaning of EB concepts such as privacy, making inferences from this literature to the archaeological records seems at best risky. Using historical and contemporary examples of built forms and settlement plans, Hillier and Hanson (1984) also made inferences, without much benefit of human subjects, about the inherent "knowability" of the built environment, which acts as a medium for controlling access and sociability.

Working with the archaeological record without the benefit of living peoples or documents of historical communities can make assertions about meanings and uses of the built environment risky. At best, researchers are able to infer simple and direct behavioral patterns, while meaning systems are a bit more challenging. This is one of the reasons why ethnoarchaeology has become so essential. On the other hand, some interpretive historical accounts demonstrate that, even with documentation, the congruence between built forms and their uses and meanings may be illusory. That both historical and contemporary built environments are subject to multiple and often contradictory interpretations is a cultural fact of significance to design research.

HISTORY AND CULTURE

Closely related to culture–environment studies that incorporate historical perspectives are a number of studies that reconstruct histories of institutional and urban forms using social and cultural interpretations. These reconstruct ideological, social organizational, and material bases of institutions and track the evolution of form over time. The analysis of institutional policies containing ideological assumptions and social values is often central to understanding the production of the built environment. But historical approaches to the built environment also incorporate tacit cultural theories relating the interaction of belief, values, and attitudes, with patterns of action and the physical environment. These studies include social histories of built forms and critical histories of urban institutions.

A fairly consistent body of work in social history tracks developments and changes in the built environment as a result of the interaction of numerous complex social forces. Hayden (1976) traced the relation between religious and political ideologies and their expression in domestic plans in a

number of North American utopian settlements. In subsequent work, however, Hayden (1981, 1984) focused on the contributions of nineteenth- and twentieth-century feminist ideology in changing the organization and meaning of domestic spaces. Social historian Wright (1981) critically examined model American homes as a social and symbolic expression of tacitly held beliefs and values about the proper form and behavior of the family. In a study of the design of women's colleges, Horowitz (1984) also explored the relationship between a vision of women in society and its accommodation in the built environment.

In the public arena is Craz's (1981) history of park design, which weaves together a complex picture of the evolution and development of ideas about the role of leisure and recreation activities with urban political processes in North American culture. Rivlin and Wolfe's (1985) investigation of the institutional lives of children also brings to bear an important historical dimension on the evolution of policy and the built environment. The authors described the sources of models for institutional childcare by outlining the social and cultural values that formed the basis for the design of physical environments and institutional programs. Within the context of historical development, the authors describe their own work and draw implications about the meaning and operation of the environment in relation to children's lives.

Other critical histories of institutional built forms (King, 1980) draw on perspectives in political economy (e.g., Castells, 1977; Harvey, 1973). Perhaps the best-known critical theory of institutional forms and sociocultural processes is found in the work of Foucault (1977), who argued that architecture acts to extend control. Foucault traced the nineteenth-century development of schools, prisons, and mental institutions to the military camp, which maximized in its layout the observational advantage of those in power. Institutional design shifted focus from concern with an exterior image to interior spaces that could incorporate forms of "hierarchized surveillance" as a technique of control. In making subjects visible and known through surveillance, they could ostensibly be better treated and trained. The technique and apparatus of control found in architectural form was perfected without considering the ideology of treatment or education, but because it expressed the tacit notion of "disciplinary power," which was rational, scientific, and universal in its application. The technique of control could be used in a variety of settings, thus detaching specific ideologies from practices and their built forms.

In an explicit attempt to extend the ideas of Foucault, Rabinow (1989) explored the development of modern French urban planning, tracing it to the state's intervention in systematically observing and collecting social, economic, and demographic facts in order to deal with the cholera epidemic of 1832. These data, coupled with the birth of social science and socialist politics and the emergence of new design ideals that sought to give formal

expression to a new social reality, led to the development of the ideal modern French city oriented at promoting productive, healthful, and peaceful living. In a history of street celebrations in nineteenth-century Philadelphia, Davis (1986) drew on Habermas (1974) to argue that the street is contested space mobilized by different social groups for the purposes of communicating contradictory social values. Davis focused on workingmen's *charivari* (a mock ritual including music) and the conflict between classes that materializes as folk culture in the public sphere; the meaning of the American street depends on its liberal democratic role as a public arena for debating issues.

Critical social histories not only draw attention to the lack of congruence between layers of ideology and patterns of practice in relation to the built environment but also focus on the complexity and subtleties of meanings embedded in institutional forms. As in culture–history research and interpretive cultural analyses, social history challenges the idea of simple and direct congruence between culture and the built environment. Social and critical histories further constitute prime opportunities to demonstrate an integrated and interpretive cultural approach and are essential to the application of cultural concepts to the study of ourselves. In a very important way, historical research brings an “exotic” perspective home to ourselves—if Lowenthal's (1985) title, *The Past Is a Foreign Country*, is any clue—because it seems to bring into focus tacit and often contradictory aspects of our own culture.

IMPLICATIONS FOR FUTURE THEORY, METHODS, RESEARCH, AND UTILIZATION

Culture is one of the most broadly defined and least tangible concepts applied to the study of EB relations. Its contribution to the literature emphasizes collective views to balance individualistic perspectives, explores dimensions of meaning to complement behavior, and approaches the study of people and their environment holistically rather than as a set of variables. Culture–environment studies have increasingly shifted away from the earlier studies of activity patterns to studies of symbolic meanings and values systems and have moved away from singular theoretical frameworks to explore a multiplicity of theoretical formulations. In addition, many culture–environment approaches have become more concerned with contextualizing descriptions either by providing broader ethnographic materials gathered through primary field research or by including historical references. As a result of developing culture–environment interests, some of the earlier concepts such as privacy and congruence have been critically questioned, and new topical areas of research on meaning, “place,” and design communication have emerged.

Although there have been many promising developments in the culture–environment field, there are still a number of important areas that

suggest the need for continued work. One of the most glaring omissions from this review is any systematic discussion of studies of vernacular or traditional built forms from developing countries. These studies are critical to culture–environment researchers, who rely on secondary ethnographic data and who have an interest in how “traditional” built forms change through governmental policies, global economic influences, ideological movements, and the like. Although some of these studies have been referenced in sources cited in this review (see also Lawrence & Low, 1990), many more appear in local journals and government publications in other countries, which are largely inaccessible to researchers in this country. Although researchers know them to exist, they have never been brought together into a bibliographic resource. Thus, an important task that could be pursued by culture–environment researchers, perhaps with the assistance of the Environmental Design Research Association (EDRA) and similar organizations, is the centralization and consolidation of this literature for reference purposes.

Another issue that confronts culture–environment researchers is the clarification of theoretical perspectives as the adoption of diverse perspectives grows. In the past, researchers sought single or global models to conceptualize culture as a theoretical formulation or tended to translate cultural theories into the psychological language of EB studies. The propensity of scholars to borrow research perspectives from other fields, such as anthropology, geography, feminist studies, and critical and social production theories, increases the potential complexity of explanatory perspectives in the study of culture–environment relations; respecting these differences with a fuller discussion and elaboration in their own language is essential to the identification of significant trends. In addition, until recently most social and cultural theories lacked a spatial dimension; Soja (1989), however, has noted increased attention to spatializing these theories. As spatialized socio-cultural approaches appear from other fields, research in the culture–environment field will intensify and dialogue with colleagues in other fields will be enhanced, but it becomes even more important to articulate the foundations of these approaches for adoption in the general EB field.

Like other disciplines, culture–environment research has tended to emphasize the study of exotic peoples, especially the tacit and not so rational features of their existence, by making those features explicit and understandable to ourselves. This preoccupation is a fundamental emphasis yielding many rich insights and is not likely to change. It is, however, possible to alter the way in which exotic peoples are viewed and understood, which is occurring in other fields such as anthropology. Indeed, this is essential if culture–environment studies are ever to apply culture–environment theories and findings to informing the resolution of our own environmental design problems. Characterizations of nonliterate cultures as homogeneous, static or slow to change, tradition bound, and nonrational have only served

to oversimplify, legitimize, or mystify some design approaches, while interpretive cultural approaches and critical theories of the social production of built form indicate the complexity and potentially contradictory nature of ideological systems in relation to practice and the built environment. Even further, however, the use of history can illuminate processes and effects of sociocultural change in exotic societies and at home. Thus, if we are to carry out research among any group of people for whom there is written documentation, it is no longer acceptable to ignore the historical context in which we work. The historical perspective is critical to understanding shifts in attitudes, behaviors, and/or built forms in our own and others' culture; the expanded context is critical to explaining the complexity of associated meanings in environmental relations.

Finally, the recent development of cultural and historical approaches outlined here has many different goals, including the specification of design guidelines and programming criteria, the elaboration of design processes, and the recommendation of policies related to the built environment. All of these specific products, however, are broadly conceived and take into account contextual issues of economy, politics, and ideology. They do not substitute for more focused design recommendations previously produced, but are an addition and complement to them. Yet, if we really are to incorporate the concept of culture in our research and use it to full advantage, we must focus on the collective meaning and holism in our own society. We must continue to explore beneath the surface for underlying value and meaning systems. Further, we must be content with contradiction and the lack of congruence between ideologies, practices, and the built environment and learn to exploit them in articulating design and planning strategies.

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bury), some of which includes research on boundaries (Pellow, 1996), housing (Arias, 1993; Cooper & Rodman, 1992; Franck & Ahrentzen, 1989), and urban issues (Rotenberg & McDonogh, 1993).

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The Relevance of Gibson's Ecological Approach to Perception for Environment– Behavior Studies

HARRY HEFT

The ecological approach developed by the late James J. Gibson (1966, 1979) has been described as a revolutionary psychology (Heft, 1988a; Mace, 1977; Neisser, 1976, 1990; Reed, 1988, 1996; Reed & Jones, 1979; Turvey, 1977). It is a radical departure from the way perceiving, and knowing more generally, have been traditionally conceptualized in psychology and philosophy. At the heart of Gibson's ecological approach is an original analysis of the *environment*, which in turn leads to a novel view of person–environment relations with significant implications for psychology and epistemology. Because of the distinctive nature of these conceptualizations of the environment and person–environment relations, Gibson's ecological approach has been promoted as having particular significance for environment–behavior (EB) studies and environmental design (Heft, 1981, 1988a; Kaminski, 1989; Krampen, 1991; Landwehr, 1988; Lang, 1987).

In the first section of this chapter, a systematic but selective overview of Gibson's ecological approach will be presented, with an emphasis on those features that are especially relevant to EB concerns. Based on this discussion,

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the second section of the chapter will examine some implications of the ecological approach for EB research and design. Specifically, this section will explore the problem of finding a psychologically adequate framework for describing the environment and will consider navigation and way-finding from an ecological perspective.

THE ECOLOGICAL APPROACH TO PERCEPTION: AN OVERVIEW

The analysis of perception has historically played a central role in psychological theorizing because it is through perceiving that individuals experience the world and come to discover its properties. For this reason, claims about the nature of visual perception have far-reaching implications for any account of epistemology.

When we turn to examine the theories of perception that have dominated thinking in recent centuries, it is remarkable how little variation exists among them. Despite their apparent diversity, most theories of visual perception proposed since the seventeenth century adopt (in some cases, only tacitly) the same starting point for their analysis—the *perceiver*. From this place, certain problems take center stage. Theorists typically begin with a consideration of the structural characteristics of the perceiver's visual system, and of the eye in particular. Owing to the eye's chambered structure, a two-dimensional image is projected on its rear interior surface, and this retinal image is taken as the first step in perceiving. This seemingly obvious fact generates a host of problems that have occupied perceptual theorists for centuries, as is reflected in the writings of such major figures as Descartes, Locke, Berkeley, and, more recently, Helmholtz. These problems include:

1. Given the two-dimensional structure of the retinal image, how does one account for aspects of perceptual experience involving the third dimension (e.g., distance perception, object size constancy, object shape constancy)?
2. Given that the retinal image is assumed to be a momentary "snapshot" frozen in time, how do we account for our experience of a world that is spatially extended and events that are temporally continuous?
3. Given that the retinal image is produced by light, a *physical* property of the world, how do we account for experience of a world with *psychologically meaningful* objects, places, and events?

REPRESENTATIONAL THEORIES OF PERCEPTION

Attempts to address these problems characteristically involve positing mental processes that overcome the limitations inherent in the retinal image by transforming and enriching this stimulus input. The result of these pro-

cesses is typically the construction of a *mental representation* of the environment, which has qualities (e.g., three-dimensionality, temporal continuity) absent in the retinal image. In most theories, it is this mental representation that individuals experience when they perceive the environment, and mental representations of the environment are viewed as serving a mediating role between perceptual input and behavior.

This *representational approach* has dominated thinking about perceptual processes to the present day. The history of perceptual theories since the Enlightenment largely reveals variations on this metatheoretical theme, with the specific nature of these constructive processes varying among the different theories. Twentieth-century perceptual theories that reflect this approach include such otherwise divergent accounts as Gestalt theory (Köhler, 1947) on the one hand and Helmholtzian-inspired theories on the other (Haber, 1985). The latter type are the most common, offering a view of perception as an inferential process based on probabilistic retinal cues—object relations (Brunswik, 1956)—or on logical processes (Rock, 1983), or alternatively, as a sequence of information-processing stages (Haber, 1974). The mental representations implicated in Helmholtzian theories have been variously described as hypotheses (Gregory, 1970), assumptions (Ittelson, 1960), and schemas (Hochberg, 1978).

Considering the historical influence of this perspective within mainstream psychology, it is not surprising that representational accounts of perception also dominate the EB area (Bonnes & Secchiarioli, 1995). As Garling and Golledge (1989) point out:

In studies of environmental perception and cognition . . . the psychological responses or processes *mediating between* the environment and actions are a primary focus. These processes include the picking up of information from and about the environment, the *internal, perceptual, and cognitive representation* of this information; and judgments, decisions, and choices made on the basis of represented information. (p. 203; emphases added)

One approach to environmental perception in the area that reflects this perspective is an information-processing analysis. An example of this type of analysis is the computational model of way-finding proposed by Golledge, Smith, Pellegrino, Doherty, and Marshall (1985), which assumes that "cognitive processes relating to perception, storage, retrieval and reorganization interact with memory structures and construct a symbolic representation of the environment" (p. 134). Kaplan and Kaplan (1982) offer a different type of information-processing model of environmental perception, but similarly they assume that a mental representation of the environment constitutes a fundamental component of perception. In addition, a representational approach can be seen in the large body of work inspired by Piaget's constructivist theory (Hart & Moore, 1973), where the focus of analysis is on the developmental transformations of children's representations of spatial relationships (see Heft & Wohlwill, 1987). Taken at the level of metatheory,

these two otherwise dissimilar theoretical approaches (i.e., information-processing and Piagetian constructivism) both adopt a representational account of perceiving. They exemplify, respectively, an interactional and an organic "world view," as explicated by Altman and Rogoff (1987). One commonality shared by these two "world views" is that the characteristics of the environment and of the person are conceptualized independently, with an "internal" variable (e.g., a mental representation), on the person side of this dualism, mediating between stimulus information and activity. Other instances of representational theories in the EB area include models that postulate the role of "plans" in guiding perception and action (Garling, Book, & Lindberg, 1984; Russell & Ward, 1982) and constructivist accounts of environmental knowing that maintain a place for mediating, cognitive processes (Moore, 1976).

The dominance of representational theories of perception may have affected the EB field in at least two ways. First, the emphasis on mental processes that accompanies most representational theories seems at odds with the professed focus of the field because it leads away from the environment. Accordingly, much EB research has been directed at the nature of "the internal, perceptual, and cognitive representation" of the environment, instead of the environment itself (Heft, 1988b; Wohlwill, 1974, 1976a).¹ Second, the tendency to conceptualize the environment and the person as independent, although interactive, entities may be an impediment to the development of a psychologically meaningful analysis of the environment. As Saegert and Winkel (1990) pointed out with regard to information-processing theories, "While this paradigm is important in psychology as a whole, information-processing models lack a conception of the environment" (p. 446). Both of these issues will be examined in more detail later in this chapter.

Are these outcomes unavoidable given the structural and functional nature of perceptual processes? Or can we find a way of approaching perception that does not necessitate a representational account of perception and thus offers a means to avoid these consequences?

THE ECONICHE AND PERCEPTION

A momentous event in the history of the life sciences provided perceptual theory with an avenue for a fresh approach to understanding perception. It was the genius of James Gibson to recognize the deep implications of this event for perceptual theory and then to build an approach to psychology

¹It would appear that Kaplan and Kaplan's (1982, 1989) significant work in environmental perception is an exception to this claim. They have argued for a representational theory of perception, and their research, and that of their colleagues, has elucidated some of the environmental characteristics that account for environmental preference. However, these research findings seem to be unrelated conceptually to the perceptual theory that the Kaplans advocate.

on its foundations. This momentous event, of course, was the emergence of evolutionary theory.² Viewed against the backdrop of species evolution, perceiving is a process that enables an animal to function adaptively in the environment through the detection of the latter's functionally significant properties. Importantly, this functional view of perception considers the animal's perceptual systems as having evolved *in relation to* a particular set of environmental properties—the animal's *econiche*.

This perspective suggests that to understand perception, one *begins* with an analysis of the *econiche* in relation to which the perceptual systems have adapted both structurally and functionally. This is precisely where Gibson's account of perceiving begins, rather than with the perceiver. From this starting point, the focus of one's analysis of perception, and of person–environment relations, shifts markedly from a preoccupation with mental processes to an examination of the environmental *context* of perceiving, and emerging from this analysis is a distinctive *relational* view of environment and behavior.

ECOLOGICAL OPTICS

In Gibson's theoretical framework, the terrestrial environment consists most fundamentally of medium, substances, and their surfaces. The *medium* of the air (among its various properties) is essentially transparent, affording light to pass readily through it; and it also affords movement through it with little resistance. *Substances* are those aspects of the environment that are more or less rigid and opaque, and a *surface* is the interface between a substance and the medium. One of Gibson's most significant contributions to the study of the ecological bases for vision is his analysis of surfaces and their reflecting properties (see Gibson, 1979, Chapter 2).

Ecological optics is the analysis of the interaction between light and environmental surface layout. When the environment is illuminated, the medium is filled with *reflected* light. That is, light transmitted from a radiating source reflects off surfaces, thereby filling the environment with light that is structured by characteristics of the reflecting surfaces. This reflected light continuously reverberates off surfaces, creating, in effect, a steady state, with light intersecting at an infinitely dense network of points in the medium. Thus, converging at any given point in the medium is reflected light that has been structured by the texture, composition, and shape of the surfaces of the environment (Figure 1). The resulting *ambient optic array* consists of reflected

²Gibson was not the only perceptual theorist to consider perception in the light of species evolution. Other investigators, most notably Brunswik (1956), also did so, but these efforts primarily involved amending pre-Darwinian (e.g., Berkeleyan) approaches to perception. Gibson was the first theorist who was able to throw off the constraints of established ways of thinking and explore the implications of evolutionary theory for perception.

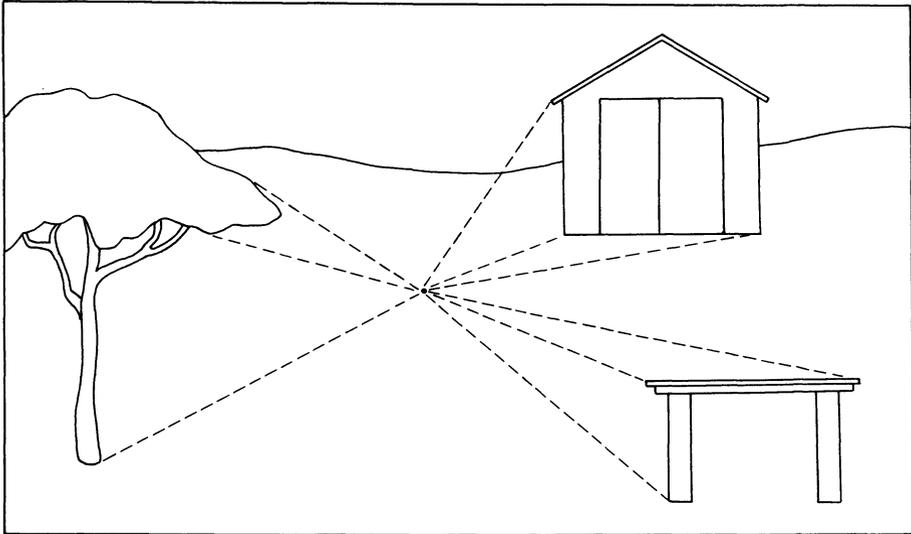


FIGURE 1. An ambient optic array at a point of observation (only a few surfaces included).

light that specifies the environmental layout and, as such, provides potential *information* for a perceiver about the environment.³

What does *information* mean in this context?⁴ That is, in what way does reflected light specify characteristics of environmental layout? Exploring these questions will not only further elaborate the program of ecological optics, but also, importantly, will begin to reveal the perceptual processes *necessary* for the detection of information specifying environmental layout.

³Prompted in part by Gibson's concept of the ambient optic array, Benedikt (1979) has explored some of the ways in which architectural "spaces" are perceived (also see Benedikt & Burnham, 1985). He has developed the notion of an "isovist," which is intended to describe the size and the shape of an interior, or rather its visibility, from a point of observation. Benedikt suggests that this concept can be applied to manipulating the perceived spaciousness of an environment as a function of the arrangement of surfaces and objects (while holding area constant) and to understanding the behavior choices of individuals in a setting as reflecting an attempt to maximize both self-concealment and visibility of the environment. Readers from the design fields may find Benedikt's work of particular interest.

⁴It is important to recognize that in psychology the term "information" has been used in a number of ways, not all of which are theoretically compatible, and this circumstance has been the source of considerable confusion. It cannot be stressed too strongly that the meaning of the term in "information-processing" theory is incompatible with the term as it is employed in the ecological approach (see Gibson, 1979, pp. 242–243). In the former approach, "information" is posited to be in the mind to be manipulated and transformed by mental processes, whereas in the ecological approach, "information" is available in the environment to be picked up by a perceiver.

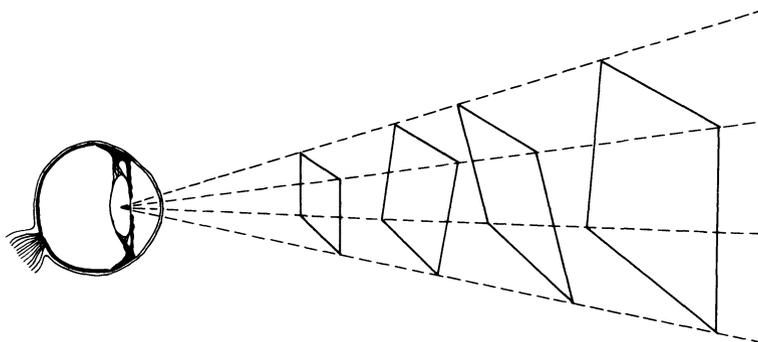


FIGURE 2. The problem of equivalent configurations.

THE NATURE OF STIMULUS INFORMATION

The information available at a point of observation in the ambient optic array may be ambiguous. This ambiguity can be illustrated by the problem of equivalent configurations. This problem, which is depicted in Figure 2, demonstrates that many different shapes can project the same visual angle to a common point of observation. This demonstration has been taken by some theorists (e.g., Ittelson, 1960; Rock, 1983) as evidence that perception must involve going beyond stimulus information to resolve the latter's ambiguities.

Note, however, that this demonstration assumes a perceiver at a fixed point of observation. When one introduces a perceiver at a *moving point of observation*, ambiguity of this sort is resolved. A perceiver moving through the medium, *continuously* changing his point of observation, generates two different types of information in the ambient optic array—changing or *perspective information* and persisting or *invariant information*—with the latter being specific to a particular environmental feature. As Gibson (1979) put it:

The optic array *changes*, of course, as the point of observation moves. But it also does *not* change, not completely. Some features of the array do not persist and some do. The changes come from the locomotion and the nonchanges come from the rigid layout of the environmental surfaces. Hence, the nonchanges specify the layout and count as information about it. (p. 73)

Two critical points emerge from this analysis of information from a moving point of observation. First, persisting environmental features are most readily detected in the context of change. From a moving point of observation, persisting characteristics of environmental features (e.g., shape) are revealed *over time* in the invariant aspects of an otherwise changing ambient array: "What is invariant does not emerge unequivocally except with a flux" (Gibson, 1979, p. 73). In contrast, static stimulus information, such as that projected to a single point of observation (e.g., a retinal image),

is a limiting case and may be equivocal in relation to its environmental source.⁵

Second, it may be necessary for the perceiver to adopt a moving point of observation so that the invariant aspects of the ambient array specifying environmental features are revealed. This point has highly significant consequences for perceptual theory. In recognizing the *basic role* that action plays in perception, one simultaneously recognizes the inadequacy of a theory that presents perceiving as the passive reception of stimulus inputs—that views perceiving as being “caused” by stimuli in some sort of stimulus-response or input–output function. These latter descriptions characterize some representational theories, mostly notably those that adopt an interactional “world view” (Altman & Rogoff, 1987).⁶ In the ecological approach, perception and action are inextricably intertwined; they are coordinative functions, as Dewey (1896) recognized nearly 100 years ago.⁷

PERCEPTUAL SYSTEMS

The fundamental interrelatedness of perception and action can be illustrated in the domain of touch. Just as we tactually explore an object by moving our hand over its surfaces to detect its invariant properties—with tactile sensory systems and motor movements collaborating for this purpose (Katz, 1989)—vision is similarly a perceiving–acting function. In other words, perceiving is essentially exploratory. This insight led Gibson (1966) to a truly radical reformulation of the nature of perceiving. Instead of limiting his account of vision to the stimulation of the eye—as is typically done—he argued that vision normally involves movements of the eyes, head, and entire body, which collaborate in the generation and detection of invariant information. That is, perceiving is an activity of an integrated *perceptual system*.

⁵Pictures such as representational drawings and paintings, as well as photographs, are also cases of a “frozen” optic array. Gibson has spent considerable time studying the nature of picture perception from the point of view of ecological optics. These issues are beyond the scope of this chapter. However, it is worth noting that rather than taking the static image (e.g., the picture on the retina) as the normative case and employing various pictorial rules (e.g., linear perspective and superposition) to explain *environmental* perception, Gibson takes perception from a moving point of observation (i.e., environmental perception) as the normative situation and treats picture perception as a special case (see Gibson, 1966, 1971, 1979).

⁶Information-processing theories are typically self-described as “active,” inasmuch as the individual engages in “mental activity” (e.g., the use of mental schemas) to enrich sensory input. This shared terminology between the representational approach and the ecological approach is another source of potential confusion. Gibson’s use of “active” is behavioral in nature; information-processing theories are not “active” in this sense.

⁷Perception and action as coordinative functions have been a topic of considerable interest to researchers working from the ecological perspective. To gain entry into this rapidly growing body of work, see E. Gibson and Schmuckler (1989), Thelen and Smith (1994), and Turvey (1990).

From this perspective, environmental perception is "the activity of getting information from the ambient array of light . . . a process of *information pickup* that involves the exploratory activity of looking around, getting around, and looking at things" (Gibson, 1979, p. 147). Through the pick-up of information, the individual perceives the features and events of the environment specified by this information. Thus, perceiving involves experiencing the world through the pick-up of information rather than by means of a constructed mental representation. "It is a keeping-in-touch with the world, an experiencing of things rather than having an experience" (Gibson, 1979, p. 239). In this sense, perception of the environment is *direct*, and not mediated (Gibson, 1967). Moreover, mental processes do not mediate between perceptions and actions because the latter are viewed as collaborative facets of a unified perceptual system.

Note that this reconceptualization of "the senses considered as perceptual systems" *follows from* an analysis of the stimulus information utilized in perceiving, which itself was derived from a consideration of the ecological context for perception. In contrast, if we had adopted as our starting point the perceiver considered apart from the environment, we would have been led to a view of perception that emphasizes "internal," mediating processes. Unlike the latter view, the ecological approach reveals the reciprocal relationship between the person and the environment.

PERSON-ENVIRONMENT RECIPROCITY

In the opening pages of *The Ecological Approach to Visual Perception*, Gibson (1979) offers a unique analysis of the concept "environment." He points out that environment is a *relational* concept, implying "an animal (or at least an organism) to be surrounded" (p. 8). Reciprocally, the concept of an "animal" implies an environment, because without a surrounding environment the animal simply could not exist. This view of the *mutuality* of animal and environment is clearly expressed through the idea of an *ec niche*, which refers to aspects of the environment delimited precisely *because* of their significance for a particular animal species. In turn, structural and functional characteristics of the animal in question point to particular aspects of the environment, reflecting an adaptation to these conditions. As Gibson (1979) stated, "The niche implies a kind of animal, and the animal implies a kind of niche" (p. 128). In short, *the environment and the animal are each mutually or relationally defined* (Heft, 1989).

Consider two examples of relational environmental properties: First, electromagnetic radiation between 400 and 760 nanometers is a particularly noteworthy portion of the electromagnetic spectrum because it falls within the range of human visual sensitivity. In other words, the visible spectrum is relationally defined, jointly determined by physical considerations of the environment and by characteristics of the perceiver. Second, graspable ob-

jects in the environment are especially significant for us because they can be used as tools. The graspability of an object is determined by its size in relation to a hand of a particular span and dexterity. In both of these cases, although the *sources* of these stimulus properties are based on environmental conditions, these properties are specified relative to a particular perceiver.

This relational view stands in opposition to dualistic approaches to the perceiver–environment relationship (e.g., interactional and organic “world views”), in which stimuli are claimed to be “in” the environment and experience of the environment is claimed to be “in” the mind of the perceiver. In the ecological approach, psychologically significant environmental properties are relational and reside within the perceiver–environment system. This view of perceiver–environment reciprocity may be Gibson’s most important metatheoretical contribution (Lombardo, 1987). It has characteristics of a *transactional* “world view,” following Altman and Rogoff (1987):

The transactional world view does not deal with the relationship *between elements*, in the sense that one independent element may cause changes in, affect, or influence another element. Instead, a transactional approach assumes that the *aspects* of a system, that is, person and context, coexist and jointly define one another and contribute to the meaning and nature of a holistic event. (p. 24)

Gibson’s conceptualization of perceiver–environment reciprocity is most clearly reflected in his concept of *affordance*.

THE CONCEPT OF AFFORDANCE

What do we perceive through the detection of stimulus information? According to the ecological approach, what we perceive are the *affordances* of the environment. “The *affordances* of the environment are what it *offers* the animal, what it *provides* or *furnishes*, either for good or ill” (Gibson, 1979, p. 127). They are the functionally significant properties of the environment for an individual.

An example will clarify the distinctive attributes of an affordance. A surface of support at approximately knee-height to an individual, and having sufficient mass relative to the individual’s weight, will afford sitting-on. A *seat*, then, is a feature of the environment with particular material properties delimited *in relation to* a specific individual. Consequently, what constitutes a seat for a child will not necessarily do so for an adult, and vice-versa, as a function of, for example, the height of the seat relative to the individual’s leg length. In view of this analysis, is an affordance an objective or subjective property? Is it “in” the environment or “in” the perceiver? It is objective in that it refers to environmental properties, but it is subjective in that it is specified in relation to a particular individual. More accurately viewed, however, the concept of affordance “cuts across the dichotomy of subjective-objective” (Gibson, 1979, p. 129); it does not conveniently fit into these standard ontological categories. Thus, the concept of affordance, and

the relational or transactional framework that it presupposes, reflects a radically new way of looking at the relationship between person and environment,⁸ and in turn, point to a new way of addressing the problem of environmental description (see later).

Consider by way of contrast how the person–environment relationship is viewed in representational approaches to perception and cognition, such as interactional and constructivist theories. These approaches adopt a view that characterizes the person–environment relationship as a dualism, as an ontological separation of fundamentally different kinds of entities. On the environment side there is the world of matter, which is describable in the language of physics and mathematics. On the person side, there is the mental realm. Mind stands *outside* the environment and is detached and separated from it. The physical and the mental realms are ontologically distinct though somehow causally related, and this causal relationship, at least among the interactional theories, is typically characterized in mechanistic terms.

The ecological perspective, and the affordance concept in particular, conceptualize the perceiver–environment relationship as a fittedness rather than a separateness, a reciprocity rather than a dualism. This focus on reciprocity emphasizes the functional compatibility of the perceiver–environment system. Events within this system are *reciprocal* rather than unidirectional and ongoing and *continuous* rather than discrete. Through the course of exploration and learning, perceptual–action skills become continually more refined, and, reciprocally, new affordance possibilities of the environment are revealed, and so on, in an ongoing manner. In addition, new environmental affordances can be created through human activities, thereby opening up new possibilities for action (Fogel, 1993; Rogoff, 1993; Shotter, 1983). Finally, affordances *create opportunities* for actions, as well as *constrain* actions, rather than mechanistically “trigger” an outcome, e.g., in the manner of a stimulus–response relationship (Heft, 1989). In these respects, “affordance” may be a prototypic transactional concept (Altman & Rogoff, 1987).

More generally, the affordance concept suggests that the environment, when relationally considered, is meaningful and value-laden. From the dualistic perspective of representational theories, the environment, as noted earlier, is often defined in physical terms, and the world described by physics is ultimately a world comprised of dead, meaningless *matter* (Burt, 1954).

⁸Of course, the concept of affordance was not invented by Gibson *ex nihilo*. It was anticipated in the work of the Gestalt psychologists Koffka and Lewin, although Gibson's use of the term, as well as the metatheoretical implications he drew from it, differ in important ways from these earlier and less-developed ideas. For a comparative discussion, see Gibson (1979, pp. 138–140). In addition, for a preliminary consideration of parallels between Gibson's affordance concept and Barker's ideas concerning the perceived functional significance of behavior settings, see Heft (1988c).

If the environment is conceptualized in physical terms, the meaningfulness that characterizes human perceptual experience can *only* have its source in the mind of the perceiver. (Although contemporary representational theories may not explicitly describe the environment in physical terms, the historical roots of this metatheory reveal such a view.) Hence, perceptual theories in mainstream psychology as well as the EB field have often viewed *meaning* as a quality that perceivers *impose on* the environment through constructive processes (e.g., personal construct theory [Downs, 1976; Honikman, 1976]) or through the interpretation of signs or codes (i.e., semiotic approaches [Krampen, 1991; Rapoport, 1982]). But for Gibson (1979), "The perceiving of an affordance is not a process of perceiving a value-free physical object to which meaning is somehow added . . . it is a process of perceiving a value-rich ecological object. . . . Physics may be value-free, but ecology is not (p. 140).

Evidence has been accumulating that individuals do accurately perceive the affordances of environmental features. Some of the results of this work indicate that individuals can perceive whether an object is graspable, relative to the hand span (Hallford, 1984), whether a stair is climbable, relative to leg length (Warren, 1984), and whether an aperture affords walking-through, relative to shoulder width (Warren & Whang, 1987). In addition, research has demonstrated that individuals can perceive whether surfaces afford sitting-on (Mark, 1987; Mark, Balliett, Craver, Douglas, & Fox, 1990), whether a gap can be crossed (Jiang & Mark, 1993), and whether objects are within reach (Carello, Groszofsky, Reichel, Solomon, & Turvey, 1989; Heft, 1993). Developmental research has indicated that infants perceive that looming objects afford collision (Ball & Tronick, 1971; Bower, Broughton, & Moore, 1970) and that young children perceive that surface edges can afford falling-off (Gibson & Walk, 1960), perceive the differences in traversability affordances of rigid versus nonrigid surfaces (Gibson, Riccio, Schmuckler, Stoffregen, Rosenberg, & Taormina, 1987), perceive whether barriers can be stepped over (Pufall & Dunbar, 1992), and perceive whether slopes afford walking up or down (Adolph, 1995; Adolph, Gibson, & Eppler, 1990).

THE NATURAL–CULTURAL DISTINCTION AND ENVIRONMENTAL MEANING

There are two broad categories of affordances: those relating to animate features such as other people, who provide "the richest and most elaborate affordances of the environment" (Gibson, 1979, p. 135), and those relating to inanimate features. Among the latter, which are the principal concern here, are affordances with universal, functional significance, such as graspable objects, falling-off places, and shelters, and affordances with culturally derived, functional significance, such as pens, mailboxes, and churches. Do these two types of *inanimate affordances* represent distinct realms? What is the relationship between natural features of the environment and those features

that are products of cultural activities? Considerations of these questions have an important bearing on how we think about the environment.

Traditionally, psychological theories have drawn a distinction between the natural world and the cultural world (Bruner, 1990). The natural world is typically considered to be primary. Humans are seen as fundamentally biological and secondarily cultural, with cultural aspects of experience super-added to our biological selves. It is likely, however, that this distinction between the natural and the cultural is a manifestation of the deeper objective–subjective dualism that continues to pervade so much of scientific thinking: The natural refers to the world separate and distinct from the human perceiver, and culture is a product of mental processes.

Much work in cultural anthropology is decidedly at odds with this view, arguing instead that culture is fundamental to what it is means to be human (Bruner, 1990; Shore, 1996). As Geertz (1973), for example, claims: “There is no such thing as human nature independent of culture” (p. 49). For one thing, our species has probably evolved in relation to culturally based selection pressures, such as the ability to work in groups and to benefit from instruction from others (Reed, 1991). Cultural and biological evolution are inextricably intertwined.

How is the relationship between the natural and the cultural domains considered from the ecological perspective? Gibson's rejection of a environment–mind dualism is paralleled by a rejection of a dualism between the natural world and the cultural world. He points out that the affordances of natural features and affordances that are products of cultural activities are not fundamentally distinct because features of the human built environment are ultimately created from natural resources of the environment:

This is not a *new* environment—an artificial environment distinct from the natural environment—but the same old environment modified by man. It is a mistake to separate the natural from the artificial as if there were two environments; artifacts have to be manufactured from natural substances. It is also a mistake to separate the cultural environment from the natural environment, as if there were a world of mental products distinct from the world of material products. There is only one world, however, and all animals live in it, although we human animals have altered it to suit ourselves. (Gibson, 1979, p. 130)⁹

As noted here, the affordances of the environment create possibilities for action, and, importantly, the environment can be modified to establish new possibilities (Heft, 1989).

Analyses of the *meaning* of the built environment are often caught in the dualisms of the natural / cultural and the objective / subjective. Because built features are fundamentally material in nature, their significances might

⁹Even though the natural and the built domains are “one world,” this does not mean that we respond to them in the same way. Research has indicated a consistent evaluative preference for natural over built settings (Kaplan & Kaplan, 1989; Wohlwill, 1976b). Drawing on Gibson's earlier work, Wohlwill (1983) has attempted to identify stimulus information that might differentiate natural and built features.

seem to fall on the natural–objective side of these dichotomies, but as human constructions, built features carry culturally derived meanings and consequently seem to fit more comfortably on the cultural–subjective side. In the struggle between these dualisms, the meaning of the built environment is often seen as a quality that transcends and is imposed on the natural order. This perspective is reflected, for example, in semiotic analyses of environmental meaning. But as Krampen (1991) argues, this type of approach creates a gulf between the environment and the person:

Semiotics has insisted too much on the role of signs in communication, that is, in the transmission of *second-hand experience*. The firsthand experience of ecological meaning of affordances of the environment is, perhaps, a more difficult study before us. . . . Perhaps the inescapable presence of the perceiver in perception [as is reflected in the affordance concept] could teach us that we are *not subjectively removed* from, but part of, the environment in which we see the meaning of things *directly*. (p. 261; emphases added)

The claim that meaning is imposed on the physical environment through interpretative processes may reflect an intellectualization of environmental experience. From such a perspective, the perceiver is positioned outside of the environment as an observer and interpreter, rather than engaging the environment as a participant or agent. Thus, a consequence of such an analysis may be a neglect of the immediate, functional character of the natural and built environment. Moreover, this claim probably grows out of a tacit acceptance of the natural/cultural dichotomy. We need to ask if this is a reasonable distinction to draw in the first place? The ecological approach suggests that the distinction is a false one and that there is but one world.

THE ECOLOGICAL APPROACH APPLIED TO EB RESEARCH AND DESIGN

In this section some implications of the ecological approach for work in the EB area will be explored by applying the approach to two different problems: environmental description and way-finding.¹⁰

THE PROBLEM OF ENVIRONMENTAL DESCRIPTION

The EB area has inherited a way of conceptualizing the environment that does not seem to lend itself particularly well to addressing what is one of its central problems—environmental description. The frameworks that have been adopted for describing environments tend to reflect the long-

¹⁰Space limitations prohibit consideration of the relevance of the ecological approach to ergonomics. For an introduction to this application, see Mark, Dainoff, Moritz, and Voegelé (1990).

standing tendency to distinguish sharply between the environment and the individual. As discussed earlier, this dualistic tendency is characteristic of representational theories of perception. Two different, broad approaches to environmental description reflect this perspective.

A *physicalistic/structural* approach draws on the concepts of physics and geometry to describe the environment. This orientation reflects one of the great achievements of Renaissance and Enlightenment science (Burt, 1954). Scientists of these periods developed a rigorous analytical framework for describing the structure and the dynamics of the natural world. From this perspective, the world is viewed as being made of material entities whose substances are to be described in the language of physics and whose structure is to be described geometrically and mathematically. Accordingly, environmental conditions can be described and evaluated in terms of their physical characteristics and their structure. In psychology, this approach is reflected in the area of psychophysics (e.g., Geldard, 1972) and in Gestalt-oriented (e.g., Pomerantz & Kubovy, 1981) and information-theoretic (e.g., Garner, 1974) structural views. In the EB field, research along these lines can be found in the area of environmental aesthetics. Physical characteristics of landscapes have been examined as predictors of perceivers' preferences (for a review, see Daniel & Vining, 1983). Approaches to environmental description from a more structural point of view have also been adopted, considering such stimulus variables as complexity, organization, and configuration (e.g., Weisman, 1981; Wohlwill, 1976b).

An alternative *subjectivistic* approach to environmental description, emphasizing the meanings that perceivers impose on the environment, developed concurrently in the EB area. Research from this approach is exemplified by the assessment of the semantic connotations that environmental settings have for perceivers (for a representative sample of this research, see Nasar, 1988) and by semiotic analyses of environmental meaning (e.g., Krampen, 1991; Rapoport, 1982).

Environmental description based on these approaches is faced with two significant problems: First, the language employed for describing the environment in the physicalistic/structural approach tends to be rather limited and sterile, omitting as it does reference to environmental meaning and other phenomenological qualities. Second, when attempting to enrich this physical language through interpretative, subjectivistic accounts of meaning, one finds oneself cut off from the environment and trapped in a mental realm. Accordingly, most attempts to do so typically lead to a description of *mental* experiences of the environment that are not well connected to the environment in an objective sense—that are, in fact, only marginally a description of the environment at all. Neither of these outcomes is desirable for EB analysis.

What kind of descriptive approach is needed? The language that is needed in the EB area for describing the environment should have the fol-

lowing characteristics: (1) it should be sufficiently rich to capture the diversity of human environments; (2) it should be objectively specifiable, being tied to environmental conditions; (3) it should be psychologically meaningful for the perceiver; and (4) it should encompass both natural and built aspects of the environment. The concept of *affordance* may provide the basis for a descriptive language that meets these criteria.

A Functional Approach to Environmental Description. The previous discussion of affordances revealed that this concept refers to the functional significance of environmental features for an individual, and, as such, it presupposes a relational view of the person and the environment. Accordingly, it offers a different conceptual framework for approaching environmental description than the physicalistic/structural and subjectivistic positions, both of which conceptualize the environment independent of any particular person.

The differences between these approaches can be revealed through an example. Consider a plaza such as the one presented in Figure 3. This plaza can be described with respect to the arrangement and composition of its features: the low walls around the sides of the plaza creating an oval configuration, with the wooden benches positioned along one of those sides; the location in the plaza of the stairways and ramps; the material composition and color of the various surfaces; and the various trees and shrubs located at the periphery. Such a description would be independent of any considerations relative to potential users. As such, this description is largely lacking in psychological content: Specifically, it fails to characterize the functional significance of the features of the plaza.

If a plaza such as this one was observed during times when individuals were present, one would see how these features are utilized (Whyte, 1980)—that is, some of the affordances of the plaza would be revealed. Adults and children might be sitting on the walls as well as on the benches. The surfaces of the plaza might be being used for walking, rolling a wheelchair, skateboarding, or various ball games. Children might be using the shrubs for hiding games and the trees for climbing. Importantly, what will determine whether any of these activities is possible is the specific relationship between the properties of the feature in question and relevant characteristics of an individual. For example, depending on its vertical dimensions, a wall might not afford sitting-on for individuals below or above a certain height (Figure 4). Also, a particular tree would afford climbing only for some children, depending on the height of the lowest branches relative to arm reach and leg length. Horizontal surfaces would only afford rolling something across if sufficiently smooth in texture. In contrast to the initial description of the plaza, this affordance description indicates some of the functional possibilities of the setting—its behavioral resources—for an individual (or group of individuals). This relational approach results in a description of the set-



FIGURE 3. A plaza considered independent of potential users.

ting that is more meaningful from a psychological standpoint than a description that examines the setting's features independent of any potential user.

The plaza example also highlights the important fact that features of a setting vary in their functional significance across individuals of different ages and across different user groups. Thus, when relationally considered, environments have a *developmental dimension*, as well as dimensions corresponding to various individual difference attributes. In contrast, viewing the environment independent of any individual results in a fixed and monolithic conceptualization of settings.

The affordance approach to environmental description has three other characteristics. First, viewing environmental features as affordances allows for the possibility that these features can have *multiple* functional significances. For example, considered from a functional standpoint relative to an individual, a bench affords sitting-on, resting other objects on and using as a table, standing-on to enhance one's view, etc. But a bench considered as a feature independent of an individual can fit into only one object category (e.g., it cannot also be a table or a wall). Second, an affordance analysis may more accurately capture our immediate experience of environments than do accounts employing object-independent categories. The latter tend to reflect more abstract ways of describing the environment, ways that remain more removed from immediate experience. In contrast, affordances have a phe-

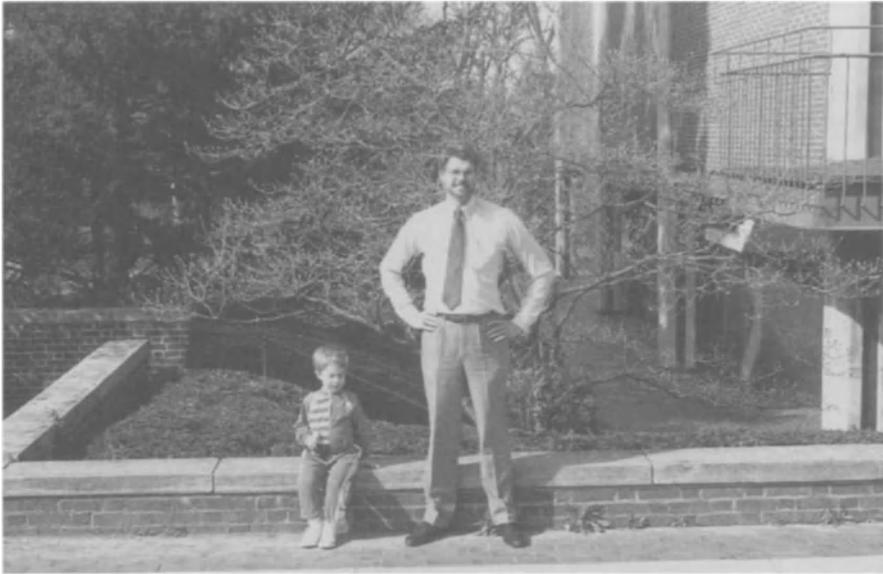


FIGURE 4. A wall affords sitting-on relative to an individual.

nomenological quality and thus perhaps an *experiential primacy* (Glotzbach & Heft, 1982; Merleau-Ponty, 1963). The functional properties of environmental features may be especially salient among young children, for whom intellectualization of environmental experience is less likely than it is for adults (Heft, 1988c; Heft & Wohlwill, 1987). Finally, an affordance description results in an account of the *functional opportunities* of a setting. Affordances do not "cause" behavior in the manner of deterministic views of environment-person relations (Franck, 1984), but instead present possibilities as well as constraints on action (Fogel, 1993; Rogoff, 1990).

In light of these considerations, how well does the ecological approach to environmental description meet the criteria specified earlier? First, it encompasses the diversity of human environments. Affordances are not limited to any particular type of setting, and because they are relationally specified, the affordances of a setting reflect the varieties of activities in which individuals can engage. Second, affordances refer to properties of the *environment* taken in relation to a perceiver, and significantly, they are in principle *objectively specifiable* in terms of information in the ambient array (e.g., Warren, 1984). Affordances are *not* mental constructs. Third, by definition the affordance approach offers a description of environmental features that brings out their functional significance for an individual. Finally, an affordance description encompasses both natural and cultural features of the environment (Heft, 1989). As discussed earlier, the ecological approach rejects a sharp distinction between natural and cultural features.

A Functional Taxonomy for Describing Environments. Can this affordance approach to environmental description be applied systematically to the development of an environmental taxonomy? To construct such a taxonomy, one might proceed in the following way: Because affordances are relationally specified, one must begin with a particular individual, or more reasonably, with a particular *type* of individual, such as children within a certain age range, adults, or individuals with certain physical limitations. With a specific population in mind, one then could consider the range of possible actions of this group within the setting of interest (e.g., preschool classroom, residential institution). This list of actions can be formulated *empirically* through observation of the behaviors of the population in question in that setting. Such an analysis of expressed or potential actions in relation to environmental features will ultimately yield a description of the affordances of the setting that support these behavioral possibilities.

To illustrate this procedure, I offer a summary of an analysis reported in more detail elsewhere (Heft, 1988c). This analysis was based on data from several observational studies of children's behavior in outdoor settings. The most detailed of these studies is reported in Barker and Wright's (1951) *One Boy's Day*, a continuous record of the behavior of a 7-year-old boy during the course of a single day. Working from this rich data source, a list of the boy's

TABLE 1. Activity Categories Appearing in
Barker and Wright's (1951) *One Boy's Day*

Climbing up something
Jumping down from something
Jumping over something
Walking along a ledge
Sitting on something
Running
Riding a bicycle
Rolling an object along a surface
Pulling or pushing an object along a surface
Rolling an object down a slope
Picking up an object and breaking it
Picking up an object and throwing it
Picking up an object and batting it
Picking up an object and tearing it
Picking up an object and squashing it
Picking up an object and hitting it with another object
Kicking an object
Molding and digging some material
Crawling into something
Hiding in something
Hiding behind something
Rocking, swinging, or swaying on something

various outdoor activities was compiled, excluding those activities taking place in designed play areas. This list was then organized in terms of the *types of activities* expressed. Most of his activities fell into a limited number of categories (Table 1).

Considering these categories, it becomes apparent that each type of action is relative to or implicates an environmental feature that supports it. That is, each activity is *situated* with respect to some affordance. For example, rocking on an object requires a nonrigid object attached to a stable feature (e.g., a tree branch) on which one can rock. Hiding behind something is relative to a feature behind which one will be concealed. Thus, from this set of activities, we can develop an initial list of the types of the affordance possibilities the *environment* offered the boy on that day. The resulting list of affordance types (with an example of each) is presented in Table 2.

Similar analyses were performed on data provided in other descriptive investigations of children's outdoor activities (Hart, 1979; Moore, 1986; Muchow & Muchow, 1935; Ward, 1978). The various affordance types generated from these analyses were then consolidated to suggest a set of affordance categories. These categories may serve as a preliminary *functional taxonomy* of children's outdoor environments, which is presented in Table 3.

It is important to recognize two significant ways in which this taxonomy differs from an approach that treats objects independent of persons.

TABLE 2. Affordances Appearing in Barker and Wright's (1951) *One Boy's Day* (with an Example of Each Type)

Climb-able feature (a tree)
Jump-up-on-able / -down-off-able feature (a bench)
Jump-over-able feature (a post)
Walk-on-able ledge (a retaining wall)
Sit-on-able feature (stairs)
Run-on-able surface (lawn)
Ride-on-able surface (sidewalk)
Roll-on-able surface (sidewalk)
Roll-down-able surface (a small hill)
Pick-up-able object (a rock)
Break-able object (a twig)
Throw-able object (a lid of a can)
Strike-with-able object (a bat)
Tear-able object (paper)
Squash-able object (a leaf)
Pick-able object (a flower)
Sound-producing feature when struck (flagpole)
Dig-with-able object (a stick)
Mold-able material (dirt)
Hide-in-able feature (bushes)
Hide-behind-able feature (tree)
Swing-on-able feature (tree limb)
Sway-on-able feature (a wooden crate)

First, instead of categorizing environmental features according to a common object category (e.g., all trees), in this functional approach environmental features that support some *common activity* were grouped together. For example, in Barker and Wright's data, the distinguishable objects bench, crate, fence, and tree all share the common functional property of affording "climbing-on." Thus, a *functional property* can be identified that is *common* to a number of different environmental features that can otherwise be considered as distinct object types. Second, and inversely, this approach draws *functional distinctions* among features that can otherwise be seen as being of the same object type. For example, in several of the studies, different trees fit into various distinct functional categories. Some trees afford climbing, while others afford shade, fruit-picking, building forts, etc. If one were to state that trees are popular natural features in children's outdoor play, that claim, although true, would obscure structural differences that lead to significant functional differentiation among these features. Thus, environmental features belonging to the same object category can have very different affordances.

It should be added that a list of functionally significant features of a place cannot possibly be exhaustive. Not only can new environmental fea-

TABLE 3. A Functional Taxonomy of Children's Outdoor Environments

Flat, relatively smooth surface	Affords walking, running
	Affords cycling, skating, skateboarding
Relatively smooth slope	Affords coasting down
	Affords rolling, sliding, running down
Graspable/detached object	Affords drawing, scratching
	Affords throwing
	Affords hammering, batting
	Affords spearing, skewering, digging, cutting
	Affords tearing, crumpling, squashing
	Affords building of structures
Attached object	Affords sitting-on
	Affords jumping-on/-over/down-from
Nonrigid, attached object	Affords swinging-on
Climbable feature	Affords exercise/mastery
	Affords looking out from
	Affords passage from one level to another
Aperture	Affords locomoting from one place to another
	Affords looking/listening into an adjacent place
Shelter	Affords prospect/refuge
	Affords privacy
	Affords a microclimate
Moldable material (e.g., dirt, sand)	Affords construction of objects
	Affords pouring
	Affords sculpting
Water	Affords splashing
	Affords pouring
	Affords floating objects
	Affords swimming, diving, boating, fishing
	Affords mixing with other materials to modify the consistency of the latter

tures be discovered, but new uses (and thus new functional significances) for *familiar* features can also be found. As discussed earlier, there is an ongoing reciprocity between, on the one hand, the opportunities provided by existing affordances and, on the other hand, actions to change the range of possibilities extended by these affordances.

TABLE 4. Mean Frequency of Potential Affordances Observed, Affordances Reported as Being Utilized, and Proportion of Utilized to Potential Affordances

Affordance category	Potential number	Utilized number	Proportion (U/P)
Flat, smooth surface	5.68	5.00	.88
Relatively smooth slope	1.96	1.36	.69
Detached object	1.28	.64	.50
Attached object	2.80	1.04	.37
Nonrigid object	2.40	1.72	.72
Climbable feature	3.00	2.20	.73
Aperture	1.68	1.32	.79
Shelter	2.56	1.72	.67
Moldable material	1.28	1.00	.78
Water	1.64	.96	.59

An Exploratory Assessment of the Functional Taxonomy. The proposed taxonomy is based on a post hoc analysis of existing EB data. Thus, the validity of this approach in general, and the functional taxonomy in particular, would be strengthened by an evaluation of the predictive character of the taxonomy. Accordingly, in an exploratory investigation, 25 children (5 years, 8 months old to 11 years, 1 month old) were asked to give an investigator a tour of their favorite play places around their home and a description of their favorite play activities.¹¹ Previously, the investigator had assessed these designated play areas for their affordances possibilities based on the categories of the proposed functional taxonomy (Table 3). If the taxonomy captures the significant functional properties of the child's outdoor environment, then there should be a close correspondence between the features identified by the investigator as potential affordances and the actual affordances reported as utilized by the children in their play activities.

As can be seen in Table 4, there was a reasonably high degree of correspondence between the identification of potential affordances in the play areas and the affordances reported by the children. The percentage of utilized affordances to potential affordances identified *within* a given category approximated 70% or higher in 7 of the 10 taxonomic categories, and in two other categories, the assessment of within-category potential affordances accounted for at least 50% of the subjects' actual citations. One functionally significant feature of the environment that was not included on the original list but was cited frequently in the interview was paths that afforded travel from the home to some other place. In the sample, 54% of the children

¹¹The participation of Randall Young in the data collection phase of the study is gratefully acknowledged.

mentioned one or more paths that afforded a means to a destination. In sum, the results of this *preliminary* study indicated that the functional taxonomy was reasonably successful in describing the functionally significant properties of children's outdoor play settings.

Conclusions: Affordances and Environmental Description. The preceding approach can be applied not only to environments for children, but also to those utilized by other groups of individuals, in order to formulate a functionally meaningful description of an environmental setting. The resulting taxonomy can then be employed to evaluate the setting in question from a functional standpoint and in turn contribute to the modification of its behaviorally dysfunctional features, as well as assist in the design of new settings.

The broader value of this type of functional approach is that it offers a way of thinking about environments that is both *objective* and *psychologically meaningful*. The dualistic, object-independent approaches described earlier typically lack one or the other of these qualities. By comparison, a *relational* description of the environment, based on the concept of affordances, provides a rich account of the psychological and sociocultural *resources* of a setting by considering the properties of the environment taken in relation to an individual.

PERCEIVING AND THE PROBLEMS OF NAVIGATION AND WAY-FINDING

Traditionally, perception as a mode of environmental knowing has been relegated to "second-class" status in relation to cognition. One of the reasons for this distinction relates to assumed limitations of stimulus information in accounting for our experience of the world (see earlier in this chapter). In this section, one of these "limitations"—the temporal dimension of stimulus information—will be closely examined (also see Heft, 1996). Assumptions about this issue have significantly affected conceptualizations of environmental knowing in psychology. In the EB field, these assumptions are most clearly revealed in the manner navigation and way-finding have been studied.

Perceiving Environmental Information over Time. According to standard perceptual theories, perception is based on stimulation "here and now" (i.e., at a specific location in space and moment in time). It follows from this assumption that awareness of aspects of the environment that cannot be seen from "here-now" must necessarily be based on nonperceptual processes such as memory (i.e., prior knowledge of what the environment was like beyond the "here-now"). After all, whatever the individual is not experiencing at this moment *must* be provided from some source other than perception.

How *extended* is this moment in time in which perceiving presumably takes place? If perception is based on stimulation "here and now," do you *perceive* the entire room in which you are presently located? No, because you cannot take in the entirety of the room from a single observation point. You cannot see, for example, that part of the room momentarily behind your head. Do you *perceive* in their entirety objects in the room? No, because you cannot see the momentary far side of objects. Can we even *perceive* the near side of objects? Not necessarily, since it appears that the eye moves in abrupt fixations that successively take in only parts of whole objects (Hochberg, 1978).

This analysis suggests the following result: If perception is considered to be limited to "immediate" stimulus inputs that are experienced "now," then very little of the environment is, in fact, perceived. In this model, perception consists of a series of limited stimulus inputs—temporally discrete "snapshots"—and from these inputs, inferences are drawn about the nature of the environment based on *prior knowledge* of its structure. Examined closely, perceiving seems to be largely a nonperceptual operation supplemented by cognitive processes such as memory (Haber, 1974).

If perceiving those aspects of an object or a room presently out of view requires supplementation from memory, then awareness of a path from "here" to a distant place for the purposes of way-finding must certainly depend on memory processes. Weisman (1981) offers a clear statement of this viewpoint:

It is assumed that most architectural settings, as with larger scale environments, are too extensive to be perceived in their entirety from any one location; it is necessary that information regarding specific locations, and the spatial relationships among locations, be stored in one's head. (p. 191)

This assumption dominates the EB field, and it is the primary reason why so much of the theoretical and empirical work in the field concerning navigation and way-finding has focused on the cognitive processes that support these functions (for reviews, see Garling & Golledge, 1989; Golledge, 1987; Portugali, 1996). At the same time, it may also explain why researchers have tended to neglect the environment in this work—an often lamented shortcoming of the area (e.g., Heft, 1981, 1988a; Moore, 1979; Wohlwill, 1974, 1976a).

However, the claim that one perceives what is momentarily or presently in view is not as straightforward as it might at first seem. As William James (1890) pointed out, the idea of *the present as a moment in time* is a convenient fiction. The present is "no knife-edge," but a *duration*, a "specious present," that points simultaneously to what was past and what is future. Thus, James argued that experience is not divisible into discrete temporal moments; rather, it is continuous (see also Bergson, 1910). From the standpoint of the ecological approach, the temporal dimension of perceiving is conceptualized

in a similar manner. According to this approach, stimulus information does not arrive in temporally discrete packets¹²; rather, it is picked up *continuously over time*. As was argued previously, the invariant information specifying an environmental feature is revealed over time through changes in the ambient array as a perceiver travels along a moving point of observation or as the environmental feature moves with respect to a perceiver (Cutting, 1986; Jansson, Bergstrom, & Epstein, 1994; Johansson, 1973).

The idea of perceiving information over time raises an intriguing question: What is the length of time over which information can be perceived? If talking about perceiving what is “presently” in view is problematic, can we specify some minimum duration over which information is detected? The invariant information specifying the shape of a small object might be detected over a few seconds of transformations in the ambient array as we move with respect to it or as we turn it in our hand. The invariant information specifying a larger object, such as a statue, or an even larger object, such as building, might be detected over transformations lasting several minutes as we walk around the feature in question. Can invariant information be revealed over even longer durations than these? Gibson (1966) suggests that it can: “Over time, as the individual moves about the house, the street, the town, and the country, . . . the fact that the transformations all make a group become evident to him” (pp. 206–207).

The claim that perceiving can take place over such extended durations of time might seem fantastic. However, if perceiving environmental features involves the detection of invariant information over time, any a priori limit on the temporal duration over which this can take place is arbitrary. Are these ideas any more implausible than assumptions concerning perception that many in the EB field, and psychology generally, have come to take for granted? As Gibson (1979) states, the notion of perceiving an invariant from a moving point of observation “is not more difficult, surely, than the notion of successive snapshots of the flowing optic array taken by the eye and shown in the dark projection room of the skull” (p. 197).

Navigation and Way-Finding from an Ecological Perspective. Environments at varying degrees of scale, from interiors of buildings to neighborhoods to cities, have a spatially extended structure. How does the individual come to apprehend this structure? From the ecological perspective, this structure is revealed as the perceiver travels through the environment.¹³ (Recall from the

¹²In information-processing models, for example, stimulus input is assumed to be temporally discrete because of the nature of the first stage of processing, the visual icon. There is good reason to believe, however, that this standard feature of information-processing models is a laboratory artifact (Haber, 1983; Neisser, 1976).

¹³Thiel (1970, 1997) has also argued that the temporal dimension of environmental experience has been neglected in the EB area, and he has been developing a “sequential notation system” for describing the experience of moving through the environment. His important work should be of particular interest to designers.

discussion of perceptual systems in the first section that perceiving and acting are collaborative activities.) What aspects of the environment revealed over time give rise to an awareness of its overall structure? An ecological analysis suggests the following possibility: "An alley in a maze, a room in a house, a street in a town, and a valley in a countryside each constitutes a place, and a place often constitutes a *vista* . . . a set of unhidden surfaces. A vista is what is seen from here" (Gibson, 1979, p. 198). As an individual moves through the environment, what is perceived is a succession of serially connected vistas. Each successive vista is occluded from view by the edge of some visual barrier, such a door frame in the case of successive rooms and hallways or a stand of trees or the brow of a hill in the case of a path. Thus, as the individual travels a sufficient distance or makes a turn, the succeeding vista is gradually revealed *over time at the occluding edge* of a visual barrier. This portion of the route where an occluded vista gradually comes into view constitutes a *transition*. A transition is the portion of the route, experienced over time, where the individual can survey the next vista; consequently, a transition is a functionally significant portion of the route. *It affords looking ahead.*¹⁴

From this analysis, one can view navigating as traveling a path leading through a sequence of transitions connecting successive vistas. Gibson (1979) puts it this way:

To go from one place to another involves the opening up of the vista ahead [at an occluding edge] and closing in of the vista behind [at an occluding edge]. And thus, to find the way to a hidden place, one needs to see which vista has to be opened up next, or which occluding edge hides the goal. One vista leads to another in a continuous set of reversible transitions. (p. 198)

In the process of locomoting to reveal the sequence of transitions that leads from one place in the environment to another, one eventually perceives the overall structure of that environment:

When the vistas have been put in order by exploratory locomotion, the invariant structure of the house, the town, or the whole habitat will be apprehended. The hidden and the unhidden become one environment. . . . One is oriented to the environment. It is not so much having a bird's-eye view of the terrain as it is being everywhere at once. (pp. 198–199)

¹⁴This preliminary analysis of the information utilized in way-finding may shed additional light on a reliable finding in the area of environmental aesthetics. Kaplan and Kaplan (1982, 1989) have reported that a variable they call "mystery" is a reliable predictor of aesthetic preference judgments. A prototypic example of a scene high in "mystery" contains a path extending from the foreground into the distance and bending out of sight around some visual barrier. The Kaplans describe this kind of scene as holding out the promise of more information if the perceiver would walk further into it. In the terms of the analysis offered here, what the viewer would perceive if she did walk further along the path would be a gradual emergence of the next vista at an occluding edge. It is for this *functionally significant* reason that scenes high in "mystery" probably have such a high interest value for perceivers. The scenes are interesting because they contain a "transition" and as such are potentially informative as to what lies beyond the present point of observation.

This analysis is consistent with the central claim of the ecological position that features of the environment are perceived through the pick-up of invariant information *over time*. Invariant information is revealed in the context of a changing array of stimulus information, whether that be produced by walking around an object or walking around a town. These invariants of structure are perceived from no one point of observation, but rather in the context of a changing array from a moving point of observation—that is, from “everywhere at once.” In the case of object shape, the invariant is that which is constant about its shape regardless of where one begins examining it or from which vantage point one views it. In the case of the structure of a town, the invariant is that which is constant about its layout regardless of the order in which one explores it or the direction from which one approaches it (see Heft, 1996). This invariant is detected for the purposes of finding one’s way around the environment. The *legibility* of a building or a town, in Lynch’s (1960) terminology, may refer to the relative ease with which an invariant specifying its layout can be detected over time and thereby support way-finding.

Is an individual’s perception of the invariant structure of a place another way of expressing the idea that an individual has acquired a cognitive map of that place? If the concept of a cognitive map refers to a mental representation of a place utilized by an individual to find her way around, then clearly the ecological approach is *not* promoting this concept. This use of the concept of a cognitive map is inconsistent with the nondualistic, relational perspective adopted by the ecological approach (see earlier in the chapter).¹⁵ Moreover, because standard uses of the cognitive map concept tend to “spatialize” temporal phenomena, they may neglect potentially significant temporally based information (e.g., transitions, invariants) that naturally grow out of the ecological approach.

Investigations of the Information Used in Way-Finding. The investigation of navigation and way-finding from an ecological perspective would focus on stimulus information supporting these functions, rather than on an examination of various aspects of individuals’ mental representations of environments. The information utilized in way-finding as the perceiver travels a route is hypothesized to be a particular *sequence of transitions perceived over time that connect successive vistas*. There is some empirical support for this hypothesis (Heft, 1983, 1985). In brief, the way-finding performance of individuals previously exposed only to the sequence of transitions along a route

¹⁵Neisser (1976) has attempted to reconcile a Gibsonian account of environmental perception with a cognitive model in which a cognitive map directs exploratory activity and, reciprocally, is continually modified by perceptual information. Unlike most uses of cognitive map in the EB field, this conceptualization does not suggest that cognitive maps are consulted as a guide in navigation; instead it is intended as a way of accounting for the structure of action (e.g., navigating). However, other than responding to an apparent need for explaining “what is happening in the head” (a need that seems to presuppose a dualistic perspective), the vagueness of the suggested process does little to clarify the phenomena in question.

(in a film presentation) was found to be comparable to that of individuals who previously viewed the entire route, in contrast to poorer performance by a control group previously exposed only to the succession of vistas in the absence of transitions. Further, when the temporal continuity of the information at the transitions was disrupted (by presenting the transitions through a slide presentation or by introducing "freeze frames" in a videotape presentation), way-finding performance was degraded. Thus, the sequence of transitions along a route may be sufficient information for way-finding, and temporal continuity at the transitions may be necessary to preserve this type of information.

In a more recent series of experiments, individuals were asked to segment a videotaped walk through a complex environment according to different task instructions. The results collectively provided further evidence for the functional saliency of transitions and, moreover, offered some support for the claim that this temporally based environmental information has a nested hierarchical structure (Heft, 1996).

In addition, other research has examined the relationship between affordances along a route and way-finding performance (Heft & Blue, 1991). With a few exceptions (e.g., Garling et al., 1984), the *purpose* of an individual's travels in relation to her knowledge of a route has been neglected in the research literature, particularly in investigations involving children (Heft & Wohlwill, 1987). From an ecological perspective, a route through the environment is learned principally because it leads to functionally significant places. Thus, a route through the environment might be more readily learned when it leads to distinctive affordances, as compared to a route lacking in salient affordances. This hypothesis received some support in an examination of children's route-learning in a complex building. Moreover, age (3 years, 7 months to 7 years, 11 months) was unrelated to successful way-finding performance, suggesting that way-finding for the purposes of locating environmental affordances may be a basic navigational skill.

Way-Finding in the Natural and the Built Environment. The ecological approach offers some insights into differences between navigation and way-finding in a natural versus a built setting. It was suggested in the last section that way-finding is the perception of a sequence of transitions connecting distinctive vistas. Elaborating on this idea, Gibson (1979) pointed out: "Note that in a *terrestrial environment* of semienclosed places each vista is unique, unlike the featureless passageways of a maze. Each vista is thus its own 'landmark' inasmuch as the habitat never duplicates itself" (p. 198; emphasis added).

In contrast, a vista in a built environment can be duplicated in its essential features. For example, the design of a hallway may be repeated within a specific building. Buildings with a history of way-finding problems may present visitors with repetitive vistas—with each floor or section looking much like another (Figure 5). Under these conditions, the various transitions



FIGURE 5. Two similar vistas in a building.

connecting vistas would look much the same. Cosmetic changes (e.g., signage or color coding) may alter the superficial appearances of the vistas, but leave their broad structural features unchanged. Way-finding should be easier in those built environments containing unique, nonrepetitive vistas, and design measures should be taken to enhance their differences.

Natural environments do not typically present this problem because natural vistas are unique. Also, they are rich in potential information, and thus are readily differentiable with perceptual experience. This kind of perceptual differentiation (E. Gibson, 1969) may be more difficult in some built settings because of the greater uniformity of the vistas.

Conclusions: The Perception–Cognition Distinction from an Ecological Perspective. It was argued previously that if one allows for the possibility that the invariant specifying an environmental feature is detected over time, then it is arbitrary to place an a priori limit on the duration of time over which perceiving can occur. This conceptualization upsets the traditional division between perception and cognition, where perception is considered to be limited to some circumscribed moment in time and cognition has a future orientation beyond the present moment through processes such as expectation and inference based on prior experience. However, if perceiving is the pick-up of information *over time*, then perceiving intrinsically has a future orientation: it is prospective (E. Gibson, 1994). "Perceiving gets wider and finer and longer and richer and fuller as the observer explores the environment" (Gibson, 1979, p. 255).

Accordingly, the ecological approach invites a reconceptualization of the traditional division between perception and cognition. Although this reconceptualization is at an early point in its development (Gibson, 1979, Chapter 14; Reed, 1987, 1988, 1996), what can be suggested at this time is as follows: The ecological approach rejects a distinction between perception and cognition as separable functions. Cognition refers to ways of knowing, and perception is one of several modes of cognition. Specifically, perception is a way of knowing that is based on the detection of environmental information; it is how we come to know about *existing things*. "It is an awareness of *existing* places, objects, persons, and animals of the environment, and of *ongoing* events" (Gibson, quoted in Reed, 1988, p. 299). In addition, there are nonperceptual modes of cognition, which are characterized by awareness of *nonexisting things*. These modes include *remembering*, which is nonperceptual awareness of an environmental object or event that no longer exists, and thus cannot be perceived; *expecting*, which is an awareness of a possible object or event that does not yet exist; and *imagining*, which is an awareness of an object or event that could happen or be created.

This reconceptualization may illuminate some conceptual inconsistencies in how way-finding is typically treated in the EB field and suggest how these inconsistencies may be resolved. As Reed (1988) points out, if knowing the way to a place that is currently out of sight is viewed as an act of

cognition (e.g., memory) *as opposed to* perception, how can one distinguish a place that exists, but is presently out of sight, from a place that does not exist?

Basing their account . . . on the retinal image and the snapshot theory of vision, modern psychologists have assumed that one has to imagine surfaces that are even temporarily out of sight (for example, my house when I am around the corner) as well as nonexistent places (for example, my dream house). The problem with this account is that it forces me into treating my house when it is around the corner as an inferred or imagined house, not as a real one. (p. 302)

The way out of this problem may be to distinguish between nonperceptual awareness of nonexistent places (e.g., remembering, imagining) and perceptual awareness of persisting features of the environment that are detectable over time, although not necessarily in view from "here." As Gibson pointed out, "the visualizing of nonexistent surfaces . . . is quite different from the visualizing of hidden surfaces" (quoted in Reed, 1988, p. 302).

It can be seen that Gibson does not deny that individuals engage in remembering, expecting, and imagining. Rather, he wants to distinguish more sharply between these modes of knowing and perceiving than is typically done and, having drawn these distinctions, to develop a theoretically consistent way of conceptualizing these various processes. The EB field will surely gain from this attempt at greater clarity and consistency in the use of these basic psychological concepts.

IMPLICATIONS FOR FUTURE THEORY, METHODS, RESEARCH, AND UTILIZATION

This chapter has attempted to demonstrate that the assumptions we make concerning the nature of the environment and perception affect directly the study of EB issues. From the ecological approach, environmental layout is ambient, extended, information-rich, and consists of functionally significant objects and events (see also Ittelson, 1973), and perceiving is an active process of detecting the invariant information specifying these environmental features. Our research needs to reflect these characteristics of the environment and perception. To the extent that it does not, we risk creating a field that, at best, accounts for a limited set of EB phenomena and, at worst, is highly artifactual.

In addition, these assumptions influence where we concentrate our theoretical and research attention. The ecological position suggests that the focus of representational approaches on internal, mediational processes to account for EB phenomena probably reflects an inadequate conceptualization of the environmental information available to be perceived and the essential role that action plays in perceiving. Given an appropriately complex description of environmental information based on ecological considerations, *and* an active perceiver who *participates* in its pick-up, environmental

description may assume a larger share of the explanatory burden in EB analysis than it has in the past. Thus, the ecological approach offers a perspective that will help to keep EB researchers focused on the environment. In making this claim, it is important to reemphasize that in the ecological approach, environmental information and environmental meaning are defined relationally. By asserting in the context of the ecological approach that environmental conditions can account for various EB phenomena, one is *not* leaving "the person" out of the analysis. Rather, as argued earlier, "the person" is intrinsic to a relational conceptualization of the environment.

Finally, there seems to be a tendency in the EB field to embrace theoretical eclecticism. It is not uncommon in the literature to find discussions and reviews encompassing diverse concepts, with little regard for the theoretical tensions that exist among them. In addition, more formal models have sometimes been offered that juxtapose often incompatible theories and concepts. Gibson's ideas in general, and the concept of affordance in particular, have often cropped up in these contexts of theoretical heterogeneity (for a recent example, see Rodaway, 1994). This tendency, however, is not apt to benefit the EB field. Constructing a model from a variety of different theoretical sources leads to a patchwork of ideas, many of which at root are inconsistent with one another. The resulting, underlying tension is usually attributable to a clash of alternative "world views" (Altman & Rogoff, 1987). Confusion and lack of clarity about basic concepts, rather than new, deeper insight, is likely to follow from this type of analysis. In addition, ideas detached from their original theoretical contexts become conceptually watered down. As a result, they lose much of their theoretical power and heuristic value.

Unless one works from a unified theoretical position, it is difficult to test effectively the limits of one's position to determine if indeed it does provide a useful explanatory model. Moreover, when an eclectic "theory" is tested, it is difficult to determine which aspects of the position have merit and which do not. As a result, problematic concepts can continue to persist within its heterogeneous fabric. In short, this tendency toward eclecticism may not be the best way for the EB field to proceed theoretically. We may wish to consider whether it accounts, in part, for the continuing, primitive conceptual state of so much of the field.

It is important to note, however, that this argument *against* eclecticism is by no means intended as an argument *for* theoretical dogmatism. Theories must remain open to growth and change, as well as to challenge and refutation. At the same time, the EB field will benefit from examining its central problems from the points of view of competing, distinctive theories.

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The Facets of Place

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This chapter will outline one theory aimed at integrating aspects of environmental psychology with issues in architectural design. The theory to be reviewed is broad in those characteristics of theory that Moore (1987) called their "form and scope." This broadbrush, top-down approach is intended as a contrast with bottom-up attempts to specify the behavioral effects of specific aspects of design, such as lighting levels or size of spaces. It also contrasts with models that seek to answer immediate design problems. However, in Moore's (1987) vocabulary, the theory to be outlined is more than an "orientation," or "framework." It is an "explanatory theory" that has been found to have considerable scope and to be open to direct empirical test.

At the heart of the theory to be presented is the struggle to create schematic models of the experience of places. These models are offered as general summaries that reflect many current explorations of the phenomenology of places (e.g., Fishwick & Vining, 1992; Stea & Turan, 1990), but have a statistical, empirical basis rather different from the overtly antipositivist proposals of earlier studies of place experience (most notably Relph, 1976).

Although the length of the present chapter does not allow a full exploration of the issues, the premise of it is that in order for empirically sound environmental psychology theories to have the potential for being absorbed into the heartland of architectural decision-making, they must enrich our understanding of the experience of places. It is only in this way that they will connect with those aesthetic objectives that are such a dominant component of creative design.

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In order to elaborate such a wide-ranging theory of place, connections will be explored between the major facets of design (what it is that designers manipulate) and the paradigms for environment and behavior research (what it is that researchers study). A framework will be sketched that links these two realms. In building these links it will be argued that many of the different areas of environment and behavior research—such as building evaluation, environmental meaning, and studies of space use—may fruitfully be regarded as subsets of a larger matrix of related processes. They are particular combinations of a family of possible combinations of design issues and psychological issues. It is proposed that because they all come from the same family, these issues have a basis in the same environmental psychology processes. It is therefore hypothesized that similar underlying structures will characterize results from these different areas of research.

In some senses, then, the theory to be discussed can be classified as what Moore (1987) calls a “structuralist theory.” This chapter responds to his point that “the tendency to date has been to argue the [structuralist] position but show little supporting evidence” (p. 1377). The present chapter will both argue the position and provide evidence in support of it.

The framework to be outlined is built upon the theory that place experience combines individual, social, and cultural processes. Furthermore, the different paradigms of environment and behavior research, rather than covering distinct, independent theories and processes, may be fruitfully regarded as exploring different aspects of the same process. It is hypothesized that these different aspects will be found to coexist when studies of place experience are appropriately conducted. In other words, it is hypothesized that the appropriate analysis of studies of place meaning or use, or of building evaluations or cognitions, will reveal similar components of place experience. Results, to be presented from a variety of studies, support these central hypotheses.

The studies reported recognize that the theory makes special demands on research methodology. These demands are answered, in part at least, by the facet approach to research. This approach will therefore be briefly described. It will be shown that this does offer the possibility for the elaboration and test of hypotheses derived from the theory of place. Examples of such research will be presented as illustrations of the potential of studies of the facets of place for integrating many currently diverse issues in environment, behavior, and design.

FUNCTION, FORM, AND SPACE

In order to develop a detailed psychological theory that can be integrated into design, a framework is needed for what it is that designers can influence. What it is that designers actually manipulate has to be specified.

Furthermore, if it is to be open to integration with psychological research, such a framework needs to have a real possibility of connecting with human experience. For example, a view of design as the manipulation of financial resources would be relevant to economic input. Conceptualizing a building as the structuring of static and dynamic forces would be relevant for drawing upon research in engineering. However, neither of these equally valid perspectives would be particularly helpful in building bridges to behavioral research.

What are the major components of the designer's task that are relevant to psychological considerations? One stimulating answer to this question has been offered by Markus (1982, 1987). He has presented a clear argument for there being three recognizable realms of architectural discourse that each reflect different aspects of what he calls "primary experiences of buildings" (1987, p. 468). He referred to these as:

1. The *function*, which is the experience of the explicit or implicit activities which a building houses
2. The *form*, which are "the geometric properties, the proportions, articulation, color, ornamentation, and surface treatment . . . summarized under the term 'style'"
3. The *space*, which embraces "the number and location . . . sequence and linkage of spaces" (1987, p. 469).

Markus did not comment on the actual size of spaces or their obvious ability to support or inhibit particular types of activity through, for example, their thermal, acoustic, or lighting characteristics. This was because he saw function in mainly social terms: "who does what, where, with controlled by, whom" (1987, p. 470). He wished to emphasize the relationships between spaces and the consequences of those relationships. However, in distinguishing "style" from "space," it may be appropriate to take a broader view of space and include within it those aspects that include the potential utility of the space, what are often referred to as the services of a building. This maintains a distinction between *what* is provided for *where* in a building (all being aspects of the space) and *how* those provision are made as aspects of the form or style of a building.

Markus's model is especially relevant for the integration of environment and behavior research because he has argued that each of these architectural discourses, which are primary for the experience of a building, enshrine ways of classifying human action and experience. These classification processes all derive from the same social milieu and therefore the discourses are expected to have common roots. He has argued, as a consequence, that although the discourses can be distinguished from each other, there "appear to be some basic, memorable, and *typical* conjunctions of form, function and space which seem more powerful, more appropriate and more dominant than others . . . such conjunctions could . . . be called 'building types' and,

further, classification could . . . be the device which is the basis for the origin and development of building types" (1987, p. 484). He thus has presented, as central to the main aspects of architecture, forces that coalesce to give conceptual structure to ways of thinking about buildings. Markus's three aspects therefore facilitate many considerations of how decisions relating to those aspects can be integrated with psychological research. However, before returning to these issues, it is necessary to look at the research side of the equation.

PARADIGMS FOR EB RESEARCH

The range of approaches currently employed in environment and behavior research is very wide indeed, but the recent review by Saegert and Winkel (1990) is helpful in mapping out the levels of complexity that need to be addressed. They have identified what they have called three "paradigms" for research in person-environment studies. These are types of research question and associated modes of studying and answering those questions. Their argument is that each of these paradigms presents a virtually distinct realm of discourse and separate domains of activity.

The first of their paradigms is concerned with *environmental adaptation*, studies of the ways in which people cope with the pressures inherent in physical settings: "In the adaptation paradigm the goal of biological and psychological survival motivates behavior. The biological and psychological individual attempts to cope with threats, to meet basic biological needs and to restore and expand capacities for coping and flourishing" (p. 446). Saegert and Winkel did not describe these adaptation processes as passive assimilation by people of the world around them but as active managing of environmental transactions. This requires the utilization of environmental knowledge in ways that help to reduce stress and strengthen survival possibilities. The individual's cognitive processing of environmental experiences in order to survive or live more comfortably is therefore central to this paradigm.

The second, the *opportunity structure* paradigm, embraces all those studies that deal with the opportunities the environment provides for the achievement of goals, with "the relationships between the behavioral requirements of the active and goal-directed person and the qualities of the environment . . . selecting the best options within a system of socio-physical constraints and opportunities" (p. 452). Here the focus is on the options for action that the environment makes available and how people can select or manipulate settings to make possible those patterns of behavior, or styles of life, to which they aspire. An important distinction between the adaptation paradigm and the options paradigm is that the former is couched in individualistic terms, emphasizing a person's own distinct reactions to their surroundings, whereas the latter carries strong implications about the social

milieu in which a person is operating. Therefore, rather than being distinct and unconnected paradigms, it is worth considering the possibility that these two realms of study are different perspectives on a common system of experiences. One focuses on the individual, complemented by the second focus on the social.

The third paradigm recognized by Saegert and Winkel is *sociocultural*: "The person as a social agent seeks and creates meanings in the environment. . . . The paradigm . . . explicitly recognizes that environmental meanings and actions are not solely individual constructions. The individual both defines and is defined by the groups in which he /she participates" (pp. 452, 465). Here studies explore the ways in which the environment is a part of processes that define and enhance group and cultural identities. The symbolic and representational qualities of physical settings are the locus of attention for researchers operating within this paradigm. The paradigm also encompasses examinations of the historical processes by which the environmental images gained their significance. Research of this third type therefore elaborates the individualistic and social perspectives by adding a dimension that goes beyond the immediate person or group, giving special emphasis to the shared meanings of environments. By recognizing that environmental meanings and symbols have an existence beyond the direct experience of individuals, Saegert and Winkel drew attention to those environmental psychology studies that explore *cultural* processes.

Saegert and Winkel presented three distinct paradigms for research, arguing that more emphasis should be given to the third than is currently the case. However, there is logic to proposing a more closely integrated model. This integration is implicit in the account given by Saegert and Winkel, as they present all three paradigms as capturing essentially dynamic transactions between people and their settings. The adaptation paradigm explores how people strive to cope with actual and potential threats, the options paradigm has people creating and selecting opportunities, and the sociocultural paradigm sees people searching for significance and meaning. The dynamic interplay between these three different aspects of person–environment transactions is a logical assumption.

It is therefore proposed that these three perspectives, rather than being merely research paradigms, are, in effect, three features of person–environment transaction, from the individualistic through the social and on to the cultural. Consequently, all three aspects are an important element in environmental transactions. A reasonable hypothesis is therefore that these three coalesce in our experience of places, although they are different aspects of it. We adapt, seek to enact opportunities, and draw personal significance from the environment, all at one time. Our environmental experience is essentially multifaceted.

It also follows that each aspect serves to provide a context and significance for the others. The modes of adaptation considered appropriate will be

constrained by notions of social identity and culturally determined meanings. For example, the clothing that people wear, influencing their thermal comfort, is limited by desires for self-presentation and existing mores. Cultural meanings will include ideas about what forms of environmental adaptation typically occur. A crowded space may signify the importance of an event in the British House of Commons because it is known that Members of Parliament are prepared to stand if there are no seats available, or it may indicate poverty in a shanty town where it is known that those with money will buy extra space. Similarly, the options that people select will incorporate assumptions about the adaptive implications of any option selection and will be, in part, defined by cultural considerations. This complex interaction between the three aspects of person–place transactions is frequently illustrated when senior management, in an open-plan office, choose spaces near the windows. They assume that daylight is beneficial but are also influenced by corporate cultural notions of the high status associated with window locations.

With three distinct aspects of place transactions—individual, social, and cultural—models can be developed linking each aspect with another, as well as linking all three together. A detailed conceptual analysis remains to be conducted into the fourfold set of transactions implied by this proposed system. As will become apparent later in this chapter, this hypothesized system is open to empirical test.

If research across a disparate range of topics using varied methodologies is all focusing on different aspects of the same system of environment and behavior processes, what it is that the different aspects have in common should be apparent. Careful reading of their review suggests that all three of Saegert and Winkel's paradigms are goal-oriented. It is the various types of psychological use to which an environment is put that provides the distinctions between the different realms of research.

At the level of individual adaptation, studies explore how a person can achieve the objective of comfortable survival, e.g., will it be warm enough or light enough? Those studies within the framework of the second, social, paradigm look at rather different types of objectives. When dealing with social processes, Saegert and Winkel refer to the goal of "selecting the best options within a system of socio-physical constraints" (p. 452). Here, then, the environment is being studied in terms of its relevance to what is socio-physically possible, i.e., the sort of opportunities for which it provides, e.g., is it a good place to meet people or to bring up a family? The third, socio-cultural, paradigm has an even broader set of implicit objectives. These all relate to the search for significance and meaning, as in studies of the social status, or potential threat, attributed to particular settings.

Comfort, opportunity, and significance may therefore be seen as three aspects of the objectives that give shape to person–setting transactions. They are all part of human attempts to gain mastery and personal satisfaction

within any given setting. If they are aspects of the same system of experience, it can be hypothesized that for any stable environment the three components will not be in fundamental conflict with each other. A very uncomfortable setting is unlikely to provide many opportunities or positive significance. Indeed, the experienced quality of an environment would be hypothesized to be a direct product of the balance of comfort, opportunity, and significance achievable by people in that environment. One direction for integrative research is therefore to explore the relationships between these aspects of places and how those relationships vary from one context to another.

A THEORY OF PLACE

THE INTEGRATION OF PARADIGMS

Markus's three architectural discourses of function, space, and form provide a map for the different types of design issues with which environment and behavior research must connect. Saegert and Winkel's three paradigms—personal, social, and cultural aspects of the process of person–place transaction—indicate three broad psychological processes with which to connect the design issues. By combining these two frameworks it is possible to map out the field of environment, behavior, and design and generate within that map an agenda for future research. So, for example, studies of the ways individuals adapt to the functional manipulations of architects cover much of the early psychophysical research on heating, lighting, and noise. Studies of differences between people in the meanings they give to particular architectural forms sits in another cell of this notional 3×3 matrix.

It may be fruitful to elaborate all nine areas of research implicit in this matrix of architectural discourses against psychological paradigms. But such an activity is likely to be less than fully productive for two reasons. One is that such an elaboration would be little more than a bureaucratic list with little inherent, conceptual integration. A second reason is that careful consideration of this matrix suggests that research is very sparse in a number of the cells. For example, studies of the cultural significance of aspects of building function are far rarer than individualistic, psychological studies of functional aspects. Similarly, most studies of building form tend to emphasize variations between groups, implicitly or explicitly, exploring cultural issues rather than within-individual processes. Indeed, it might be suggested that only a small subset of the nine cells make psychological sense. In other words, these two frameworks are unlikely to be two separate, independent systems but naturally interact, being two aspects of the same process.

It may therefore be the case that, although Markus's and Saegert and Winkel's perspectives have very different intellectual origins, they nonethe-

less represent a common underlying structure to person–place transactions that is reflected in the different discourses of architecture. Support for the logic of this convergence can be found by reconsidering Markus's point that "some . . . conjunctions of form, function and space . . . seem . . . more appropriate than others." This suggests that the processes of person–place transaction limits the types and range of buildings that are produced. Certain forms and spaces are deemed appropriate for some functions and not others. Particular spaces are expected to be housed within specific forms for one function, but not another. For example, compare the space in a church with the space in a theater. The spatial requirements in both cases are similar, but their interactions with functional demands give rise to recognizably different forms.

What limits the range of design possibilities, then? There are many possible answers to this question, but one productive direction to explore follows. The discourses of architecture are limited by the personal, social, and cultural processes of person–place transactions. Recognizable types of setting can be created and used because the different aspects of person–place transactions are themselves an integral part of the same system. For instance, if the lighting levels were not appropriate in a library, the types of social transactions culturally acceptable in a library would not be able to occur. Or consider another example: If a parliament building did not have a form to it that represented the social processes deemed appropriate by that culture, it would probably never be built. The examples are as many as the buildings and people who create and use them.

Another way of looking at this proposed integration of architecture and psychology is to see that the history of human habitation has been characterized by the apparently self-evident assignment of particular types of activity to particular types of place: sleeping in bedrooms, praying in religious places, working in workplaces, and so on. As will be discussed in more detail later, there are greater and lesser degrees of spatial differentiation and flexibility of space use; these are variations around a norm of the "conjunctions" that Markus calls "building types," but equally well describe room types and types of urban areas.

This approach to integrating the different facets of architectural discourse and person–place transaction is fundamentally systemic in the sense that it hypothesizes that particular qualities of personal, social, and cultural aspects of places combine to create a limited set of possible states that can be created and experienced. These limited states will each have typical functional, spatial, and formal properties.

The suggestion that there are a limited set of combinations of qualities of person–place transactions may, on a superficial reading, appear to imply that components of the environment are primary and shape our experiences in accord with those theories that Winett (1987) described as "positivist" and "determinist." However, there will be stages in the experience of environ-

ments at which preexisting conditions do carry implications for later actions and experiences. It is also the case that the approach being outlined does recognize that it is important "to explore and describe the lifeworld, with the eventual goal of identifying its invariant *structures*" (Relph, 1976, p. 6). A person's experience of the world about him or her reflects personal, social, and cultural processes of which he or she is a part. For a person to survive with any sanity he or she must, at least implicitly, recognize the "conjunctions" of which Markus wrote. One important task is therefore to identify those structures that are invariant within architectural discourses and experience of the instantiation of those discourses.

What is being hypothesized here, then, is that personal, social, and cultural transactions coalesce within a person's location-specific experiences. It follows that what is experienced is not simply a location but a sociophysical construction that has constituents of physiological comfort and cultural significance. As has been argued by a number of people (see, for example, Seamon & Mugerauer, 1985), the terms environment or location ignore these psychological and social aspects of location-specific experience. The word "place" has been proposed as an alternative.

For the theory being developed in the present chapter, *place* will be used in a slightly different sense from the ways in which Seamon and Mugerauer (1985), Relph (1976), and others have used it. It is proposed as a technical term for describing the system of experience that incorporates the personal, social, and culturally significant aspects of situated activities.

This is a clarification of some of the ambiguities in the Canter (1977) model of place and is distinct from the more value-laden usage of other authors. That usage sees "place" as a quality of a location, akin to Ruskin's adoption in Victorian times of the Roman notion of *genius locii*. Relph (1976), for example, has done much to contrast place with "placelessness." More recent publications (for example, Stea and Turan, 1990, or Shields, 1991) have broadened the notion but still emphasize the *special* qualities that create a feeling of "place."

There are a number of weaknesses in using the term "place" as a form of evaluation of a particular location. In this usage, there is no such thing as a place that does not have a clear image. Such settings may be termed "placeless," especially for those authors like Relph, for whom "placeness" is a positive quality. The major problem with the scientific exploration of places, when the term is used to imply praise or some special quality of a location in this way, is that personal value judgments of the properties of certain physical phenomena are being treated as if they were technical definitions for the existence of common experiences. Such an approach, in effect, terminates the scientific exploration of what it is that makes a place experienced as good or bad, salient or nondescript, by different individuals or groups, replacing this exploration with personal opinions. If, on the other hand, the exploration of the meaning and significance of places is part of empirical explorations, as in

studies of *place identity* (Proshansky, Fabian, & Kaminoff, 1983), then the term "place" is being used much in the same way as described here.

The reason, then, for using "place" as a neutral, technical term rather than implying a quality of a location is to make available a unit of study that encapsulates the mixture of processes that create our experience of our sociophysical surroundings. There are some senses in which this is a development of Barker's (1968) concept of the *behavior setting*. It differs from that conceptualization by including much more directly the understanding and expectations that participants have of the place in which they find themselves, together with the qualities that the physical shape and perceptual properties of that location. Indeed, Barker's ecological psychology tends to focus on the social aspects of the Saegert and Winkel model at the expense of both psychological and cultural processes.

Places can therefore be distinguished from Barker's concepts in that they are not defined by unitary, standing patterns of behavior. One place may have many different, overlapping patterns of behavior that occur at different or the same points in time. Furthermore, a place may characteristically be rather amorphous, housing uncoordinated activities, never giving rise to the consistency that would create a recognizable behavior setting, such as a public park, a railway station, or a shopping mall.

It is hypothesized, then, that the experience of places evolves out of transactions between the personal, cognitive-emotional system that a person brings to any setting and the socially structured patterns of action that occur within that setting as given significance by the culture in which the transactions occur. Together the actions and reactions of users generate the wide range of experiences that Rapoport (1982) has reviewed in his account of meanings of a places.

In essence, then, a theory of place is being proposed. The following points summarize the main hypotheses of the theory that have been presented so far:

1. There are focused units of environmental experience, "places."
2. These aspects of experience incorporate personal, social, and cultural constituents of person-place transactions.
3. Each of the constituents will be reflected in the functional, spatial, and formal aspects of a place.
4. For any given place there will be structural similarities in the ways in which psychological constituents are reflected in the aspects of the place.

PLACE AS A FOCUS

The first hypothesis implies that there will be core aspects of places. In general, there will be some coherence, or consistency, in the overall goals that a place is seen to serve for a particular group at a particular point in

time. This central hypothesis proposes that a place will have a focus that helps to define its characteristic nature. A subsidiary hypothesis is that such core aspects of places will be consistent across places that house similar sets of objectives.

The idea that our experience of our surroundings has an almost molecular structure, in which the molecules are places, is consistent with Markus's (1982) argument that buildings are essentially instruments for classifying aspects of experience and action. The process of design is one of giving space and form to ways of thinking about human events and their relationships. Once such forms are produced, they are recognized as "places." Just about any conventional English usage of the word place, in relation to a physically identifiable location, will generate examples: "a place at table," "my bedroom's a private place," "there's no place like home," "Berkeley is a crazy place to live," "I don't know who they are, but from the way they're dressed they must come from some place like California."

In more pragmatic terms, the theory suggests ways of considering what the focus of a place may be. For example, what is the central mood of a living room or a house? What are the distinguishing characteristics of a school or a shopping mall? How do urban parks change, as the urban structure around them changes, while still maintaining their focus? These and many related questions derive from the general theory of place that has been proposed. As will be discussed later, there are quite specific methodological tests available for challenging and elaborating this theory.

CONFLICTING GOALS FOR PLACE USE

Perhaps the strongest challenge to the theory of place outlined here is the recognition that many places will be required to house conflicting goals. Different groups of people may wish to use the same location for competing activities, as when fishermen and water sports enthusiasts wish to enjoy the same area of water. Or the same person or group may have opposing conceptualizations or uses for the same place, as when a study bedroom must be used for semipublic entertainment or private sleep or study.

The theory of place prediction is that any such conflict or competition is inherently unstable. Processes will be set in motion that will tend toward one or another usage becoming the dominant one. Indeed, in some of his earliest writings, Alexander (1964) argued that a central objective of the design process is to help resolve such conflicts. But it is hypothesized that, even without direct design intervention, other modifications will occur in how the place is construed or used so that the setting ends up being one type of place. This may be achieved through time-tabling different uses at different times, for example, or by one conceptualization of a place becoming dominant over others, as when a study bedroom is treated as a meeting room and study with the bed regarded as a settee for general use. Another type of develop-

ment that is hypothesized is the differentiation of a place into more than one, geographically smaller, place, as when one area of a public park becomes identified with teenage gangs and another with courting couples.

The hypotheses mentioned here are just a few of those that are open to exploration and test. Many such tests can be carried out from the existing literature in cultural anthropology and architectural history. But it is worth emphasizing that the central premise is that there are naturally occurring psychological processes that move toward a clear definition of any place.

THE EVOLUTION OF PLACES

The move to a clear definition of a place implies a constant evolution in those places that already exist. As a consequence, one of the strongest tests of the central hypothesis of a theory of place, i.e., that places tend to change toward a focus of experience, may be derived from historical examination of the evolution of places. The argument here is that if distinct places with identifiable foci exist, then there should be historical evidence of the continuing emergence and refinement of places, an evolution of places that is analogous to the evolution of species. One early, amorphous, all-encompassing place would be proposed that then evolved into ever more specific places, each place taking on a significance of its own, out of which new types of place would emerge.

The essentially dynamic, changing experiences of places inherent in this theory of place have already been briefly outlined (Canter, 1985), but evidence for these evolutionary processes in the creation of places has been long recognized, most notably by the social architectural historian Girouard (1978, 1985, 1990). He has presented numerous examples of how places evolve into ever more specific forms. For example, in his discussion of English townhouses, Girouard (1990) pointed out:

Medieval town houses were seldom more than two storeys high. Pressure on space in the centre produced houses like the four-storey High House in Stafford. . . . [I]n eighteenth-century London the five-storey house became standard. One of these storeys was produced by putting the kitchen and servants' hall into a basement . . . and it became common to stratify different sections of the family into separate floors above the basement: husband on the ground floor (which was the floor for business), wife on the first floor (which was the floor for entertaining), children on the second floor, and servant in the attic. (p. 122)

The pressure on space in towns and the growing mixture of activities that were carried out in townhouses, then, lead to increasing divisions within townhouses. The discourses of space and function reflected divisions that were associated with specific activities and the specific subgroups of the household that carried out or were held responsible for those activities. The discourse of form lead to a design and decor of the spaces that were also expected to reflect their different qualities, even when other opportunities outside of the house made compartmentalization within it less detailed, as

Girouard (1990) wrote: “[I]n the course of the eighteenth century . . . husbands still tended to have their dressing-rooms or studies on the ground floor and express their taste in the dining-room, and wives to have their boudoirs or bedrooms on the first floor, and express their taste in the drawing-rooms” (p. 123). Among many examples, Girouard (1990) discussed the emergence of assembly rooms in the early part of the eighteenth century:

At first public assemblies were held in any large available room. Houses which had lost their original use, or were seldom occupied by fashionable owners, provided one venue. Other early assemblies took place in public buildings, at Hull, for instance, in the grammar school, at Shrewsbury in the Jacobean town hall. . . . Purpose built assembly rooms inevitably followed. (p. 138)

Town halls, law courts, municipal offices, schools, hospitals, and many other currently recognized types of building have been shown by Girouard to have evolved from other mixed usages. The historical record shows over and over again that the trend is to produce ever more differentiated places rather than more complex, multipurpose settings. If there are economic or other pressures to combine places, then the most likely consequence is for some aspects of a place to suffer and for a dominant quality to emerge, unless there are strong organizational pressures that distinguish multiple place uses in time or by other means of control.

Detailed explorations of this evolutionary hypothesis have not been carried out, but there are a number of themes in the environment and behavior literature that bear it out. The most obvious is the documented failure of fully open-plan schools or offices (Wineman, 1985). Their lack of place differentiation formed a considerable part of their failing. In contrast to the evidence from the negative effects of open plan, the positive significance of privacy (Altman, 1975) can also be seen as one aspect of creating distinct places. Indeed, it may be speculated that if we think of a group requiring privacy rather than an individual, then many of the privacy-control mechanisms that Altman describes may apply to the maintenance of distinct places.

If places are evolving, the question arises as to what constituents of them change. One answer may be found in a consideration of the personal, social, and cultural aspects of place experience. Many research questions emerge from these considerations. For example, does the evolution of places lead to any change in the relationships these constituents have to each other? Is there a tendency, for example, to separate personal comfort from cultural significance, or do the two evolve together? Does the definition of the function of places evolve through the patterns of space use in tandem with the meanings of places, or does meaning tend to follow use?

These questions serve to illustrate, also, that detailed examination of what underlies the evolution of places requires the specific study of the components of place experience. Indeed, any further study of place evolu-

tion must await the empirical clarification the constituents of place experience and of the relationships between those constituents.

Of course, the environment and behavior literature is replete with accounts of the experience of place. Postoccupancy evaluations, studies of environmental cognition, explorations of environmental meaning, the examination of the perception of crowding, and so on, all deal with aspects of place experience. The goal in this chapter is to see if a superordinate framework is possible that brings these disparate areas of study together as part of an understanding of the psychology of places. This requires the study of the systems of place experience to be carried out in an integrative way that shows the relationships between components that are comparable from one context to another.

As is so often the case in science, it is difficult to specify the details of research without some understanding of the methodology by which the research is to be conducted. The theory of place puts special demands upon the methodology, so, before detailed empirical studies can be reviewed, it is necessary to summarize one's approach to research that does appear to respond to many of the demands of the theory of place.

THE FACET APPROACH

DEMANDS ON METHODOLOGY

The theory of place draws attention to the essentially multivariate nature of that experience. This is central because the personal, social, and cultural aspects have to be studied together. Furthermore, the studies have to be carried out in such a way that it is possible to identify any existing dominant core of such experiences for any particular setting. Another demand of the theory is that comparisons can be made, from one architectural discourse to another, between the patterns of relationships between components. This is a comparison of what Seamon (1987) called "structures."

The theory of place is also sympathetic to the phenomenological objective of establishing "the actual nature of everyday environmental experiences" (Seamon, 1987, p. 6). This is taken to mean that the *methodologies* employed do not make any prior assumptions about the structures that will become apparent. The constituents discussed are hypothesized to be naturally present, underlying place experience. No strong prior assumptions are made about how they relate to each other, i.e., their structure. Thus, although the theory of place discussed here does share with the phenomenologists a desire to describe experiences as they exist, it does eschew the "the main vehicle" of "*intuitive insight* directed towards the phenomenon studied" (Seamon, 1987, p. 7) because of the arbitrary nature of the driving of such a vehicle. Application of such insights without any firm basis on which to draw are difficult to evaluate or to incorporate into archival scholarship

(Sixsmith, 1983). However, as will be demonstrated, such intuitive insights can be harnessed with profit to the appropriate empirical analyses.

Methodologies appropriate to the elaboration and test of the theory of place therefore have much in common with both the qualitative methodologies favored by those operating within a phenomenological orientation (cf. Seamon, 1987) and the descriptive analyses developed by the overtly positivist approach of the ecological psychologists (cf. Winett, 1987). As with these other orientations, the theory of place would be difficult to test, for example, through experimental studies in which statistical differences in response are established between specific levels of a variable, say, way-finding and the complexity of a building layout or ceiling angle and assessed room friendliness. Neither provide indications of the interacting components of a naturally existing system of relationships nor, typically, demonstrate effects that are robust enough to be found in uncontrolled conditions.

However, the demands on research methods go beyond the need for nonexperimental strategies. The tactics, the ways in which any data are collected, need to be flexible, allowing for the qualitative properties of real world events and experiences as well as numerically more sophisticated measurements. Analytic procedures that can range across many forms of data to generate comparable results are therefore of more value than those that are special to particular forms or levels of measurement.

FACET THEORY OR APPROACH

One approach to research that has some potential for responding to these demands is known as *facet theory* (Canter, 1985; Shye, 1978). This approach can be used to *test* hypotheses about place experiences as in much conventional experimental science. In these circumstances, the theory to be tested will have already been formulated, say, from previous research or logical examination of the environmental literature. More importantly for the theory of place, the approach can be harnessed to the *generation* of hypotheses, i.e., the discovery of naturally occurring systems of place experience, in which loosely formulated "intuitive insights" can be explored, elaborated, and tested through replication. It is in this latter mode that the approach shares some common ground with other strategies for the *description* of existing systems of action and experience.

Although the term "theory" is quite accurate in referring to facet theory, in the sense that hypotheses can be derived and tested from it, the term is a little misleading because the theory being espoused is about how theories may be best formulated and tested. In other words, it is a *metatheory*. As such, it specifies with some degree of rigor the constituents of theories and ways in which the hypotheses derived from those constituents may be tested. In summary, it can be seen to combine: (1) a rationalist scientific epistemology, in which the scientist is seen as the creator of accounts of the

world rather than the discoverer of Platonic truths, with (2) formal ways of specifying the constituents of a theory, with (3) strategies for deriving and testing hypotheses about the relationships between those constituents, and (4) modes of data analysis. Such a mixture of procedures and techniques, in effect, provides a whole approach to research so that the term "facet approach," while being looser, is more readily understandable.

Central to the facet approach is the proposition that the building blocks of any theory are ways of categorizing phenomena. Such categories may be qualitative, as when categorizing activities into rest, recreation, and work, or they may be quantitative, like frequency of place use. These categorizations are known as "facets." The specification of facets is the central, formal process for developing any facet theory. The only limitations on what may be regarded as a "facet" are: (1) facets exhaustively cover all the phenomena under consideration, i.e., every example being considered is covered by one subcategory of the categorization scheme, e.g., a facet of twentieth-century architectural styles would need to include subcategories covering both modern and postmodern styles; (2) each of the subcategories is mutually exclusive of all the others in that categorization, e.g., every design would have to find a place in only one style subcategory; but (3) all the phenomena under study can be categorized into as many facets as the researcher wishes; for example, buildings could be categorized into primary functions, such as dwellings, offices, shops, etc., as well as styles. Indeed, the values of facet theory derive from the fact that all studies are inherently of multifaceted phenomena.

Following mathematical set theory, the subcategories of a category scheme (the facet) are referred to as the *elements* of that facet.

The approach is profoundly multivariate because it is based on the principle that every entity under study, and thus every associated observation, will be classifiable on every facet the researcher identifies. The metaphor of different perspectives on the phenomena being examined, looking at different faces or facets of them, is central to the whole theory. Science is seen as the bringing together of particular ways of looking at the world and showing how these different perspectives form an integrated structure. A theory is a related set of such facets together with empirical evidence for their existence and relationships.

THE FACETS OF PLACE

Having summarized the central thesis of the theory of place by drawing attention to the ways in which Saegert and Winkel's (1990) review and Markus's (1982, 1987) reviews can be seen to suggest hypothesized constituents of places and the importance of identifying their focus and sketched out the facet approach as a way of formally specifying those constituents of place experience in a way that is open to empirical elaboration and test, it is

now possible to provide a more precise account of the constituents of places. These constituents are defined as facets. The specification of facets is therefore a first step in producing a testable theory of place. In a nutshell, the theory of place can be seen, therefore, as the proposition that the following facets of place commonly exist and have consistent relationships with each other, i.e., "invariant structures."

Facet A: A Functional Differentiation. This first facet derives from the central proposition that places will tend to have a distinct character, what was called earlier a "focus." For instance, in studying the use of space in houses, looking at what happens in each room in the home, it is hypothesized that there will be some activities that will typically take place anywhere in the home. These are the activities that are characteristic of homes in general. These are the *central* or core elements of activities in the home. Exactly what they are depends upon the particular place and is therefore a descriptive question of some interest. The hypothesis is a structural one. It proposes that when a range of components of any particular type of place are considered, some of those components will share common features. Another example can be drawn from evaluation of the functioning of houses, what is often called residential satisfaction. Here the hypothesis is that there will be some general aspects of satisfaction that relate highly to all the others. These general issues will go some way to help define what it is that gives satisfaction with a home distinct qualities, distinguishing it from satisfaction with other types of place such as offices or hospitals.

If a central hypothesis is that some aspects of a place will be typical of all aspects of such places (conceptually central), then it follows that there will be other aspects of the place that are not typical of all aspects, being conceptually *peripheral*. Two types of "peripherality" are possible. One is a random, unstructured collection of possible constituents of the different components of places. Take the example of activities in the home again. The first type of peripherality would, therefore, predict that beyond the core activities that take place in most locations, there are other activities that tend to happen in few locations, but where those locations are varies arbitrarily from one home to the next. The second possibility is a structured sets of constituents, each subset being associated with one subset of components. This second type of peripherality would predict that there would be groupings of activities associated with each room in the home.

The theory of place is much more comfortable with the second type of peripherality because this implies a structure for the whole pattern of activities that make up the home. It also implies that each room could be treated as a type of place with central activities that could take place anywhere in that room and other activities associated with different parts of it.

The elements of centrality and peripherality have been described, for simplicity, as a dichotomy, but it is logical to assume that they are concep-

tually distinct poles with various gradations between these two extremes. The degree of precision with which the different gradations can be identified will depend upon the clarity of the data.

One further point of clarification is also important to understand. Because Facet A is a hypothesis about the structure of relationships between components of places, the content of the facet, i.e., what it is that is central or peripheral, will be defined by other facets under consideration. This relationship between facets serves to emphasize that any theory derived using the facet approach is a *systems theory*; it is a theory about the structure of constituent components. In the context of places, this structure is seen as derived from the consistent *process* that lead to the differentiation of places.

Facet B: Place Objectives. This second facet can be identified from the earlier considerations of Saegert and Winkel's (1990) review of research paradigms. In considering those paradigms, it was proposed that they were distinct because they studied different aspects of a coherent system of place experience. It was argued that, in essence, each paradigm dealt with different types of objectives for considering the effectiveness of places—in other words, different aspects of the *goals* that a person has in a place. The distinct constituents each lead to a proposed distinct element, i.e., *individual, social, and cultural*.

Thus, for example, when considering the forms of buildings, they may be hypothesized to reflect either a concern with individual comfort, or opportunities for social contact, or the cultural significance of the building. Of course, because these are all co-occurring aspects of the same system, it is expected that they are all operative at the same time. The hypothesis, therefore, is that different emphases will be given to them for different buildings. It is these differences in emphasis that are hypothesized to underly, for example, different building forms.

Just as there were possible gradations between central and peripheral elements of the first facet, so gradations may be identified between these three elements. Psychosocial and sociocultural emphases, for example, each combine two elements. The third possibility of psychocultural objectives in places illustrates an important aspect of this and all facets. If such a third possibility had a logical and empirical existence, it would mean that this was not a simply ordered, essentially quantitative facet. If elements could be found that had a logical location between psychological issues and cultural issues, then the simple sequence from the individual to the social and then on to cultural would be untenable. In a sense, the sequence would have to double back on itself to provide a position for an element between the supposed two extremes.

The question about whether psychocultural aspects of places do exist helps to demonstrate that the logic of the facet approach implies hypotheses

not only about the existence of facets but also about the structure of the elements within those facets.

To clarify this crucial idea further, it may be hypothesized that there are aspects of people's personal experience of places that are more directly related to their cultural context than to their social, interpersonal context. Any data dealing with such psychocultural matters as, for instance, personal identity, would therefore be expected to relate more closely to psychological and cultural data than to social, interpersonal data. A simple order of relationships from psychological through social to cultural would not be found in such a case. This contrasts with the logic of the first, functional differentiation, facet. What elements could logically exist partway between high differentiation and low differentiation except those that were between low and high differentiation? In other words, the very logic of the differentiation facet leads to hypotheses of it being simply ordered, i.e., being essentially quantitative.

But what of the relationship between these two facets? A system is being described, so all the component parts must have distinct interrelationships. The logic would seem to be that the degree of differentiation must interact with the objectives facet. The more differentiated the aspects of a place are the more clearly they should reveal particular objectives. A simple example would be if the possibilities of a certain level of comfort was a crucial differentiator between the qualities of rooms, but the options it provides for social interaction had less of an impact, then satisfaction with the space in a kitchen would be predicted to have less relationship to satisfaction with space in a bedroom of any given house than would the comfort (satisfaction) levels of heating and lighting levels. But the general mood of a house would be hypothesized to reflect the space for social contact rather than lighting and heating provision. In other words, Facets A and B are not expected to operate like either two independent dimensions or distinct clusters. They are hypothesized, to be part of a set of related processes. Indeed, the second main facet gives content (e.g., focus on individual comfort, social contact, or culturally related meanings) to the place differentiation of the first by interacting with it.

Facet C: Scale of Interaction. The third facet is so fundamental that it is often ignored in theory building, although it is typically used in organizing the contents of textbooks. Put simply, this is the issue of environmental scale. It is generally accepted that there is a difference between use of space in the home and in the city. The experience of rooms is usually discussed very differently from the experience of buildings, neighborhoods, or regions of a city. Researchers usually decide to ask different questions or record different behavior when considering a playground in contrast to, say, a national park. But it is rare to question what the fundamental psychological differences are between these different scales and whether there are any parallels from one

scale to the other, or even how these different scales, which are elements of a common facet, relate to one another.

This facet is an ordered facet like Facet A, place differentiation. Places can be categorized from the smallest to the largest in a quantitative sequence of scales. However, it differs from Facet A in that there is an empirical question as to how Facet C relates to the other two facets. As has been argued, it is logically necessary for place differentiation to interact with place objectives, but how might it be expected that the scale of a place interacts with Facets A and B? There are at least two hypotheses that can be developed for the possible relationships between different facets.

One hypothesis, for example, would be that the experience of the large scale, a town or an area of countryside, is a direct combination of the experiences of smaller-scale constituents—streets, buildings, fields, streams. This hypothesis would state that it was possible to predict the satisfaction of an area of countryside from knowledge of satisfaction with each of its constituents, the trees, streams, and so on. Another example would be that it would be possible to build up models of the significance of a building from analysis of each of its components in isolation. A contrasting hypothesis would be that people experience a place in a more holistic, molar way, whatever its scale. This would mean that it would be more difficult to predict the qualities of that experience from knowledge of the experience of the subplaces it contains, say, predicting the overall use of a building from the use of individual rooms. However, it would imply that no matter what the scale of the place, the personal, social, and cultural elements would be identifiable in much the same way.

The two contrasting hypotheses about the relationships between the experience of one scale of place to larger or smaller scales are, in facet terms, actually hypotheses about the interdependence of the scale facet with the others. The first hypothesis proposes that Facet C will interact with Facets A and B. It suggests that experience at any scale, i.e., the quality of places and how differentiated they are, will interact with experiences of the smaller-scale components. The second hypothesis suggests that Facet C will be independent of the other two facets. The same relationships between the components of place experience will be found at each scale. As will be shown, it is possible to carry out direct empirical tests to establish which of these two structural hypotheses has the most support.

Facet D: Aspects of Design. Markus's threefold constituents of design—function, form, and space—are also a major facet of places. This facet draws attention to the different aspects of the design of places that need to be considered when exploring the other three facets. Facet D therefore gives rise to a whole basket of hypotheses about how the structure of place experience may take on different forms in relation to the aspects of design that are being considered. For example, personal comfort at the immediate scale, say

in a room, may be most clearly revealed by examining the functions of a particular space and how readily these are achieved. This is probably what most building evaluations seek to do. To take another example, the form (or style) of a place may be examined to see whether it reveals emphases at the personal, social, or cultural level of differentiation.

This complex range of hypotheses will take considerable elaboration. Given the limits of the present chapter, a few examples will be given in the presentation of example studies of some of these hypotheses. A more detailed review of all of the hypotheses and their relationship to each other will have to await a lengthier publication. However, it is worth noting that the combinations of elements from Facet D with those of other facets do appear to provide a framework that might well incorporate most types of environment and behavior study. Building evaluations, studies of environmental cognition, explorations of personal space use, and so on, may all be analyzed as focusing on particular combinations of the elements of Facet D and the other facets.

A GENERAL MAPPING SENTENCE

The network of facets that have been summarized is quite complex. Four have been presented here, but many others could be proposed. This is typical of most facet theories. Guttman (see Shye, 1978, for details), who formulated the facet approach, proposed a summarizing device for presenting the main points in any facet theory. The essence of this device has three constituents:

1. To identify what it is that all the facets have in common. This will be another superordinate facet that indicates the range over which the observations can vary. This *common range* is typically frequency, accuracy, or value.
2. To specify the population to which the facets are seen to apply, with any facets that might describe that population. This may be the population from which the people whose views are being solicited is drawn or the types of places that the places being studied are taken to represent.
3. To summarize in ordinary language the relationships between the facets.

This summarizing device, then, shows how the facets map together into the common range facet, encapsulating all the possible descriptions of the variables being mapped. For this reason it is known as a *mapping sentence*. It has the distinct advantage of making explicit many of the aspects of a theory that are often kept implicit. The algebraic ideas behind it are discussed most fully in Borg (1978).

A preliminary mapping sentence for the theory of place is proposed in

TABLE 1. A Summary Mapping Sentence for the Theory of Place

<i>Facet D</i>		
The extent to which aspects of design of place (p) achieves		
[1. Function] [2. Space] [3. Form]		
<i>Facet A</i>	<i>Facet B</i>	<i>Facet C</i>
Differentiated	Place objectives at	Scale of interaction
[1. Central]	[1. Personal]	[1. Immediate]
[2. Peripheral]	[2. Social]	[2. Local]
	[3. Cultural]	[3. Distant]
<i>Common range</i>		
will be →	[Effective] to [Ineffective]	Achievement of objectives through design aspects
where place (p) is one of a population (P) of places that are experienced by people and open to empirical study.		

Table 1, summarizing the key points of the earlier discussion. The major hypothesis encapsulated in the mapping sentence in Table 1 is that there will be distinctions between the individual, social, and cultural effectiveness of any place when that effectiveness is examined in terms of the functions of the place, its spatial qualities, or its form. The mapping sentence, as such, does not propose details of the relationships between the hypothesized facets, although their interconnections are indicated by connecting words. Logical discussion and presentation, as in all scientific discourse, are required to elaborate the details of the facet structure. A number of hypotheses about the relationships between the elements of a facet and the relationships between facets, all of which are more detailed hypotheses about the facet structure, were summarized in the earlier presentation of the facets.

As has been mentioned, the purpose of the mapping sentence is to summarize a variety of hypotheses, all of which are open to empirical test, as will be illustrated in the following sections. The range of types of hypothesis are so many, however, that it is useful to list the *types* of hypothesis that are inherent in any mapping sentence. There are three broad types of hypothesis:

1. *Existence of the facets.* These are hypotheses that the elements indicated in the facets will be empirically distinct within the domain under study.
2. *Internal structure of the facets.* If the facets do exist, then the structure of each facet, i.e., the relationships between its elements, is open to

consideration—whether it is ordered or not, and, if it is ordered, what the actual order is.

3. *Relationships between the facets.* Once facets can be seen to have a structure to them it is possible to hypothesize relationships between them. The consideration of these relationships reveal the processes that underly the system being examined.

The facet approach is therefore also fruitful in providing a strategic structure for considering many different types of environment and behavior study. Three examples of this will be presented and empirical study of them reviewed later in the chapter:

1. The consideration at the immediate level (element 1 of Facet C) of social aspects (element 2 of Facet B) of space (element 3 of Facet D) can be regarded the study of territorial and related uses of space (as, for example, reviewed by Altman, 1975).
2. Personal objectives (element 1 of Facet B) at the immediate scale (element 1 of Facet C) may be most clearly revealed by examining the functions (element 1 of Facet D) of a particular space and how readily these are achieved. This is probably what most building evaluations seek to do (e.g., Marans & Spreckelmeyer, 1981).
3. Studies of environmental meaning can be seen as explorations of how the form (or style) of a place reveals personal, social, or cultural significations (Rapoport, 1982). Typically such studies are at the immediate or local level of interaction. Lynch's great contribution (shown so fully in Banerjee & Southworth, 1990) was to point out that such studies are also very valuable if conducted at the distant level of interaction.

TESTING FACET MODELS OF PLACE EXPERIENCE

In order to elaborate the research implications of the facet theory of place, summaries of three sets of empirical studies will be presented. Each illustrates the application of different aspects of the theory to the consideration of a number of studies. The three areas of research have been chosen to provide one example for each of the elements of Facet D, aspects of design. The first example deals with space use (element 2), the second with functional matters as revealed through evaluations (element 1), and the third with a study of architectural form (element 3). It will be argued that all three studies reveal analogous empirical structures, thereby supporting some of the key hypotheses of the general mapping sentence of the theory of place.

ACTIONS AND SPACE

One starting point for the theory of place is the hypothesis that particular patterns of activity are associated with particular places. This is an hy-

pothesis that has been accepted by many architectural theorists, most notably Alexander (1964) and subsequently Alexander, Ishikawa, & Silverstein (1977). However, few of these theorists have explored the processes that may generate such patterns or the empirical evidence for the system of interrelationships that maintains them. A development of these ideas can be derived from the facet framework described earlier. Facets A, B, and C would be hypothesized to be reflected in all three of the Facet D elements. Here, however, we are concentrating on Facet D, the spatial environment, at the immediate level of space use.

In other words, the facet model of place use leads to three hypotheses. The first is that there will be differentiation of places in terms of the uses to which they are put, as discussed earlier when describing Facet A. The second is that there will be three distinguishable types of place use. One, linking to element 1 of Facet B (Saegert & Winkel's first paradigm), would be hypothesized to emphasize the physical adaptations that are necessary for the actions associated with the places. Another, derived from element 2 of Facet B, would be hypothesized that emphasizes relationships between people. The third (B3) would deal with the sociocultural structure, reflecting connections with the broader culture and, for example, power and status. The third hypothesis, discussed earlier, is that the two facets of place use will interact with each other.

This threefold framework can be seen as an hypothesis that there are three broad classes of behavioral setting (Barker, 1986). These three classes, however, are expected to interrelate to form a system of space uses for any given type of place. Somewhat paradoxically, then, this set of hypotheses are more "ecological" than Barker's original (1968) behavior setting theory. Barker wrote little about how one setting influenced the existence of others. His primary task was to identify distinct settings. The present model, however, presupposes a set of interrelationships between settings. They form a system, each defining the other.

Physical layout is seen, in this regard, as a manifestation of the rule structures that exist across a set of social processes. These rules are a product of the coexistence of a number of related activity expectations, shaped by processes of social control, such as privacy (Altman, 1975). Facet analysis leads to the hypothesis that there will be underlying structures for activities associated with places.

A number of studies have been carried out in which the actions typical of particular locations are recorded, usually through an interview, e.g., studies of the use of different rooms in the home (Canter, 1983). Studies of societies in which space use is not obviously fixed, or difficult for a foreign observer to take for granted, are particularly helpful in revealing patterns that might otherwise be obscure. An early study of Japanese apartments (Canter & Lee, 1975) or more recent studies of polygynous households (Omotayo, 1988) are interesting examples of these type of study.

In these studies, a matrix is derived in which the columns are different activities and each row is a different room. In studies of space in the home, a number of different homes are studied and the activity that takes place in each room noted in the appropriate cell of the row and column. By adding the frequencies across all the homes studied and putting those values into the cells of the matrix, a summary matrix is created that indicates the frequency with which each room is used for each particular activity. Other aspects of the rule structure, such as who is responsible for the room or has control over it, can also be incorporated. This matrix, therefore, encapsulates the similarities and differences between the rooms in a house in terms of the uses to which they are put.

The theory of place predicts that there will be a facet structure underlying the co-occurrence of activities. Activities that have similar defining facets, for example, being highly functionally differentiated (element 2 of Facet A), and are also social in orientation (element 2 of Facet B), e.g., having a formal meal, would be hypothesized to be more likely to occur in the same range of places as other similar activities, e.g., holding an important family meeting, and not to occur in other locations that typically housed activities with very different facet profiles. In other words, an empirical correspondence between the facet definitional structure and the empirical structure is taken as support for the original facet hypotheses.

This is known as the facet *principle of correspondence*. Conceptual, *theoretical* relationships, implied by a similar combination of facet elements, are tested by looking for corresponding relationships in the observations. In other words, each activity that might occur in the home (e.g., sleeping, eating, studying, etc.) is classified in terms of the two facets of interest here (Facets A and B). This means that a number of activities will have a similar *facet profile*. For example, having a meal together, "dining," would be classified as similar to having a casual snack, "snacking." Similarly, studying and practicing a musical instrument would be deemed to have the same facet profile and therefore be hypothesized to take place in the same locations.

The facet framework is essentially multivariate. All possible relationships between variables are of potential relevance to the hypotheses because every observation (variable) can be classified on every facet. However, no assumptions have been made about the statistical structure underlying these relationships. Furthermore, because a system of relationships is being explored, it is to be expected that some facets will relate to each other. Orthogonal, distinct, linear dimensions can therefore not be assumed. Indeed, as discussed earlier, some of the facets are theoretically posited to be nonordered, so that a linear dimension may be a very inappropriate model around which to search for any evidence to support or challenge facet hypotheses.

These considerations of the importance of not using models that make strong statistical assumptions has taken the people who use the facet perspective away from the use of multiple regression and factor analytic ap-

proaches and encouraged them to use multidimensional scaling (MDS) procedures, especially nonmetric procedures (Shye, 1978, 1985; Canter, 1985). These procedures represent relationships between variables as distances in an abstract "Euclidian" space, i.e., an area or volume that has no predetermined axes. Typically, each variable is represented as a point such that the further apart any two points are, the lower the relationships between them. Points can represent people, places, actions, drawings, or any of the possible populations of entities that may be studied.

MDS procedures, then, typically start with an association matrix. In the example of place use, this would be a matrix that is derived from the original summary matrix of the frequency of room use. It is derived by correlating the frequencies of every activity with every other across the rooms. Put simply, the more likely any two activities are to occur in the same rooms, the more highly correlated they will be. One of a number of possible algorithms is then used to produce a spatial configuration of activities that represents the correlations as closely as possible. So, the closer together any two points in the space representing two activities, the more likely those activities are to occur in the same rooms.

The interpretation of these MDS configurations is not limited to the search for dimensions or any other particular structure. Instead, a *regional hypothesis* is used. This is the hypothesis that the elements of a facet will be reflected in distinct regions of the MDS space. If no regions can be identified that relate to the elements, then there is no support in that analysis for the particular facet. As illustrated in Figure 1, the relationships between elements, whether ordered or nonordered, and between facets are tested by examining the topographical relationship between the regions.

Of course, the MDS procedures can be used to generate hypotheses about facets and their relationships as well as testing such hypotheses. As in all science, the replication of results is the key to establishing the robustness of hypotheses.

For the study of space use in the home, the facet approach leads to the examination of the relationship that every activity has to every other activity. The activities are represented as points in a space, the nearness of the points to each other representing the similarity in their patterns of occurrence across rooms. A summary of such analyses is given by Canter (1983) and is reproduced in Figure 1.

This configuration provides some interesting perspectives on the theory of place. First, the overall structure does point to a system of interrelating places within the home. Strongly distinct places, or those ordered, say, along one continuum from public to private, are not demonstrated by this analysis, although for some households there may be clear discontinuities, e.g., where a husband has a number of wives living with him in the same compound (Omotayo, 1988). In general, then, Figure 1 shows a picture of some activities being more central to the plot and therefore likely to occur in most rooms.

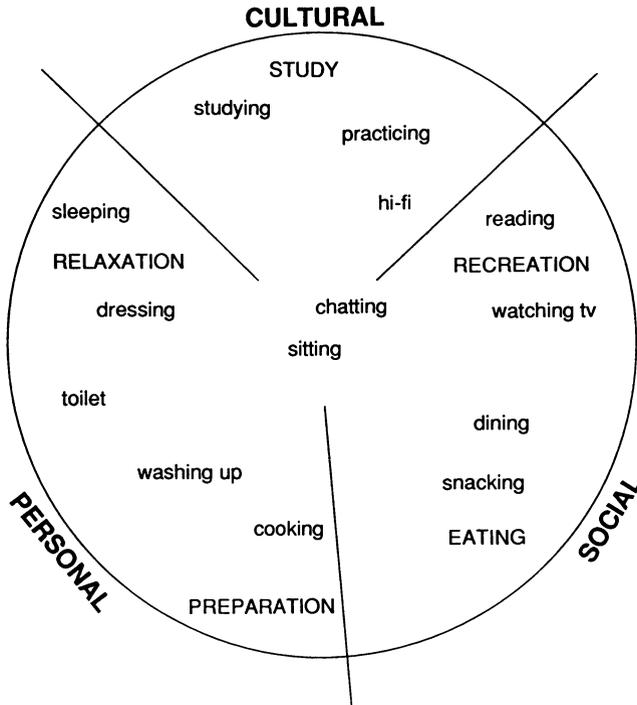


FIGURE 1. Schematic representation of domestic activities.

Others activities are much more differentiated. This is taken as support for the existence of Facet A, place differentiation.

With concrete instantiation, it is possible to say something about the nature of this place differentiation in the home. The general activities are those that are the essence of domestic existence having some of the qualities of the more differentiated activities: brief moments of relaxation, casual reading, chatting to others, eating snacks. The analysis also reveals that there are more developed, distinct forms of these general activities that tend to have spaces particularly associated with them: sleeping, studying, family gatherings, eating meals, preparing meals, and so on.

The original paper (Canter, 1983) proposed a fivefold segmentation of activities in the home. These five elements were derived post hoc as ways of describing consistencies in a number of studies, including studies of Japanese furniture arrangements (Canter & Lee, 1975) and the use of bed-sitting rooms by students (Tagg, 1974). What speculations are fruitful about the relationships that relaxation, study, recreation, eating, and preparation may have to our hypothesized elements of place objectives (derived from the original categorization by Saegert and Winkel of research paradigms)? Is it

possible to see personal, social, and cultural emphases in the structure of activities in the home?

To take personal objectives first, these are postulated to be individualistic activities that are physically oriented toward the servicing of an environment and the possibilities in particular of physiological adaptation. So although all activities will have some of this adaptive component, it is proposed that there will be an identifiable set for which this is predominant. It is proposed that bedroom- and kitchen-related actions most readily reflect this orientation. This proposal does give a rather different bias to adaptation goals for activities in the home, suggesting that for sleeping, cleaning, and food preparation a dominant functional issue will typically be the service provision and fundamental physical environmental provisions. A kitchen or bedroom that is used for other activities beyond, say, food preparation or sleeping, for instance for meals in a kitchen dining room or for studying in a study bedroom, would take on environmental demands that related to other objectives.

The social, interpersonal objectives, the second element of our facet, are obviously related to living room and dining activities. This draws attention to the essentially social nature of dining. Most societies have detailed rituals for the interpersonal transactions that take place around eating. For many people, the room in which communal meals are eaten and the room for social gatherings are one and the same. Any distinctions grow out of the degree of formality with which meals are eaten. Regarding eating and lounge areas of a home as the ones that make possible various social opportunities does help in understanding the significance that is typically given to these places in many households. Detailed studies of how the use and decor of these rooms carry social significance (Giuliani et al., 1993) are important in developing the exploration of these issues.

If the two elements are interpreted as indicated, the resulting hypothesis is that the cultural identity objectives (the third element of Facet B, derived from Saegert and Winkel's sociocultural paradigm) are most dominant in what was called the "study" activities of the "workroom/den." Clearly, as with both the other elements, there is an aspect of achieving some culturally related meaning with all the activities. Even sleeping is done in different ways, in Japan, for instance, when compared with Western countries. Yet it does not seem so plausible that the location chosen to sleep has major implications for cultural identity. By contrast, it might be expected that it is in the social and recreational activities that significance as a member of a society is most emphasized. For example, the music people listen to often appears to define the particular subgroup to which they belong. However, to define an activity as strongly cultural in its emphasis, it is necessary to be clear as to whether this is seen as at the far extreme from it being a personal activity, with social activities sitting somewhere between the two. Empirically, no analyses have revealed such a linear ordering from the most indi-

vidualistic, through the social, and on to the cultural. Instead, the results suggest that cultural emphases sit *between* the individual and the social. This raises the question of what an extreme, *purely* cultural activity could be. An example that comes to mind is of religious actions, like praying. But are these not also personal as well and often conducted in groups? Their emphasis may be to strengthen an individual's identity within a particular cultural context, but this does not put them at the end of a continuum.

In daily usage, as a nontechnical term, "cultural" activities are taken to include listening to music or other forms of participation in the arts. Most commentators argue that in the modern home the television provides the focus for such cultural activities and that in a more anthropological sense the mass media is the culture of our age. But this view reveals that the contact which a person has with their culture often takes place at a personal, individual level. The objectives facet should not be taken to imply, necessarily, that they will be reflected in increasing sizes of group contact. In fact, since at least the early writings of G. H. Mead, it has been clear that one of the most culturally determined aspects of experience is a person's concept of self. Is it far-fetched to suggest, therefore, that the activities that coalesce around recreation, study, and relaxation may be usefully thought of as having a dominant objective of enhancing a person's own identity through sociocultural transactions?

More detailed hypotheses for future test emerge from these considerations. For example, the design qualities that are important for study/recreation areas would be hypothesized to carry considerable symbolic significance, especially in regard to how they reflect the user's view of themselves as portrayed through known cultural artifacts. By contrast, the design qualities of a kitchen or bedroom would be expected to have roots in the services it is wished to reveal that they supply.

PURPOSIVE EVALUATION

The studies to be summarized in this section deal with the effectiveness of the functioning of a place (element 1 of Facet D). In essence, studies of the strengths and weaknesses of a particular design are dealt with under the heading "evaluation." *Evaluations* of places are the products of assessing how the components of places combine to help people achieve a variety of objectives. This perspective puts environmental evaluations on center stage, enabling us to examine the satisfactions that reveal how effectively a place supports a person's objectives. Evaluations are seen as an important part of the experience of places, of value to study in their own right.

The "purposive evaluation" approach complements other approaches to evaluation, such as that of Marans and Spreckelmeyer (1981), in that it hypothesizes that evaluations will consist of a system of interrelated components that center on dominant purposes for any given place. Part of the task

of research, then, is to establish whether the core of purposes is identifiable for classes of place.

If a place has some sort of "core," it would be expected that a place evaluation would reveal some common theme in any particular setting. This theme would be an aspect of the place that was crucial to its evaluation. For example, the acoustics of a concert hall might be hypothesized as being the best predictor of the evaluation of most other aspects of the place. The physical comfort of a bedroom or the spiritual mood of a church are other examples that come to mind. What the theme was would depend on the type of setting. It would be identifiable from an empirical structure that revealed variables that had high average correlations with all the other variables. The fundamental hypothesis here is that there will actually be variables that have a high average correlation with many other aspects of evaluation, rather than there being a lot of separate groupings of intercorrelations. In MDS terms, these variables are likely to be central to the configuration as well as having a conceptual centrality to the experience of that place.

Donald (1985) reviewed a number of evaluation studies carried out within the facet framework, finding strong evidence for the differentiation facet (A), and consequently for specific foci for different types of place. For example, in hospitals it is the care and attention at the bedside, and the way in which the design facilitates that, that are crucial to the whole evaluation (Kenny & Canter, 1981). In contrast, satisfaction with the space and servicing of the living room has been proposed as the core of housing satisfaction (Canter & Rees, 1982).

In some settings, the reported research expresses more difficulty in identifying what is at the heart of satisfaction with that particular place. In offices, for example, the ability to communicate with other people within the organization emerges as central but may not be tapped by any particular question dealing with place evaluation in an office (Donald, 1983). This raises the possibility that there may be places that are conceptually encapsulated by what *happens* within them almost to the exclusion of spatial or stylistic issues. An alternative hypothesis is that these settings do not form a coherent system of related aspects but are separate clusters of places. Support for such an hypothesis would be very important because, within the framework presented here, it would be predicted to be an inherently unstable type of place. Such places could therefore be of great theoretical value in testing the limits of the theory of place. This is clearly an area in which future research would be very productive.

If there is a core to place evaluation, then the other aspects of the evaluation are likely to have degrees of differentiation that enable the distinct aspects to be identified. It is thus hypothesized that any aspect of evaluation has a number of constituents that interrelate, rather than a set of orthogonal dimensions. Following the earlier discussion, it is hypothesised

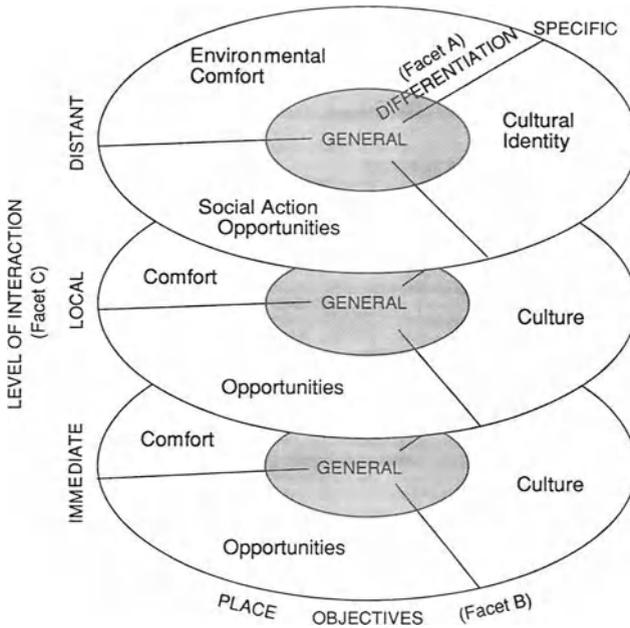


FIGURE 2. Schematic model of the structure of place evaluations.

that the key constituents should reflect the aspects of place experience of Facet B, i.e., adaptation that relates to the servicing of the environment, assessment of the action opportunities that are achievable, and the self-identity-enhancing sociocultural implications of the setting. In effect, these constituents would be hypothesized to radiate out from this core, as illustrated in Figure 2.

Figure 2 is derived from the analysis of questionnaire-based postoccupancy evaluations of buildings and summarizes the results of a number of studies as reviewed by Donald (1985). For each of these studies, a large number of building users evaluated their places of work or residence by answering a set of Likert-type questions. The questions were then intercorrelated, and MDS analyses were carried out in which each question is represented as a point in space. The closer together the questions, the more highly correlated they are. By looking at the meaning of the questions, it is possible to identify the theme that describes the region of the space in which the questions are found. Figure 2 is a schematic representation of that regional structure. The full technical details are given by Donald (1985) and in the papers he cites in his study.

As is seen in Figure 2, the elements of the place objectives do not produce some simple order. As with the activities in Figure 1, they have a circular sequence to them. This implies that all place evaluations share the

different aspects to various degrees. What is of a special note is that the different elements do indeed group together. It is typically the case that heating, lighting, and acoustic aspects of an environment highly correlate with each other. These were assumed to be the individual aspects of evaluation relating to element 1 of Facet B.

Similarly, the different spatial aspects relate to each other. It is proposed that when considering spatial evaluation, the main implication is for social contact. Therefore, this region is seen as evidence in support of element 2 of Facet B. These questions about satisfaction with spatial equations are also distinct from those aspects that link to the sort of people who are found in a place and the symbolic meanings that a place has. These are all aspects to do with what we have called cultural processes, i.e., element 3 of Facet B.

The scale of transaction with the physical surroundings (Facet C) also appears to operate as a separate facet. It can be found in a dimension quite independently of the other two facets. It implies that the transactions a person has with a place have the same basic psychological structure whether that place is conceived as an area of a town or a particular room. Whether an urban park or a restaurant, the quality of the place will emerge from the interaction between the three constituents that have been identified. The significance of these constituents will be directly related to the central objectives or purposes that characterize a place.

A further hypothesis that emerges from the model of evaluations in Figure 2 is that different classes of place will give differing emphases to the major elements. For example, buildings that have a great deal of ritual significance would be expected to be evaluated with special weight given to their symbolic, cultural qualities. Most architecture regarded as significant would fall into this categorization. Here are the churches and parliament buildings and, in the modern city, the banks and insurance companies.

Buildings aimed at providing opportunities, as well as particular types of social transaction, are predicted to be built around their spatial components. Theaters and airports would fall into this scheme, as would football grounds.

A third type of emphasis, on the services and provision, would be hypothesized to be characteristic of those places in which the adaptation and coping of the individual was a central focus or in which there were activities that made very special demands on the users. Hospitals and schools may be hypothesized to be of this type.

This outline of ways in which buildings may differ emphasizes those places that may be regarded as pure types. However, the model would predict that recognizable combinations would also occur. Future research could fruitfully move toward a classification of types of place in terms of the particular combination of service, spatial, and sociocultural components that have been emphasized within them.

One further advantage of such a multivariate typology would be that

the effectiveness of a building could be examined in relation to what was considered a typical profile for places of that type. This would go beyond explorations of the meaning of places and their symbolic functions or the ad hoc attempt to identify the characteristic purposes. It would provide a cumulative framework within which to consider the different approaches taken to a variety of designs.

PLACE FORM AND MEANING

The final study to be considered draws upon the formal element 3 of Facet D. It looks at the way in which the designs and styles of famous buildings may reflect the same psychological distinctions as do the functional and spatial aspects.

The theory of place draws attention to the ways in which forms of building may be hypothesized to reflect different approaches to modes of transaction with places.¹ It is hypothesized that these variations would be analogous to those found for activities and building evaluations. Here the hypotheses derive from consideration of the ways in which the form or style of a building, mainly reflecting visual aspects of its design, may emphasize different approaches to place objectives. Is there any evidence for personal, social, or cultural elements in the style of buildings? If there are, how do they overlap? What is the core of architectural style?

In order to develop further an understanding of how architectural styles may be considered within a theory of place perspective, it is useful to review briefly the central discussions of differences in style that have been characteristic of aesthetic criticism. Historians of art and architecture have always pointed to a clear distinction between the classical and the romantic approaches to the creation of art forms in all media, including architecture. In the classical styles, there are pure abstract rules that are seen as being free of culture and related to effects that are immediate and personal. *Collins Dictionary* defines *classical* as "marked by stability of form, intellectualism and restraint." The *romantic* style, by contrast, is more local; it does not espouse abstract principles that define what is good and bad. The *Collins* definition is "an emphasis on feeling and content rather than order and form . . . the free expression of the passions and individuality." In his extensive review of the history of art, Gombrich (1950) showed in considerable detail how these broad movements in art touched every aspect of their activities, so that the terms "romantic" and "classical" could be taken as summaries of a conglomeration of objectives that the designers themselves were espousing.

Is the individual adaptation perspective, when seen as style, essentially

¹I am especially grateful to Linda Groat for sharing with me her unpublished lectures that clarified the ways in which styles may reflect different psychological emphases.

classical? Are the social and cultural essentially aspects of a romantic style of architecture? A precursor to these questions is whether even architects can recognize relationships between different building styles that have any structure to them. If they can, then their judgment could reflect these hypothesized architectural movements. One series of studies (Wilson & Canter, 1990) does lend some intriguing support to these hypotheses.

In the Wilson and Canter studies, architecture students were given 26 examples of contemporary architecture in the form of color photographs. Using a multiple sorting procedure (Canter, Brown, & Groat, 1985), students of different years in two schools of architecture freely assigned the building to categories of their own choosing. A particular type of MDS procedure, multidimensional scalogram analysis (MSA), which is especially suitable to this type of data, was then used to examine the underlying structure of their judgments. For the present discussion, the judgments made by final-year students are of most relevance. These respondents had all spent a year in professional practice and were therefore acting from a basis of some considerable experience.

As reported in Wilson and Canter (1990), each of the buildings that was judged was represented by a small line drawing. The closer together these drawings in the MSA output, the more likely were the buildings to have been assigned to the same groupings in the sortings that the students made. So, just as with activities and evaluation questions, it is possible to look at the configuration of buildings and consider what underlying structure it might reveal.

The findings indicated that 10 buildings were *modernist* in their form, perhaps most obviously building 21, Mies Van der Rohe's Seagram Building, and building 23, Eisenman's House VI. The other buildings in the *individual* category all have an essentially simple, almost cubist form that apparently is driven by abstract concepts typical of classical "intellectualism and restraint." By contrast, the lower half of the configuration contains buildings that are more complex in form and make more obvious reference to *social* and *cultural* issues. They exhibit much more directly romantic "free expression of the passions and individuality," typically being drawn from styles described by Jencks (1982) as clearly "*postmodern*," e.g., building 22, Moore's Piazza d'Italia, or building 24, Turner Brooks' Butterworth House.

It is therefore suggested that "modernism," with its abstract, classical forms, creates places in which the individual's reactions to the building, independently of any social or cultural processes, is the essence of the design approach. As such, a simple, pragmatic view that the form relates directly to the functions of the building would be consistent with the aesthetic stand. By contrast, the major developments of postmodernist thinking are to accept the relevance of the social and cultural significance of design.

Within the theory of place, then, these findings are seen as evidence for a general approach to architectural style being influenced either by the no-

tions of individual adaptation or by the opportunity and sociocultural objectives that form other paradigms of person–place transactions. Indeed, a close examination of our data indicated two distinct subregions in the “post-modern” region. Some are buildings that draw upon broad references to *cultural* meanings, including what Jencks (1982) called “postmodern classical,” whereas others are building that Jencks called “postmodern vernacular.” These latter have a much closer reference to local, *social*, and subcultural design issues. It is therefore hypothesized that the distinctions between the cultural identity place objectives and the social place opportunity objectives are reflected in these two different approaches to architectural styles.

Is there a core to architectural place styles? The center of the MSA output in Wilson and Canter (1990) was empty. There therefore does not appear to be any archetypal place within these contemporary buildings that could find an association with most of the other buildings. The idea of the evolution of places would predict this, arguing that by focusing on contemporary buildings, a later stage in differentiation is being illustrated. This leads to the hypothesis that the central region would be filled by older buildings such as the early work of Frank Lloyd Wright. This is an hypothesis relatively easy to test.

IMPLICATIONS FOR FUTURE THEORY, METHODS, RESEARCH, AND UTILIZATION

This chapter has provided a broad sketch of a theory of place. Patterns of place use, building evaluations, and explorations of architectural style have been discussed as distinct but related examples of issues that all have a place within our experience of places. It has been proposed that each of these studies illustrates a different one of the three major aspects of design, namely, function, space, and form. The theory also predicted that each of these three aspects would show similar constituents that related to the individual, social, and cultural objectives that people have for their transactions with places. A reexamination of earlier published research gave some general support to this central hypothesis, although there is clearly a very great deal of research still needed before the theory can claim any general validity.

LINKING FUNCTION, SPACE, AND FORM

The results summarized and illustrated do indicate that consistent facet structures are likely to be found within the functional, spatial, and formal realms of architectural discourse. In each of these realms, there is some evidence for distinct, but interrelated, personal, social, and cultural aspects of person–place transactions. These findings throw new light on the nature of evaluations, studies of place use, and architectural meaning. The possi-

bilities for links between these three areas of research are also strongly suggested by some of the common aspects of their structure.

However, the complexity of the models proposed here presents a challenge to future research. How can the richness of possibilities that derive from the combinations of all the facets be reduced to manageable proportions?

One answer lies in the comments by Markus that there are basic, typical conjunctions of form, function, and space. Are there, at least by analogy, typical conjunctions of the personal, social, and cultural modes of place transaction? Indeed, is it not possible that there are a limited subset of combinations of the particular aspects of building and experience, a subset limited by custom, tradition, design process, and the requirements of human beings—in other words, a faceted typology of places?

This is a topic directly open to study using procedures like those described here. The hypothesis would be that identifiable structures would be found that have characteristic profiles across the facet elements discussed. Preliminary pilot studies following-up these ideas have produced encouraging results.

EXPLORING THE DEVELOPMENT AND DECAY OF PLACES

If such characteristic places profiles can be identified, then the question immediately arises as to how they came about. To answer this, there is a need to address more closely the issue of the inherent processes of change in places. The general theory of place evolution argues that the major changes will be toward increasing differentiation of places, although the mechanics of this have hardly been touched upon. Does this mean that there are no conditions under which places will become less differentiated? These would be situations in which a number of separate places, housing distinct functions, were amalgamated while still supporting the different uses. My own view at present is that such a reduction in differentiation is inevitably decadent in the sense of implying a deterioration of social and psychological processes. Examples of this are therefore likely to be found in destructive contexts such as war or famine. However, this is a matter of importance for future research.

A further range of research possibilities within this framework derives from new ways of looking at the physical forms of places. For example, some of the meanings of physical forms derive from the opportunities that those forms offer. Size of a space, for instance, carries limitations on what can happen in that space. Other meanings are more arbitrary, relating to historical accident or the availability of materials, such as the use of bricks in English houses. Studies to establish the universality of the association of meanings with forms could help to demonstrate whether functionally based

meanings, such space and status, are any less manipulable than those that are arbitrary, such as brick and domesticity.

Another related area of research would be to study, say, the evaluation of contrasting building forms that offer the same function but have quite different social connotations. Pilot work in which I have been involved does indicate that the evaluation of any given physical form may change enormously if the perceived function of the building is changed, even when only visual aspects are considered.

DEVELOPING PLACE PROGRAMMING

Even a general acceptance of the theory of place outlined here has profound implications for the approach to design. Consideration needs to be given to the different modes of transaction that the building will facilitate, at the personal, social, and cultural levels, as well as the functional, spatial, and formal qualities of the building. The various interactions between these different components also need to be considered. The way the interactions will vary with the type of place that is being produced, and how they might evolve over time, add a further complexity to the processes that could be studied. A tall order indeed, and one that is only feasible if more research is carried out to reduce the implicit complexities of the processes involved, creating a distilled framework of the facets of place.

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New Developments in Aesthetics for Urban Design

JACK L. NASAR

Imagine walking through an unfamiliar city. As you proceed, the surroundings change from what you see in Figure 1 to what you see in Figure 2. You might evaluate the change as unpleasant, feel less safe, and change your behavior, walking faster or leaving the area. In contrast, had you passed by the scene in Figure 3, you might evaluate it favorably, feel a calming change in emotion, and you might slow down or enter the area to savor the experience. In each case, environmental cues, which you may not have noticed, affected your appraisal of the scene, emotions, inferences, and behavior. This chapter is predicated on the conviction that the visual character of buildings has important impacts on human experience—aesthetic impacts.

The chapter reviews empirical research on urban design aesthetics. First, it presents definitions of the terms *aesthetics* and *urban design*. Then, it discusses the importance of the study of urban design aesthetics. A theoretical framework is presented, and two kinds of aesthetic variables—formal and symbolic—are described. The chapter reviews the empirical findings on each. In response to shortcomings of the present findings and approaches, two new directions—historiometric inquiry and aesthetic programming—are presented. Historiometric inquiry brings the scientific method to the study of long-term trends. Aesthetic programming uncovers guidelines for the visual character of specific projects. The chapter concludes with a discussion of implications for theory, research, and application.

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FIGURE 1. Imagine walking along this street.

Several reviews of research in empirical aesthetics inform this chapter. *Aesthetics and Psychobiology* by Berlyne (1971) defined and initiated the study of the new empirical aesthetics. Wohlwill's (1976) "Environmental Aesthetics: The Environment as a Source of Affect," extends Berlyne's work to everyday built environments. The Kaplans' (1989) *The Experience of Nature: A Psychological Perspective* and Ulrich's (1983) "Aesthetics and Affective Response to Natural Environments" offer a perspective with a cognitive orientation and particular emphasis on natural environments. Rapoport (1982) points out the importance of environmental meanings in *The Meaning of the Built Environment: A Non-Verbal Communication Approach*. Lang's (1987) *Creating Architectural Theory* connects the research on perception, evaluation, and meaning to design/planning decisions. Now let us turn to the definitions of urban design and aesthetics.

URBAN DESIGN AESTHETICS

BUILDING EXTERIORS AS A DOMAIN OF URBAN DESIGN

The term *urban design* has many different meanings. As used here, it refers to physical and spatial design (Shirvani, 1985) in such forms as large-



FIGURE 2. How would you feel encountering this place?

scale private sector development projects, public conservation of the environmental quality of communities, and low-cost neighborhood improvements by citizens (Appleyard, 1982). It includes a variety of scales, land uses, and intensities of development: The design and development of policies and design controls for a central business district of a large city, a small rural commercial strip, a residential neighborhood, a mixed-use development, an industrial park, and a retail sign ordinance all constitute urban design activities.

The domain of urban design extends from “the exterior of . . . buildings outward” (Shirvani, 1985, p. 6). It affects high-style and developer-designed buildings, groups of buildings, individual buildings seen alone, the building facade, and features, such as signs, vegetation, and open space. Whether a development occupies private or public land, or involves private or public resources, the exterior is a public object, subject to public controls such as building codes, sign ordinances, and design review (Pearlman, 1988). Although this chapter stresses the aesthetics of building exteriors, this does not imply a facelift as the answer to urban design problems. Successful solutions must consider a variety of other factors, such as social equity, land use, circulation, and activities (Shirvani, 1985). Nevertheless, decisions on ap-



FIGURE 3. Would you feel calmer encountering this place?

pearance should be informed by scientific evidence. In stressing appearance, this chapter overlooks sound, smell, touch, and kinaesthetic experience. These undoubtedly affect the experience of place, but vision is the dominant human sense and the one that most research considers. In sum, this chapter explores the factors that affect the human experience of the appearance of building exteriors.

DEFINITION OF AESTHETIC RESPONSE

Traditional definitions of *aesthetics* (Lang, 1987, p. 179) refer to the perception of beauty in the arts and may imply extreme and intense feelings such as the sublime. Such definitions overlook smaller changes that people experience every day in their surroundings. Psychologists have broadened the definition of *aesthetic* response to include these less extreme affective responses (Ulrich, 1983; Wohlwill, 1974). *Aesthetic response* in this chapter corresponds to the broader definition. It refers to favorable evaluative affect experienced in relation to the environment. In line with Sparshot (1972), an aesthetic response is one that is “valued otherwise than for its commercial,

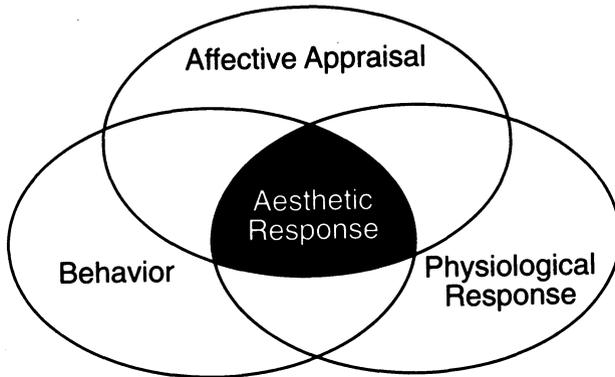


FIGURE 4. Components of aesthetic response.

economic, vital or hygienic significance" (p. 18). As can be seen in Figure 4, it includes *affective appraisals* and *emotional episodes* or *reactions* (Russell & Snodgrass, 1989) and changes in behavior (Izard, 1977). An *affective appraisal* implies an attribution to the built environment such as individuals' judgments that they like a building or the individuals' inferences about the kinds of people within. An *emotional reaction* refers to an internal state (such as pleasure) that, unlike simple mood, relates to the environment (Russell & Snodgrass, 1989). It also involves changes in physiological state (Izard, 1977).

Affect consists of more than feelings of pleasure and displeasure. Early work, replicated hundreds of times (cf. Heise, 1970), found three dimensions of emotional meaning—evaluation, potency, and activity. When research turned to the physical environment and included a variety of verbal and nonverbal measures, it uncovered four aspects of *affective appraisals* of places—pleasantness, arousing, exciting, and relaxing—and similar aspects of *emotional reactions* to places—pleasure, arousal, excitement, and relaxation (cf. Russell & Snodgrass, 1989). Figure 5 shows the circular ordering of these affective appraisals and emotional reactions. The two orthogonal dimensions on the pleasantness (the pure evaluative dimension) and arousing axes mirror the earlier dimensions of evaluation and activity. Excitement and relaxation result from mixtures of evaluation and arousal: Exciting places are more pleasant and arousing than boring ones, and relaxing places are more pleasant but less arousing than distressing places. A potency dimension, while possibly relevant to environmental response, did not emerge as critical.

Does the relaxing feeling of resting in a peaceful field or the excitement of a visit to Times Square represent an aesthetic response? In each case, the presence of an environmental referent and an evaluative feeling or appraisal make them relevant. It would be useful to identify the factors contributing to the feelings of relaxation or excitement as well as pleasantness. As most

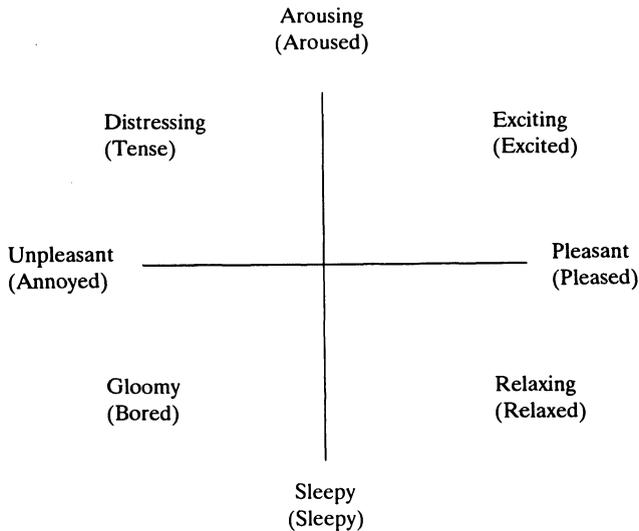


FIGURE 5. Dimensions of affective appraisals (and emotional reactions) (cf. Russell, 1988).

studies center on the evaluative and excitement (interest) dimension, this review follows suit, occasionally touching on relaxation.

WHY STUDY AESTHETIC RESPONSE TO BUILDING EXTERIORS?

The empirical study of urban design aesthetics might have little practical value if designers shared the aesthetic values of the public and delivered those values to the public. This has not been the case. Observers from within and outside the design professions have noted the disregard many designers have for popular values and the negative consequences that result from this (Blake, 1974; Gans, 1974). Research has also consistently found that architects have building preferences different from those of the public and misjudge the public's preferences (Devlin & Nasar, 1989; Groat, 1982; Nasar, 1989b; Nasar & Kang, 1989a). The differences go beyond differences in intensity of preference to differences in direction: What architects like, the public dislikes, and what the public likes, architects dislike. For example, Devlin and Nasar (1989) had architects and other professionals evaluate 40 homes (20 representing "high-style" homes and 20 representing "popular" styles). The architects liked the "high-style" best, and the public liked the "popular" best. The architects often most liked the homes that the public liked least and vice versa. Figures 6 and 7 show example of the kinds of homes receiving these opposite ratings. If, as often occurs in the design of public and corporate facilities, the designer does not work with the public, the expert-lay differences can result in designs incompatible with the preferences of the inhabitants and passersby.



FIGURE 6. Example of the type of style most liked by architects and least liked by nonarchitects (based on Devlin & Nasar, 1987).

The mismatch takes on greater importance in light of the primacy of the evaluative (aesthetic) dimension in humans' experience of their surroundings. Studies have consistently found evaluation as foremost in human response to the exterior environment. In a factor analysis of lay responses to 25 buildings, Hershberger (1969) found a space-evaluative factor (with loadings of scales such as pleasing, delightful, beautiful, and interesting) as dominant. Lansing, Marans, and Zehner (1970) found aesthetic factors had major influences on judgments of community satisfaction. In factor analysis of ratings of the quality of residential environment, Carp, Zawadzki, and Shokron (1976) found the highest proportion of variance explained by aesthetic variables. Horayangkura (1978) had students both sort and rate residential scenes. Fitting the ratings to the multidimensional space resulting from the sorting task, he found evaluation as foremost. From an evolutionary perspective, there is good reason for the primacy of evaluation. To survive, humans would have had to evaluate events that might benefit or threaten their well-being. If so, the aesthetic character of our surroundings is not a trivial concern.



FIGURE 7. Example of the type of style least liked by architects and most liked by nonarchitects (based on Devlin & Nasar, 1987).

Many people believe that aesthetics is *qualitative*, subjective varying from person to person—a matter of taste. Over 100 years ago, Fechner (1876) showed that aesthetics could be studied scientifically and quantified to reveal patterns of preference. In the 1960s a renewed interest in the empirical search for principles underlying aesthetics and environmental aesthetics appeared. This period saw the formation of the International Association for Empirical Aesthetics in 1965, Division 10 of Psychology and the Arts in the American Psychological Association, and a number of early studies in architectural psychology. Some of these studies pointed to the presence of commonalities in aesthetic preference and showed that aesthetics could be quantified (Canter, 1969; Hershberger, 1969; Hesselgren, 1975; Kasmar, Griffin, & Mauritzen, 1968). Subsequent research has confirmed these findings (cf. Kaplan & Kaplan, 1989; Nasar, 1988).

Policy-makers have also acknowledged the need and possibility of *quantifying* aesthetics in the environment. “Aesthetics” and related terms such as beauty, compatibility, and harmony appear in federal, state, and local planning guidelines. The National Environmental Policy Act (1969) and the

Coastal Zone Management Act (1972) mandate consideration of aesthetic variables. Federal and state courts grant aesthetics alone as an adequate basis for design controls (Pearlman, 1988), and communities have been using various financial, administrative, and regulatory techniques to control appearance (cf. Shirvani, 1985).

Aesthetics and community appearance is too important to be left to developers or to designer intuition, which often clashes with public values. Although many theoretical and practical questions remain, aesthetics can no longer be seen as *just* a matter of taste. Researchers no longer need to ask whether certain universal principles underlie aesthetic response. Instead, they have progressed to identifying and transforming such principles into guidelines for design.

THEORETICAL CONCERNS

A THEORETICAL FRAMEWORK FOR URBAN DESIGN AESTHETICS

Models of the relationship between human responses and the environment have been described as on a continuum (cf. Moore, 1989). At the one extreme, environmental determinists view *external* forces, such as social, physical, and cultural factors, as determining the behavior of the human, a passive reactor. Responses are shaped by and associated with certain external stimulus conditions. At the other extreme, nativists view the human mind as acting on and structuring the environment. This perspective also sees things deterministically, but changes the control to *internal* forces of heredity and biology. Distinct from these views, mediational–interactional and transactional perspectives do not see behavior as determined by genetics nor external stimuli alone but rather the product of an ongoing interaction between an active organism “adapting to the world in response to both internal and external demands” (Moore, 1989, p. 1377).

Although much research in environmental aesthetics takes a stimulus–response form suggesting a certain kind of determinism, the empirical evidence conforms to the interactional or transactional perspectives. Cognitive processes represent important mediating variables in human aesthetic response. Aesthetic preference arises from the person, environment, and interaction between the two. It may vary with biology, personality, sociocultural experience, goals, expectations, and internal and external factors.

A comparison of the fundamentals of transactionalism versus interactionalism shows the latter as more realistic for urban design. Unlike the transactionalists’ view of the person and environment as “a single unit of analysis” (Altman, 1981, p. 5), interactionalists accept the duality between the person and the environment. As urban design, by definition, must split the single environment–behavior (EB) unit the interactional perspective is a better fit.

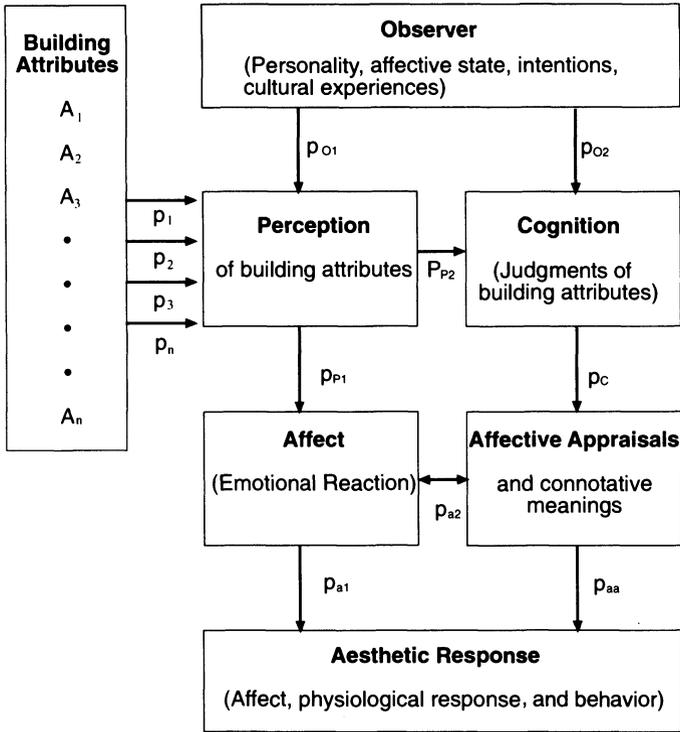


FIGURE 8. Probabilistic framework for aesthetics.

Interactionalism suggests that aesthetic response has probabilistic relationships to physical attributes of the environment. This perspective allows for both commonalities and differences in aesthetic preference across groups. Figure 8 depicts the probabilistic framework, an extension of Brunswik's lens model (Craik, 1983). The arrows in the figure have probabilities associated with them. The boxes, acting as lenses, alter what is seen, affecting the probabilities. The framework includes the observer's initial state, physical attributes of building exteriors, perception, cognition, and aesthetic responses. Humans may have a variety of evaluative responses to any environment, but given a set of circumstances (a point in time, specific group of humans, certain affective states and intentions) an aesthetic response has probabilistic relationships to environmental perception and cognition. Perception and cognition, in turn, have probabilistic relationships to one another and to the physical character of the built environment. The probabilities result from the ongoing interaction between individuals (biological, personality, sociocultural factors, and goals) and the environment.

AFFECT: WITH AND WITHOUT COGNITION

Can humans experience affect independent of and prior to recognition or cognition? Lazarus (1984) claimed that cognition of meaning *must* precede emotion, but Zajonc (1984) presented convincing evidence that affect *can* occur independent of and prior to cognition. He described such affect as rapid initial responses to gross environmental characteristics. In Figure 8, the line from perception to affect reflects the possibility that affect can precede comprehension or recognition (cognition) and that certain kinds of aesthetic responses (particularly those referred to in the next section as formal) may well precede and occur independently of cognition.

There has been widespread agreement and evidence that cognition can change affect (Lazarus, 1984; Zajonc, 1984). Such cognition need not involve rational calculation but can include such things as categorization and inference without conscious thought (Kaplan & Kaplan, 1989). In Figure 8, the lines to cognition and from cognition to affect represent this cognitive process. In relation to the environment, such cognitive influences may well take on greater importance than cognition-free affect. Cognition-free affect may have been relevant to response to the nonsense figures of the early research in aesthetics (Berlyne, 1971). But as humans inhabit the built environment and have to navigate through it, we need to make sense of our surroundings to survive (Kaplan & Kaplan, 1989). Confronted with something that could threaten or enhance survival, we have to be able to recognize what it is, evaluate it, and act on that evaluation.

In sum, aesthetic response can be seen as having probabilistic relationships to physical attributes of the built environment. The probabilities stem from the ongoing interactional experience of persons with their surroundings.

TWO KINDS OF AESTHETIC VARIABLES: FORMAL AND SYMBOLIC

Two kinds of environmental variables have bearing on the study of aesthetics: formal and symbolic (Lang, 1987). This somewhat artificial division accepts a difference between the structure and content of forms. *Formal aesthetics* emphasizes the structure of forms. *Symbolic aesthetics* emphasizes the content (or meanings) of forms. Some authors see such meanings as innate (Cooper, 1974). Others regard meanings as a product of experience (Altman, 1981; Moore, 1989). In either case, favorable meanings and affect for the *content* of design fit into the category this chapter treats as symbolic aesthetics. The following sections discuss formal and symbolic aesthetics separately. A third section discusses possible relationships between the two kinds of variables.

Formal Aesthetics. Formal aesthetics is defined as human aesthetic experience in relation to the formal or structural *parts* of the work "for their own

sake" (Lang, 1987, p. 180). Formal variables include physical properties and relationships such as shapes, proportions, rhythms, scale, degree of complexity, color, illumination, and shadowing (Lang, 1987), composition and the system of spatial relations (Groat & Després, 1991), and complexity, incongruity, ambiguity, surprise, novelty, and order (Wohlwill, 1976). Groat and Després (1991) note that architectural discourse on formal aesthetics stresses form independent of human experience. In contrast, this chapter uses the term formal aesthetics to include human experience in relation to formal variables.

Symbolic Aesthetics. Humans also experience architecture through mediating variables (cf. Evans & Lepore, Chapter 8, this volume). These properties relate to the building but are not the building itself. They reflect the individual's internal representation of the building (Moore, 1989) and associations with that representation and building. Such meanings can take several forms. *Denotative* meanings refer to judgments of what a building is (a church, an office, a Queen Anne house). Inferences about the quality and character of the building and its users represent *connotative* meanings. Modern and Tudor style houses of similar type, size, and cost may share similar denotative meaning as single-family homes, but differ in connotative meanings—inferences about their quality, value, and characteristics of the typical owner.

Symbolic aesthetics is defined as pleasurable connotative meanings associated with the content of the formal organization. These meanings relate to individual's "recognition or formal categorization" of "types," a "group of objects characterized by the same formal structure" (Groat & Després, 1991, p. 31) or "formal structure," a "composite of parts and relationships" (Norberg-Schulz, 1965, p. 148). In contrast to formal aesthetics, which refers to the appreciation of the parts for their own sake, symbolic aesthetics depends on a cognitive process, where the individual recognizes the denotative meaning, the content or style of a formal structure, and infers connotative meanings about it.

What makes for a style? A singular example of a particular formal structure stands alone and, as a formal structure, lacks meaning. It takes on meaning when seen in relation to a system of forms (Norberg-Schulz, 1965). As individuals experience and interact with other examples of a formal structure or other similar formal structures, they begin to categorize them internally as a "style" (that is, they assign denotative meanings as a particular style) and to associate connotative meanings with that style. (Designers and critics might describe a singular example, thus giving others a system within which to categorize the example as having content—perhaps as an example of a new style.) Symbolic meanings are relational: According to Norberg-Schulz (1965, p. 156), the probability of a particular formal structure varies in relation to syntax (the likelihood that certain elements and combi-

nations go together) and different building purposes (such as work places or single-family housing). However, the probability that a formal structure will be recognized as a style depends on the probabilities that the observer encounters (and mentally interacts with) some formal structures more often than others. The style classification depends on the degree to which the building instance has the probable attributes and relations of the style for its building type.

Style, then, represents a mentally constructed "characteristic formal organization" in relation to the system of forms (Norberg-Schulz, 1965). Research confirms that groups recognize styles and that these styles have distinct formal properties. Groat (1982) had accountants and architects sort photographs of modern, transitional, and postmodern buildings and found that while each group used different criteria in their classifications, members in each group used consistent categories. Espe (1981) found that laypersons saw differences in architecture of Classicist and Nazi styles and associated different formal features with each. Respondents have been found to differentiate between "high" and "popular" styles (Devlin & Nasar, 1989; Verderber & Moore, 1979), and distinct formal properties have been found associated with these styles (Devlin & Nasar, 1989): "High" style homes had fewer building materials per building, more concrete, flat roofs, punched windows, vertical proportions, off-centered entrances, and white and were judged more complex and novel than the "popular" (pp. 337-338, 341). Using similarity sorting of 45 homes and cluster analysis, Kang (1990) uncovered nine clusters of perceived home styles, each with distinct physical characteristics. For example, he found that farmstyle homes had porches with simple balusters, windows with louvered shutters, and patterned shingles; Spanish style homes had asymmetrical facades with large expanses of windowless stucco wall, an arched entryway, and a low-pitched roof. With common formal organizations of styles, shape grammars have been developed that enable a computer to generate a style, such as a Frank Lloyd Wright prairie house or Palladian homes (cf. Stiny, 1981).

In sum, symbolic aesthetics centers connotative meanings in relation to *content* variables. For building exteriors, style is an important *content* variable. Its connotative meaning and aesthetic value depend on the viewer seeing a style and on its correspondence to the viewer's expectations to the probability structure of the symbol system (Norberg-Schulz, 1965).

Relations between Formal and Symbolic Variables. Judgments of formal and stylistic features reflect an interaction between the two kinds of variables. Stylistic classifications depend on formal features. The judgment involves an internal comparison of formal features of the instance with systems of formal features. Variations in features may affect style classifications such that one easily classifies an instance as one style or another style or is uncertain about its classification. Judgments of formal variables are also affected by

style, because style organizes experience. For example, judgments of complexity or order may depend on an observer's understanding of the style within which they are embedded. Consider two styles that share similar levels of variation in their formal features. If observers have had more experience with, recognize, and identify one style better than the other, they might see the first as less complex. Perhaps the recognized style yields more complex thought, in which case it would be judged as the more complex. In either case, the interaction of the observer with style affects judgments of a formal feature. In support of this view, Devlin and Nasar's (1989) study of "high" and "popular" style houses found that the architects judged the "high" style houses as more meaningful and higher in novelty, complexity, coherence, and clarity, while lay respondents gave higher scores to the "popular" styles. The "objective" appraisals of formal features depended on each group's recognition and comprehension of the styles.

Failure to consider the interaction between formal and symbolic variables can lessen the relevance of empirical findings. For practice, design guidelines most orchestrate both formal and stylistic features. For theory, research centering on one kind of variable without considering effects of the other may end up with flawed measures. Nevertheless, because most studies handle formal and symbolic variables separately, the following sections discuss the findings on each separately.

EMPIRICAL EVIDENCE: FORMAL VARIABLES

Rather than discussing all the formal variables, this section highlights several that stand out in human responses to the built environment. These include complexity (visual richness, ornamentation, information rate), openness (openness, spaciousness, density), and order (unity, order, clarity), which have emerged as salient formal dimensions in human judgments of architecture (cf. Nasar, 1988, 1989a). Other prominent factors, such as natural versus man-made influences, upkeep, and intensity of use (Herzog, Kaplan, & Kaplan, 1976, 1982), are treated as content variables and discussed in the section on symbolic meaning.

Two kinds of theories have been put forth for aesthetic response. Arousal theories view aesthetic experience as dependent on arousal (Berlyne, 1971; Mandler, 1984; Wohlwill, 1976). Individuals may differ in their response to arousal depending on their internal state. Berlyne (1971) felt that individuals may seek an increase in arousal through diversive exploration or a decrease through specific exploration, and individuals such as artists may differ from others in the amount of arousal they favor. He posited several kinds of variables as affecting arousal, but his collative variables and, in particular, complexity have garnered the most research attention. Figure 9 shows his predictions for interest and preference in relation to complexity.

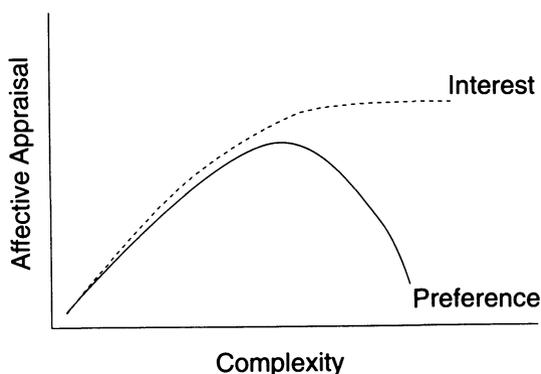


FIGURE 9. Berlyne's (1971) view of the effect of complexity on interest and preference.

As you can see, interest increases monotonically with arousal generated by complexity, and preference has an inverted U-shaped relationship to arousal with a peak in preference at a moderate level of arousal. The model has two processes. In one, individuals low in arousal (i.e., to the left of the peak) seek an arousal boost through reduced structure and increased uncertainty from the collative variables. In the other, individuals high in arousal (i.e., to the right of the peak) seek a reduction in uncertainty through increased structure and decreased uncertainty from the collative variables (Wohlwill, 1976).

The Kaplans (1989) cited a potential flaw in the arousal-based models when applied to the physical environment. Because humans must navigate through the environment, cues that help them make sense of the surroundings may take on importance. The Kaplans (1989) replaced optimal level of arousal with a two-process model, which has more of a cognitive flavor. Extending Gibson's (1979) idea of perceptual affordances in the environment (see Heft, Chapter 3, this volume), they argued for cognitive affordances that while related to survival require information-processing. According to them, humans needed to prefer environments that were involving and that made sense or promised to make sense. Figure 10 displays the Kaplans' (1989) model of preferred features. In the first column, legibility and coherence contribute to preference through making environments understandable. In the second column, complexity and mystery (a deflected vista that promises further information) contribute to preference through involving the observer and inviting exploration. Coherence and complexity represent immediately available information. Legibility and mystery offer the promise of more information. As a result, the Kaplans (1989) have argued that for understanding, coherence and legibility are preferred, and for exploration, complexity and mystery are preferred.

The two theories use similar variables—complexity/diversity and coherence/organization—but differ in their idea of the role of arousal and

	UNDERSTANDING	EXPLORATION
IMMEDIATE	Coherence	Complexity
INFERRED	Legibility	Mystery

FIGURE 10. The Kaplans (1989) model of preference.

cognition. Berlyne/Wohlwill place more emphasis on perception and arousal, with preference highest for a moderate level of arousal generated by a mix of diversity and structural complexity. The Kaplans take a cognitive approach, replacing arousal with information-processing required to survive—the need to be involved and the need to make sense.

What does the research show? First, consider a methodological choice shared by many of the studies—the use of color photographs or slides as surrogates for the real environment. Do responses to such simulations apply to on-site experience? Yes. Studies confirm responses to color photographs or slides as accurate measures of on-site experience (Feimer, 1984; Hershberger & Cass, 1974; Oostendorp, 1978).

COMPLEXITY

Early studies on responses to nonsense figures showed exploratory behavior and judged interest to increase monotonically with complexity (cf. Berlyne, 1971, Chapter 13). When the research moved from nonsense figures to real environments, the findings confirmed increases in looking time associated with environmental complexity (cf. Wohlwill, 1976). This finding has shown stability to responses to building exteriors. Oostendorp (1978) obtained on-site responses to 20 buildings in Toronto and found judged interest related to complexity. In a study using responses to color slides of architecture, Oostendorp and Berlyne (1978) found interest and looking time related to one another and to complexity. Nasar (1984) found interest related to complexity for two sets of 30 Pittsburgh housing scenes. Nasar (1987) also found increases in excitement associated with increased complexity of retail signscapes. The findings agree that interest increases with environmental complexity. Although lacking direct measures of arousal, the findings conform to the expectation that complexity is arousing.

The results for evaluative responses to the visual complexity are less consistent. For natural scenes, preference has been found to increase with complexity (Kaplan, Kaplan, & Wendt, 1972; Wohlwill, 1974), but as the scenes in the studies lacked high levels of complexity, the linear function may only reflect the left side of the inverted-U curve. Studies of urban

scenes, which vary more widely in complexity, have also found preference to increase with complexity (Devlin & Nasar, 1989; Herzog et al., 1976; Kaplan et al., 1972; Nasar, 1983, 1984). These findings may be flawed in other ways. First, some studies left content (such as land use) uncontrolled or examine preference across content categories. As the relationship between complexity and preference varies across content categories (cf. Kaplan & Kaplan, 1989; Herzog et al., 1976, 1982; Wohlwill, 1974), the effects may result from the content associated with complexity. Second, some studies have the same respondents rate complexity and preference, such that the rating rather than complexity may have affected preference. In one follow-up study, independent judgments of complexity reversed the direction of the relationship between preference and complexity and, in natural and urban categories separately, showed no significant *linear* relationship (Kaplan & Kaplan, 1989). Finally, researchers must go beyond tests for linear relationships to examine nonlinear relationships between complexity and preference.

Several studies testing nonlinear relationships have confirmed preference associated with moderate complexity. Wohlwill (cf. 1974, 1976) studied a variety of scenes and urban scenes. He found preference to have an irregular inverted U-shaped function in relation to (independently scaled) complexity. (The irregularities may result from the absence of other preferred attributes, such as coherence, or the presence of disliked content such as litter, poles, vehicles, and signs, which may covary with complexity.) Other studies used artificial stimuli to control for such extraneous effects. In one, respondents evaluated movies of trips through scale-model streets varying in diversity (cf. Wohlwill, 1976), and in another merchants and shoppers evaluated color photos of model retail streets manipulated for signscape diversity (Nasar, 1987). Both studies confirmed preferences for moderate diversity or visual richness. The terms diversity and visual richness (cf. Kaplan & Kaplan, 1989; Wohlwill, 1976) represent complexity without negative connotations such as those associated with environmental clutter and other variables that reduce order. In sum, complexity produces increases in interest, and, other things equal, people prefer moderate diversity or visual richness.

ORDER

With regard to order, most studies have shown preference associated with organization and related variables (such as order, coherence, fittingness, congruity, legibility, and clarity). The Kaplans (1989) cite several studies in which organizing variables such as legibility, identifiability, and coherence were important predictors of preference. Nasar (1990) found order as one of the frequently cited preferences in relation to the evaluative image of the city. Nasar (1984) found order as a predictor of preference for urban

street scenes by Japanese and U.S. respondents. Devlin and Nasar (1989) found clarity as one of three predictor variables of pleasantness of housing scenes. Oostendorp (1978) found preference associated with increases in order in on-site responses to building exterior, and Oostendorp and Berlyne (1978) found preferences for photos of architectural exteriors from around the world associated with order. Wohlwill (1982) found that preference increased with the congruity of buildings to their natural setting, and Groat (1984) found preference related to the compatibility of buildings to their neighboring buildings. Finally, Nasar (1987) found that increases in the coherence of a signscape produced increases in preference.

What makes a scene appear orderly? A few studies have begun to identify the specific physical features contributing to order. The Kaplans (1989) have cited features such as repeated elements, uniformity of texture, distinctive elements, and identifiability as likely contributors to coherence and legibility. Research suggests that low contrast between elements or between objects and their context and identifiability via a focal point may help give a scene order. For example, Ulrich (1983) cited evidence that preference related to the presence of a focal point; Wohlwill (1982) found that decreases in contrast in color, size, texture, and shape of buildings to their natural context enhanced judged compatibility; and Nasar (1987) found that decreases in contrast in colors and size of retail signs enhanced judged coherence. Groat (1984) found that replication of facade elements enhanced judged compatibility. In sum, preference increases with order, which may be increased through the use of a focal point, replication, and reduced contrast.

SPATIAL VARIABLES

With regard to spaciousness, the research points to preferences for defined openness. Lynch and Rivkin (1959) reported spaciousness or constriction of streets as the most important part of the pedestrian's experience. Some studies suggest that more space is better: Lansing et al. (1970) found that people prefer lower densities, and Nasar (1983, 1984) found preference associated with increases in openness. Other work suggests that, at least for natural scenes, people prefer moderate and defined openness to either wide-open or blocked views (Kaplan & Kaplan, 1989). In relation to the built environment, Im (1984) found scenic beauty estimates to be related to "space-confining elements." It remains unclear whether other factors, such as variations in diversity or naturalness that covary with openness, may explain some of the differences found. Another spatial variable deals with the arrangement of space. The Kaplans (1989) put forth "mystery" (or a deflected vista) as preferred for its promise of new information. There has been ample evidence of preference for environmental "mystery" (Kaplan & Kaplan, 1989), but the studies involve unthreatening situations. When people feel vulnerable (as they often do in urban areas after dark), they might view a deflected vista as hiding a danger such as an attacker, in which case

mystery would depress preference. A study of fear of crime in relation to a campus building confirmed this expectation. At night students avoided areas with deflected vistas and judged them as less safe than others (Fisher & Nasar, 1992). Herzog and Smith (1988) also found perceived social danger to depress preference for alleys (with deflected vistas). Thus, the research on spatial variables suggests broad patterns of preference—for moderately open spaces and mystery (under no threat).

SOME PRACTICAL CONCERNS

Order, diversity, and spaciousness represent broad constructs. What specific physical features influence our perceptions of these broad constructs? The Kaplans (1989) offered a clear physical definition of mystery as a deflected vista, Groat (1984) showed judgments of contextual fit to depend on replication of facade features, and Wohlwill (1982) showed the manipulation of color and size contrast to affect compatibility. To guide design, more refined definitions of the physical bases for order, diversity, and spaciousness are needed. In addition, research must go beyond formal variables. Preferences differ across cognitive contents (such as nature, nuisances, building type, and style), and within different content categories preferred features might vary.

EMPIRICAL EVIDENCE: SYMBOLIC VARIABLES

According to schema theory (Mandler, 1984), an individual's experience of an object, such as a building, depends on the interaction between its features and knowledge structures (the representation in memory of past experience related to the particular class of objects). Knowledge structures can be seen as cognitive affordances that had survival value. They offer humans a quick way to apprehend, organize, retain, retrieve, and act on complex environmental information. Rosch (1977) saw categories for knowledge structures as hierarchically organized from the general to the specific—moving, for example, from the superordinate (inclusive) level of buildings, to the basic level of houses, to the subordinate level of a particular kind of house. For the environment, research has confirmed that knowledge structures have a hierarchical organization, with each category having associated parts and attributes (cf. Kaplan & Kaplan, 1989, pp. 19–39; Tversky & Hemenway, 1983). Through interacting with the environment, humans could be expected to infer different meanings and develop differences in preference across content categories.

NATURALNESS AND BUILT NUISANCES

Two prominent content categories are the natural and the man-made (cf. Kaplan & Kaplan, 1989). Preferences for the addition of natural elements

and for natural over built scenes has received repeated empirical support. For example, Kaplan et al. (1972) and Wohlwill (1974) found higher preferences for natural over man-made scenes, independent of complexity. Other studies have found naturalness as a predictor of preference in residential and downtown scenes (Nasar, 1983, 1984). Thayer and Atwood (1978) found the addition of natural material to increase preference in urban areas. The preference for nature may affect spatial behavior, as one study found that individuals commuted on a parkway even though they knew a less-natural expressway to be faster (Ulrich, 1983).

Other evidence suggests a calming and restorative value of nature. Patients with a window view of deciduous trees had faster postoperative recovery, fewer negative evaluations by nurses, and fewer doses of narcotic pain killers than did patients with a view of a brick wall (Ulrich, 1983). Individuals viewing videotapes of nature showed more rapid psychophysiological recovery than did those viewing tapes of urban scenes (Ulrich, Simons, Losito, Fiorito, Miles, & Zelson, 1991). Hartig, Mang, and Evans (1991) obtained verbal, behavioral, and physiological measures that indicated restoration in relation to walks through natural as opposed to man-made environments. The pattern of findings, although compelling, does not necessarily demonstrate nature as restorative. The restoration may be mediated by the positive aesthetic experience associated with nature. It could be the aesthetic experience itself that is restorative.

The results have not yet shown whether the preference for nature only reflects a preference for foliage (the natural material used in most of the studies) and whether the preference derives from the form or content of natural materials. Wohlwill (1983) speculated that natural forms might have smoother, less intense, and less predictable irregularities, movement, and sound than carpentered materials. In urban areas, foliage may have more unity than buildings. Whatever the cause, for urban design, the introduction of nature (trees, shrubs, water) could be expected to have beneficial effects.

Another set of content categories involves nuisance content. These include dilapidation, poles, wires, signs, vehicles, and undesirable land uses such as industry. Nuisances such as these have emerged in open-ended questions as having unfavorable impacts on the visual quality of two cities by residents and visitors (Nasar, 1990). Dilapidation has regularly been found to depress preference (Cooper, 1972; Marans, 1976; Nasar, 1983, 1984). Increases in the size and contrast of signs have been found to reduce preference (Nasar, 1987), and the removal of utility poles, overhead wires, and billboards or other signs has been found to improve evaluations of roadside scenes (Winkel, Malek, & Thiel, 1970). Reductions in traffic have been regularly found related to favorable changes in the perceived quality of residential streets, neighborhoods, and quality of life (Appleyard, 1981; Craik, 1983; Lansing et al., 1970; Nasar, 1983). Intense uses, such as commercial and industrial, have also emerged as disliked (Herzog et al., 1976, 1982; Wohlwill, 1982). The findings for nuisances also agree with findings of prefer-

ences for coherence and for natural over man-made materials. The nuisances may increase complexity at the expense of coherence, thus reducing preference, or they may depress preference because of their conspicuous man-made content. For urban design practice, the removal or buffering of nuisances with more desirable elements (such as foliage) could be expected to enhance aesthetic quality.

STYLE

Studies of evaluative and connotative responses to style have found differences in relation to styles, suggesting that stylistic content conveys meanings. Whitfield (1983) found people preferred Georgian to Modern style. Across four U.S. cities, three different sets of housing stimuli and response measures, several studies of house styles (cf. Nasar, 1989b) converge on the desirability to U.S. respondents of vernacular over high styles and, in particular, on the desirability of Farm- and Tudor-style houses (Figure 11). Interestingly, Sadalla, Verschure, and Burroughs (1987) found that connotative inferences from exteriors were accurate: Inferences about a variety of characteristics of the interior of the home and the residents reflected the actual characteristics. Does this mean that designers should replicate Farm and Tudor styles? Not necessarily. If research confirms the desirability of a particular style such as Farm and Tudor styles, designers might achieve desired effects through the use of selected elements of the desired styles.

Building type may also moderate stylistic meanings. Buildings serve a functional purpose, and humans regularly group buildings into content categories (Herzog et al., 1976, 1982; Tversky, 1977) and attend to denotative meaning, or building purposes—home, school, store, restaurant, or other use (Tversky & Hemenway, 1983). The search for building purposes, like the need to make sense of the environment, has been found to be a central concern in public evaluations of buildings (Groat, 1982). Furthermore, judgments of building purposes have been found associated with physical features such as size, additions, shape, roof form, number of stories, number of windows, window size, and direction of windows (Krampen, 1989). The criteria people use for evaluation have been found to vary across building types (Michelson, 1987). Individuals recognized building types, made inferences about occupants, and used these inferences to define their evaluative criteria. Cherulnik (1991) found that from observations of restaurant exteriors, people accurately differentiated between patron's experience in four kinds of restaurants. As we have seen earlier, preferences may vary across building content categories, and such categories may act as moderating variables (Herzog et al., 1976, 1982) setting the condition under which certain design characteristics are preferred. In agreement with this view, Nasar and Kang (1989b) found the pattern of preference for suburban office styles differed from that for home styles. The study also revealed distinct uses

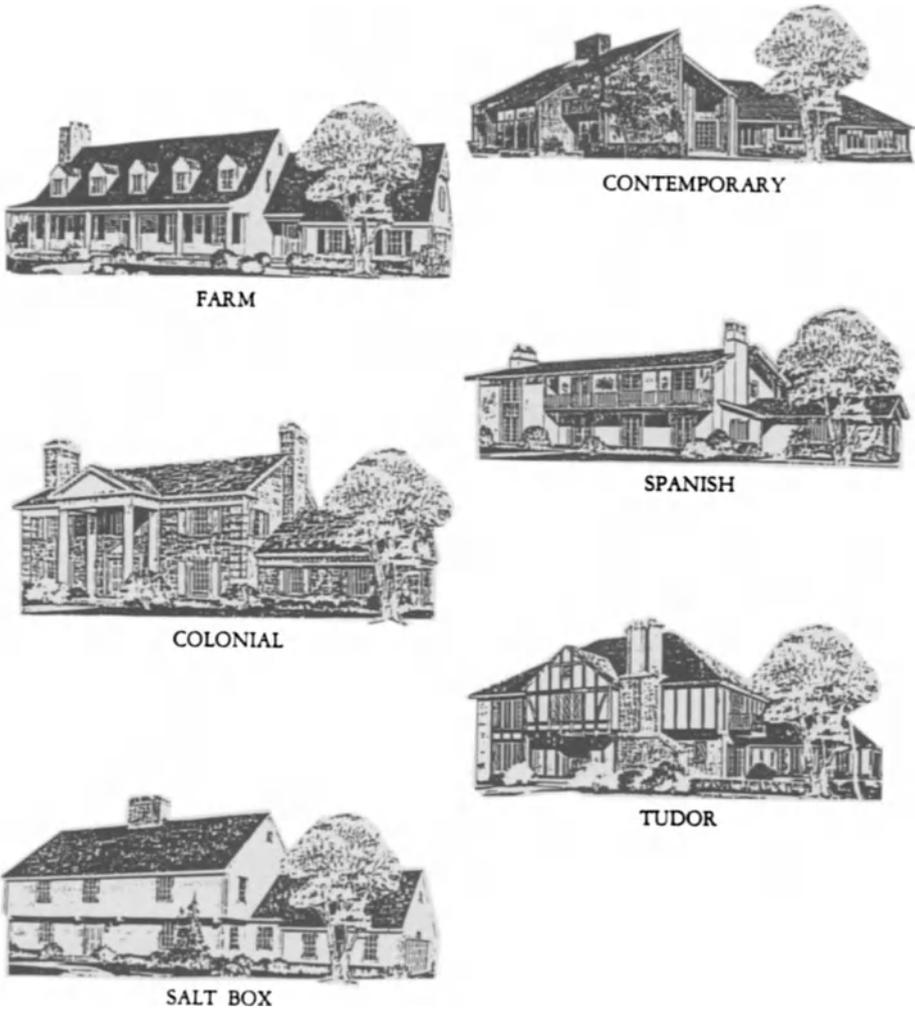


FIGURE 11. Farm, colonial, saltbox, contemporary, Mediterranean, and Tudor homes (from Nasar, 1989b). © Home Planners, Inc.

inferred from each style. For example, many respondents inferred that the colonial-style office housed a funeral home and that a plain glass style housed a research laboratory.

To understand the impacts of land use decisions on aesthetic quality, we will need more studies aimed at uncovering salient environmental content categories and associated preferences. The discussion here also suggests that the study of formal and symbolic aesthetics could benefit from research that

centers on particular building types as content categories rather than mixing building types in the stimuli.

In sum, with regard to stylistic meaning, the results do provide convincing evidence that people infer connotative meanings from stylistic content. However, the generality of the specific findings to other examples of the styles, other respondents, locations, times, environmental contexts, on-site experience, questions, and purchasing behavior remains to be seen. Now, consider predictions from schema theory about differences in preference within content categories.

SCHEMA DISCREPANCY

Knowledge structures for the built environment develop through an active process in which individuals select and organize from experience (Moore, 1989). Confronted with a new building instance, individuals test it against their knowledge structure for that category of building. When they find a discrepancy, they may expand their knowledge structure to include the instance, place the instance in a different category, or create a new category. Environmental categories are seen as prototypically organized: Within a category, instances vary in their typicality from better to worse examples of the category. Research has confirmed this prototypical organization. Judgments of a wide variety of buildings and natural scenes have each been found to vary in typicality in a way that seems related to experience (Purcell, 1984, 1986; Purcell & Nasar, 1992; Wilson & Canter, 1990).

Gaver and Mandler (1987) argue that high typicality (a fit to a knowledge structure) is associated with familiarity and a low level of preference and that as discrepancy increases, preference increases up to a point, after which it decreases. In seeming contradiction to this view, Whitfield (1983) found preferences for a more typical over a less typical style, but this may result from differences in content, high versus popular style, rather than differences in typicality within the contents. Studies looking at variations within content categories have found preference for moderate discrepancies from the best examples (Purcell, 1986; Purcell & Nasar, 1992). The differences between groups such as architects (with extensive exposure to atypical examples) and others can be explained as resulting from a shift in knowledge structure or from adaptation to (or predisposition to favor) atypicality. Preliminary findings support the second case. Although architects develop a more differentiated knowledge structure for buildings than do others (Wilson & Canter, 1990), their schema for a good example remains similar to that held by the public (Purcell & Nasar, 1992). Architects simply favor higher discrepancies from that shared knowledge structure (Purcell & Nasar, 1992).

Mandler (1984) sees the arousal of the mismatch as influencing affect. Although the research has found interest associated with increased discrepancies (Purcell, 1986; Purcell & Nasar, 1992), the connection to arousal has

not been adequately tested. Furthermore, for design application, the default values, or physical features and relationships underlying judgments of typicality, must be specified.

A schema discrepancy model agrees with aspects of the theories of Berlyne (1971) and the Kaplans (1989). As with Berlyne (1971), the schema discrepancy model views preference as associated with internal comparisons and moderate arousal. In fact, the use of prototypicality gives a clear measure of one collative variable—novelty. Rather than having respondents judge novelty without specifying the range of stimuli for comparisons, the schema discrepancy approach has them define the base (or prototypical values) through judgments of goodness-of-example (Purcell, 1984, 1986; Purcell & Nasar, 1992; Rosch & Mervis, 1975). The degree of mismatch represents a measure of novelty; and findings of preference for a moderate mismatch supports Berlyne's (1971) view that moderate novelty should be preferred. The schema discrepancy model also suggests a way to achieve the qualities of involvement and coherence, mentioned by the Kaplans (1989). By organizing experience, a good fit to a knowledge structure should be experienced as coherent. Without bringing in arousal, mismatches, through the promise of additional information through cognitive activity to classify them, should contribute to involvement. Too much discrepancy would sacrifice coherence for involvement. As a result, a moderate level of discrepancy should be preferred.

So far we have considered shared preferences for the form and content of building exteriors. Recall that the interactionist perspective also suggests differences between individuals, groups, and cultures. We have seen some evidence of differences with regard to designers and nondesigners. Now let us turn to some other aspects of individual and group differences.

INDIVIDUAL AND SOCIOCULTURAL DIFFERENCES

Characteristics of the individual, such as internal state, purpose, personality, and culture, may affect preferences. Consider an individual's internal state prior to rating a scene. Gifford (1980) found that individuals in a pleasant mood rated interiors as more pleasant than did others in a less pleasant mood. Adaptation level may also set a frame of reference influencing responses. For example, Sonnenfeld (1966) found environmental response to depend on the kind of places typically experienced by the respondent. Wohlwill and Kohn (1973) found migrants' views of their new community to vary in relation to the size of the community from which they had migrated (or adapted to). As predicted by an adaptation level theory, migrants from larger communities judged the new community as less noisy, polluted, lower in crime, and more safe than did residents. Migrants from smaller cities did the reverse. A laboratory study showed that responses to target scenes

had adaptation level effects in relation to anchor scenes chosen to induce one of several affective adaptations (cf. Russell & Snodgrass, 1989).

Cognitive set, an individual's plan for processing information, may also affect preference. Planning has been found to differentially influence affective appraisals of a room, executing a plan has been found to improve mood, and scene ratings have been found to vary in relation to the purpose of the rating or the respondent's plans (cf. Russell & Snodgrass, 1989). Leff, Gordon, and Ferguson (1974) reported a series of 11 experiments in which an induced cognitive set (for example, asking participants to figure out how they might make the scene more pleasant) affected evaluations of the scene.

Finally, consider personality. Personality theories vary from situational theories, emphasizing variation in behavior across situations, to trait theories, emphasizing stable characteristics of personality across situations (Carson, 1989). The literature supports an interactional perspective in which both predispositions and situations influence behavior (cf. Carson, 1989), and this suggests a need to consider possible effects of personality predispositions. Researchers have found attitudes, behavior, academic performance, and occupational choice linked to personality (Dingham, 1989; Lanyan, 1984; Myers & McCaulley, 1985). Personality may well affect environmental appraisals. Some preliminary evidence comes from Gifford's (1980) finding of differences in building evaluation related to responses on McKechnie's (1977) Environmental Response Inventory, but other personality dimensions warrant attention. In studies dating back to the 1940s, psychologists derived five salient dimensions of personality (cf. Dingham, 1989): extraversion, openness to experience, agreeableness, conscientiousness, and neuroticism. Called the "big five," these dimensions have been found robust and linked to behavior (Dingham, 1989). They also have precedence in young children's behavior. In Gardner's (1982) observations of young children performing a variety of tasks, he found recurrent patterns of behavior indicative of three of the big five personality dimensions. Reflecting extraversion, some children used copious language, while others did the tasks silently. Reflecting openness to experience, some children performed well on undefined tasks, while others displayed anxiety with these tasks, but performed better when given specific instructions to copy something. Reflecting agreeableness, some children were "person-centered" and others were "object-centered." For normal individuals (i.e., drop neuroticism), the remaining four of the big five also correlate with the dimensions of the widely used Myers-Briggs Type Indicator (MBTI) (McCrae & Costa, 1989): introversion-extraversion, sensing-intuition (or openness), thinking-feeling (or agreeableness), and judging-perceiving (conscientiousness). The MBTI has repeatedly been found as reliable, valid in predicting behavior, and correlated with other standard measures of its constructs (cf. Carlson, 1985; Myers & McCaulley, 1985).

How might the four dimensions affect environmental appraisals? Open-

ness (sensing–intuition) refers to the degree to which an individual favors solid facts of experience versus imagination. Open individuals might notice the whole and favor the novel, while less open individuals might notice details and favor the traditional. Agreeableness (thinking–feeling) refers to the degree to which individuals make decisions objectively versus seeking the solution agreeable to others. Thinkers might favor the abstract object elements, while feelers might favor what they feel would please others. Conscientiousness (judging–perceiving) refers to the degree to which individuals prefer planned versus spontaneous life. Environmental order may appeal more to judging types than to perceiving types. Finally, introversion–extraversion refers to the degree to which a person’s interest flow inside or out to other people. Introverts may respond more to abstract geometries than would extraverts. At a broader level, personality may account in part for architect/lay differences: The profession of architecture has a higher proportion of intuitives, introverts, and thinkers than is found among the public (Myers & McCaulley, 1985). In sum, various aspects of interior state may produce individual differences in aesthetic response, but this has not been adequately studied.

Group differences may arise from differences in shared learning and experience across cultures and subcultures. Following Lynes (1954), Gans (1974) argued that America has distinct taste cultures, each having different standards for aesthetics. He described five taste-culture groups, distinguished primarily by education and occupation: high, upper-middle, lower-middle, low, and quasi-folk. He argued that each read different magazines, watched different shows, and lived in different areas. Lynes (1954) saw the preferences as dynamic, with the high culture borrowing from the low (consider Disney’s use of “high” art designers, such as Graves) and the upper middle aspiring to the high. Members of the high culture group have graduate/professional degrees in design or the arts and have attended select private universities. As creators of art, Gans (1974) felt they would favor the most novel and new developments. Members of the upper-middle group also have graduate/professional degrees and professional or administrative jobs, but not in the arts. Gans (1974) saw them as liking high culture art that has become popularized. Rather than selecting works of the risky innovators, they would chose works of the innovators who have already proven themselves. Members of the lower-middle culture group may have some college, and they tend to be clerical, administrative support, or public school teachers. Their tastes should be less analytical and represent the “popular” taste common in society. They might favor the entertaining styles such as the artificial Main Street at Disney World. Members of the low culture group (less educated skilled or semiskilled laborers) and quasi-folk culture members (the least education, unemployed or working in an unskilled blue-collar job) simply do not care about taste. The model, then, suggests subcultural differences in preference stemming from difference in experience from edu-

cation and occupation. The groups exhibit clear differences in lifestyles and values (cf. Michelson, 1987). Nasar (1989b) found moderate differences in connotative meanings attributed to houses by individuals from different educational and occupational groups. For example, the desirability of a contemporary design increased with education level and occupational class. In an explicit test of the model, Kang (1990) sampled members of each taste group and found some differences between the groups in their ratings of ten house styles. The most pronounced and consistent difference, however, occurred between the high culture group (designers) and all of the others. Thus, the model may simplify to differences between the high culture group and the others.

NEW DIRECTIONS

This chapter has identified some broad patterns of preference associated with formal and symbolic variables and has highlighted some factors that may differentiate responses across individuals and groups. In general, further research is needed to identify the specific criteria needed by designers or for design review guidelines. In addition, because of individual, group, and content differences, any application of the findings should be treated as a test to be evaluated. Finally, present methods have not examined the critical issue of long-term variations in preference. Advances in theory and practice require new methodological approaches.

HISTORIOMETRIC METHODS OF INQUIRY

A complete theory of aesthetics should explain universal and longitudinal principles of preference. Efforts to deal with aesthetics have come from two directions: the scientific and the philosophical. Most research reviewed in this chapter takes the scientific (empirical) approach. The studies expose individuals to stimuli (buildings or simulations of buildings) and measure their response (verbal, physiological, or behavioral) to the stimuli. Legitimate questions have been raised about the degree to which the stimuli and responses reflect and thus generalize to people's daily experience with their surroundings (cf. Wohlwill, 1976). More importantly, because most of the studies have been cross-sectional, the results may only explain patterns of response at the particular period of time. Initial reactions to a building may change or reverse themselves over time. The typical cross-sectional study misses such longitudinal effects, and it cannot directly assess the process through which aesthetic values hold or vary over the generations. For application, such limitations are severe. If, as Lynes (1954) has argued, designers lead popular taste such that initial public scorn changes to praise, why bother following popular preferences? Anecdotal evidence for twentieth-

century architecture, however, suggests a strong and long-lasting distaste for high-style architecture.

This brings us to the second approach—philosophy of history, typical of what Lang (1987) refers to as speculative aesthetics and Groat and Després (1990) refer to as architectural theory. This approach looks at chronology and the long-term pattern of events. For buildings, this approach might focus on a select set of “masterpieces” and “master” designers in support of a normative statement for a particular aesthetic. By examining design holistically over time, the historical approach can deal with the longitudinal questions, but it, too, has shortcomings. Architectural masterpieces only occupy a minuscule part of the environment (Rapoport, 1990), expert evaluations may miss popular reactions, and the argument holds up less on objective criteria than on its subjective persuasiveness (Simonton, 1984).

Simonton (1984) has shown that the shortcomings of each approach can be reduced by merging them into an “historiometric inquiry.” This approach tests universal hypotheses about human behavior by applying quantitative analyses to historical data. For example, by examining performance records over time, Simonton (1984) identified composers and compositions that might objectively be called aesthetic masterpieces. They stood the test of time. By comparing the note structure of the most famous to the less famous products from the same time period and throughout history, he quantified attributes that made the masterpieces different from the others.

Unlike other historical endeavors that try to understand important events, people, or creations, historiometry, as a science, seeks the general laws across creators and creations. It may examine the particular, unique, or detailed information about the creator or creation, but it does so in a way that looks for a pattern. Historiometry follows the scientific method, defining and sampling “units of statistical analysis,” operationalizing “the crucial variables under investigation,” calculating “relationships among these variables,” and using “statistical analyses to tease out the most probable causal connections” (Simonton, 1984, p. 8).

Such a scientific study of history need not limit itself to the “masterpieces” or to Western culture (Rapoport, 1990). Historiometry could also consider popular reactions to vernacular designs of places and buildings across cultures. Consider the way this kind of inquiry might be applied to the study of building aesthetics. Historiometric methods could be used to (1) identify both critical and popular masterpieces, (2) analyze attributes that make for the masterpieces and account for changes over time, and (3) analyze characteristics of the creators and their times that make for the masterpieces.

Using fame as a measure of aesthetic value, one could assess the aesthetic value of designs and the work of designers by examining citations in encyclopedias, yearbooks, *Who's Who* books, and art and design texts over time. (As book revisions may only do minor cutting and adding, one might

only include revisions that had been significantly rewritten.) To get at popular preference a full range of popular media through periodical indices or travel guides might be considered. Because of the immensity of the full written record, representative sampling from the population of written materials might be used. Having developed a list of texts to consider, the researcher could select a sample of those texts at random. Having selected the media, one could assess the amount of graphic or text space devoted to buildings, places, or designers to measure the masterpieces. Or one could count the number of pages devoted to each instance from indices and, as a validity test, compare the rankings derived from an index to rankings derived from a more detailed inspection of a text. As with any measure, these archival measures have shortcomings. For example, a straightforward assessment of space devoted to each instance might have biases. The figures might need to be adjusted for the recency of the designer or design, the lifespan of the designer, and the number of creations. (Independent of the quality of the design or designer's work, a shorter citation may result from a short life or a small number of works.) A clear report of the approach and potential shortcomings can enable others to test and refine the methods. An additional check on validity might involve surveying living experts for their opinions of the derived masterpieces. One could argue that the further back in history the object or designer is, the more likely that present-day experts and historical texts would agree. Thus, present-day experts and texts might agree on the merits of the Parthenon but disagree on the merits of recent works such as Philip Johnson's AT&T Tower. The agreement of present-day experts with previous texts, of course, could be tested.

Some researchers have begun to apply scientific methods to historical data on design. Lawrence (1986) analyzed Swiss housing forms from 1860 to 1960 to infer cultural meanings in relation to the plans. Martindale (1990) examined novel content in gothic architecture to identify evolutionary trends. Rapoport (1990) sampled 192 streets from around the world and from the seventh millennium BCE through 1970 CE to identify precedence for design. He also reported studies from other fields, notably a paleosociological and landscape archaeological study that analyzed 20,000 structures in an ancient city to yield inferences about social life in the city. Other research has begun to touch the issue of aesthetics by empirically deriving lists of "great" architecture (see Table 1). Prak (1984) measured the amount of print devoted to architects in two dictionaries of architecture and *Who's Who* books from 1963, 1975, and 1977. Starbuck (undated) counted citations in fifty books about architecture from 1930 through 1945 and from 1945 through 1978 to identify the most-cited building and architects. Brooks (undated) examined citations in 108 history texts. A compilation of these sources produced the list, shown in the right column of Table 1, of the most frequently cited architects back through the fifteenth century. Although reliance on expert judgments of Western European and U.S. architecture (rather than popular

TABLE 1. Rankings of Fame of Architects or Buildings for Various Time Periods (Most Cited on the Top of the Table)

Prack (1984)	Starbuck (undated) (from 1930 to 1945)	Starbuck (undated) (from 1945 to 1978)	Nasar from Brooks (undated)
Le Corbusier	Lever House	Kaufman House	Johnson 1887–1965
Wright	ITT	Johnson Wax	Corbu 1887–1965
Gropius	Guggenheim	Philadelphia Savings	Mies 1886–1969
Mies	Lakeshore	Taliesin West	Gropius 1883–1969
Aalto	Seagrams	Rockefeller	Scott 1889–1960
Saarinen	GM	Lovell	Wright 1869–1955
Kahn	TWA	Daily News	Richardson 1838–1866
SOM	Johnson Tower	Millard House	Pugin 1812–1852
Rietveld	Richards Labs	Chicago Tribune	Jefferson 1743–1820
Utzon	Dulles Air	Lincoln Memorial	Adams 1728–1792
Rudolf			Wood Elder 1704–1751
			Vanbrush 1664–1726
			Hawksmoor 1661–1736
			Wren 1632–1723
			Jones 1573–1652
			Palladio 1508–1580
			Alberti 1404–1472
			Bramante 1444–1514

reactions to the full built environment around the world) represents an obvious limitation, the studies serve as examples of the way such inquiry might proceed—selection of texts, sampling of citations, and the derivation of most-cited works. When combined with other data and analyses, such lists can be used to derive principles and test theories or generate new theories.

For a particular historical period, one could consider the derived ranking of buildings. Using each building as the unit of analysis, features (such as complexity, typicality, verticality, and size) that may relate to aesthetic value could be measured. The features of the most famous works can be compared to the features of less famous works during the historical period. In relation to schema theory, one could derive the most typical building features at a time as well as the degree to which a building is discrepant from those features. Then, the degree to which fame relates to discrepancy from the typical could be tested. By expanding the analysis across historical periods, the features of the most famous works can be compared over time. Such analyses can point to the features that make for a masterpieces and to the process through which masterpieces have changed over time. Simonton's (1984) research on musical masterpieces shows the kinds of findings that might emerge. He found musical masterpieces to have either more or less

TABLE 2. Building Citations by Type and Location (from Wright, 1989)

Building type	Frequency	City location	Frequency
University/campuses	99	New York	61
Offices	94	Chicago	25
Museums/galleries	43	Los Angeles	14
Multiuse government	39	San Francisco	14
Research/technical	36	Boston	13
Religious	34	Cambridge	13
Concert hall/theater	29	Washington, DC	13
Recreation	24	Columbus, Indiana	7
Libraries	24		
Airports	15		
Other (aquarium, clubhouse, social service center, community center, courthouse, hospital), each	14		

complex note structures than works of their period, but the trend over time was toward increasing complexity.

One could also examine the kinds of buildings and locations that tend to be favored. Wright (1989) examined awards and mentions in architectural journals from the 1940s to the present to identify the 500 most-cited buildings. From these data, a list of the frequency with which various building types and locations were cited can be derived. As can be seen in Table 2, awards and mentions most frequently went to university buildings and office buildings and to buildings in New York City. Such data on location and building type may identify factors other than design quality that account for expert judgments of masterpieces. By examining the costs and predominance of various building types, research could also determine whether awards and citations have biases toward certain kinds and costs of buildings. For example, houses, which occupy the largest portion of the urban landscape but are seldom designed by architects (Gutman, 1983), are notably absent from the list in Table 2. The figures for location could be adjusted for city size and local economic conditions to identify the relevance of location to professional acclaim. Over time, the geography of "high" design could be tracked, and for any time period, research could determine whether professional acclaim is affected by centrality (i.e., are the most famous architects practicing in New York?).

In addition to examining historical trends, historiometric inquiry, used along with other methods, can provide a validity check. Where convergent findings emerge across different methods (each with their unique biases), it increases the likelihood that the findings are valid. Although some research in environmental aesthetics has used a multimethod approach (using inter-

views, observation of behavior, and physiological measures), the methods have been constrained to the present. Historiometry adds the time dimension.

AESTHETIC PROGRAMMING

Still, our present knowledge does not provide specific guidelines for urban design decisions relating to appearance. Faced with an aesthetic goal such as making a streetscape pleasing to passersby, planners can glean some general guidelines (such as increased coherence) from the research, but the research does not adequately indicate the specific actions needed to achieve the guideline. Furthermore, urban design decisions affect a variety of socio-cultural groups and environmental contexts, each with potentially unique requirements. Thus, for specific projects, an alternative approach would involve the applied study of visual qualities desired for the particular project, context, and populations: *aesthetic programming*. Such research may not solve the broader theoretical questions, but it can provide immediate answers to questions relating to the appearance of the project.

The term aesthetic programming reflects its connection to architectural programming. In architectural programming, one investigates, develops, gathers, and organizes information to produce design guidelines supportive of the goals for the facility and may evaluate the project after construction and occupancy (Sanoff, 1989). Architectural programming generates objective criteria for guiding and evaluating the design. Similarly, in aesthetic programming, the programmer investigates, develops, gathers, and organizes information to produce an aesthetic program or objective guidelines to achieve a desirable appearance. Aesthetic programming need not be limited to planning new facilities. One can also conduct evaluations and generate recommendation for aesthetics after construction and occupancy.

Architectural programming has typically tried to accommodate goals, activities, and their relationships in the program. Such an emphasis has assumed an artificial separation between function and appearance. More importantly, it has often left decisions on appearance to designer intuition. Yet, activities and appearance interact (such that appearance has important effects on function). Systematic guidelines for aesthetics should be part of a program. Some may bristle at the idea of such guidelines, but just as architectural programming does not predetermine one solution, aesthetic programming need not specify "the" solution. Rather, it sets guidelines within which the designer operates. For urban design, such a consumer-oriented approach has the additional benefits of involving people in decisions that affect them and providing politicians with save (popular) actions to take.

Aesthetic programming also has value for design competitions. Consider a study of a design competition for a building at the Ohio State University (Nasar & Kang, 1989a) in which a cross-section of the public ranked the five

sign configurations manipulated to represent three levels of complexity and coherence. They can be presented images that vary on stylistic variables of interest, as did Nasar (1989b) in studying connotative meanings associated with six styles of houses (shown in Figure 11, p. 170).

To develop an aesthetic program, several methodological choices must be made. The programmer must select respondents, environmental stimuli and measures of environmental features, and human response. Trade-offs may be necessary between practicality (time, resources, and convenience), external validity (the degree to which the results apply to the population, settings, and measures of interest), and internal validity (the degree to which rival hypotheses about causal relationships between variables can be eliminated). Space constraints do not allow a full treatment of these methodological issues. However, the following sections outline some of the methodological choices. As an applied endeavor, aesthetic programming should employ realistic and relevant stimuli and measures, while minimizing loss of control.

Selection of Respondents. The individuals likely to experience the design represent the population to whom the aesthetic program should apply. They might include all passersby, regular users of the facility, occasional visitors, and possibly funding agencies. The programmer must identify this user population. In situations such as new projects, where the actual passersby, users, or occasional visitors are not present, surrogates for them (i.e., similar groups) could be identified. For a relatively small population, the programmer could obtain responses from the full population. Otherwise, a sampling procedure—probability or nonprobability sampling—would be needed to select respondents from the population.

In a probability sample, one can estimate the probability that any individual or group of individuals has of getting into the sample. Probability samples include simple random samples, stratified samples, and cluster samples. To develop a simple random sample, you compile a list of persons in the population of interest and select names from the list at random. For a stratified random sample, you split the population into relatively homogeneous groups or strata (where responses across groups are expected to vary) and draw a random sample from each strata. You might stratify the sample into socioeconomic groups and sample at random from each group. Probability samples can have strong external validity because they allow for precise estimates for the population, but because of the need to compile the full population list, select names, and go to various places for participants, these procedures are time consuming, costly, and impractical. Cluster sampling can be more efficient, in that you select clusters on a locational basis. First sample at large levels, and then sample within them at smaller and smaller levels. For example, for a library, you could list states by size and select a probability sample of states. For each state, you could use a probability sample to select cities and, within each city, use a probability sample to select

libraries and then users of the libraries. With some loss in generality, this narrows the study to few sites.

Nonprobability sampling is most efficient, but it may not allow estimates of the degree to which the results apply to the population. You know neither whether each person has had a chance of being included nor the probability that each person has of being included. For example, in a nonprobability opportunity sample one simply selects respondents readily available. For the case of a new building, passersby near the site might be sampled. To reduce biases, systematic selection procedures could be used to decide which of the passersby to interview. To make comparisons across groups, the sampling plan could be altered to ensure that it captured adequate numbers of various groups. For population estimates, group scores could be weighted to reflect their actual proportions in the population. The external validity of nonprobability samples tends to be limited. For example, downtown streets might have fewer executives (with private cars and parking lots) than other workers, such that an opportunity sample on the street would underrepresent the executives. However, with a random selection procedure to select respondents for the opportunity sample, it may yield a sample representative of certain populations of interest. For example, an opportunity sample based on cluster sampling to select days of the year, times of day, and locations for interviews and a random number table at each site to select passersby could yield a sample representative of persons passing by the site. In this case, satisfactory efficiency and external validity may be achieved.

Scene Stimuli. The programmer also has to sample scenes for evaluation and choose the mode of presentation of those scenes. One approach to sampling scenes involves the systematic manipulation of scenes. As this allows the programmer to vary selected variables and control others, it can have strong internal validity. Unless the stimuli represent a realistic range of actual environments, however, the results may not generalize.

In a second approach, you could select real scenes that vary on the variable of interest. This could yield a more realistic sample, but this sample may lose internal validity, because other naturally occurring variables may covary in all of the scenes. Preselecting variables presents another problem. The variables may not be relevant to ordinary experience: A difference found between preselected conditions may not be one that people notice in their daily experience. To identify salient variables, a separate study might be conducted, or the programmer could use variables—such as complexity, coherence, openness, typicality, naturalness, and style—identified as salient by existing theory and research.

In a third approach, the programmer could sample a broad variety of scenes relevant to the kind of scene to be programmed, without attempting to select scenes for the presence of an environmental feature of interest.

Some controls may be needed to get comparable and typical views and to reduce bias from photographic quality and viewing angle. This approach could have strong external validity, but the presence of so many variables, some interrelated and some (such as traffic and upkeep) irrelevant to the design decision, makes it difficult to rule out rival hypotheses and tease out cause. Still, this kind of approach has been used to identify patterns of preference (Nasar, 1983).

The dilemma of the choice between internal and external validity can be alleviated through the use of an appropriate simulation. Of the various modes of simulation, on-site exposure, because it most closely reflects day-to-day experience in the environment, should have the best external validity, but internal validity may suffer because of the lack of control over extraneous variables (such as sound and sky conditions). The difficulties of taking respondents to a variety of sites also makes this approach impractical. (In one case the corporate billionaire Les Wexner built a full-scale exterior wall with the actual materials for a multimillion-dollar home to see what it would look like prior to initiating construction on the house.) More practical simulations include plans, elevations, perspective drawings, models, color slides or photos, and color film or video. Drawings can achieve high internal validity, because they allow one to manipulate variables of interest and control others, but responses to drawings may not best predict on-site experience. Most studies have shown that responses to color slides or photos accurately reflect on-site experience, and they do so more accurately than do responses to black-and-white photos or drawings (Hershberger & Cass, 1974; Kaplan & Kaplan, 1989; Oostendorp, 1978; Seaton & Collins, 1970; Shafer & Richards, 1974). The lack of movement and sound may represent a limitation (Wohlwill, 1976). For example, in programming the visual quality of a roadside environment, speed of travel might affect response such that responses at various travel speeds would be useful. Color photos and slides cannot be easily changed (unless one is skilled at airbrush or collage techniques) to simulate different conditions. Photos of models represent one way to overcome this problem, but model construction with adequate detail also takes much time and resources.

Computer imaging provides a practical alternative. Computer imaging allows one to digitize live images, manipulate them on the computer, merge them with other images, overlay other images, and output the result as realistic color photos or videotape. The products have been found to be indistinguishable from color slides and photos of real environments (Vining & Orland, 1989). Using this technology, a wide variety of real environments could be sampled, digitized, and altered to control extraneous variables. The resulting stimulus set would have the realism needed for external validity and the control needed for internal validity. This same technology could be used with a single scene (such as a facade to be renovated) to develop and test alternatives (varying features such as materials, fenestration, or colors).

Computer imaging can also be used to present images that users could manipulate.

Measurement Issues. The programmer needs measures of both scene attributes and human responses to the scenes. If the programmer manipulated or selected environments for variation on scene attributes, an independent measure may be needed to check the programmer's assumptions. Direct physical measures can be used for certain concrete features, such as height, depth, openness, symmetry, number of colors, or roof shape, and these measures can be combined to create measures of more abstract attributes. Often, however, judgmental methods may be needed for abstract attributes (such as complexity or coherence) of relevance to aesthetic response. Clearly defined and worded scales that refer to scene features rather than subjective experience would be needed. A set of observers would use the scales to rate the scenes. Scene order should be varied across observers to reduce order effects from the order of scenes. To reduce biasing effects of one scale on another, different observers should be assigned to each scale, or the order of the scales should be varied across the observers. Finally, to reduce bias in determining the relationship between the scene attributes and aesthetic experience, the assessments of these two kinds of variables should be obtained from different people.

As with the environmental variables, the measures of aesthetic preference should reflect relevant dimensions of evaluative and connotative responses. This might include assessments of pleasantness, arousal, excitement, calmness, status, and friendliness. Verbal measures, such as semantic differential scales, ranking methods, and checklists, can be administered to large numbers of people evaluating large numbers of scenes relatively quickly. Reliance on self-report measures alone may identify what Lazarus (1984) called "cold cognitions." The preferences may lack emotional involvement. Ideally, behavioral and physiological measures would be obtained as well. Behavioral measures might simply involve observing how long individuals look at a picture or which of two pictures they choose to look at. One could also observe spatial behavior (do people approach, avoid, speed up, slow down) in relation to an object. Physiological measures include measures of pulse, heart rate, graduated skin response (gsr), brain waves, or pupil dilation. Lacking behavioral and physiological measures, the verbal measures could be designed to tap behavior and physiological response indirectly. Questions might refer to feelings of arousal or ask about expected behavior in real situations. For example, Nasar (1987, 1989) had respondents imagine themselves winning a dream house lottery and then selecting the house they would want to win for free and had respondents indicate at which of nine commercial strips they would most likely shop.

In conclusion, with appropriate choices of respondents, scenes, and measures, aesthetic programming can answer immediate questions about

visual quality, and it can be used to create a database that may help answer broader questions. The product of the program can be evaluated to see how well it performed.

IMPLICATIONS FOR FUTURE THEORY, METHODS, RESEARCH, AND UTILIZATION

This chapter identified certain formal and symbolic attributes that contribute to aesthetic appraisals of building exteriors. Respondents generally prefer structuring variables (such as compatibility, use of the typical, use of styles that are perceived as fitting a purpose), familiar and historical elements, moderate complexity, moderate discrepancies from the prototypical, defined open space, deflected vistas, popular styles, and reductions in nuisances such as traffic, dilapidation, litter, billboards, poles and wires, and incompatible land uses. Symbolic (content) attributes, such as building style, may have dominant impacts on building meaning and preference. Figure 13 shows a scene having many of the desired features.

For application, research must better define the linkage between judged



FIGURE 13. Housing scene with some of the preferred features.

attributes and the actual physical features. To orchestrate the formal and symbolic attributes to achieve the planned affective appraisals, decision-makers will need more specific information about the relationship between physical attributes, meanings, and preferences. In addition, for various building types, research needs to identify the salient dimensions of meaning, the perceptually relevant styles, and their specific physical characteristics. It would also be of value to know at what age the meanings and preferences develop, their stability, and their variation through the life cycle and across various sociocultural groups.

This chapter also discussed the need for new approaches to address unresolved theoretical and practical issues and described two in some detail—historiometric inquiry and aesthetic programming. The first (through applying scientific methods to historical data) can enhance our understanding of longitudinal factors in aesthetics. The second can generate aesthetic criteria for specific projects and a database of such information.

Beyond that, more realistic methods should be considered. Most studies rely on verbal responses to some form of selected stimuli—a reactive and unrealistic set of conditions. To get a more accurate sense of human aesthetic experience with the kinds of places they regularly encounter, less artificial conditions should be employed. This might entail on-site experience with movement through the environment, representative sampling of buildings, direct physical measurement of building features or derivation of physical cues underlying psychological judgments, and representative samples of the population. In addition, the meaningful assessment of aesthetic response requires more than verbal report. Recall that an aesthetic response involves subjective report and behavior and physiological change (Lazarus, 1984). Some verbal measures may capture casual choices lacking in emotional intensity. Multiple measures tapping all three components are needed to accurately gauge aesthetic response. Some researchers have adopted a multiple-measure approach. For example, in two separate studies, Hartig et al. (1991) used two validated self-report instruments to measure emotional state and happiness, a proofreading task and physiological measures to assess affective restoration. Other studies have moved toward other realistic conditions. For example, rather than selecting or defining environments, Chenoweth and Gobster (1990) used a naturalistic approach, having respondents carry a diary and record aesthetic experiences (the nature, object, ecology, and value) soon after they occurred in their regular experience with their surroundings. Ulrich (1983) interviewed people about route choice in shopping trips and found that while they saw an expressway route as faster, 56% drove on the more scenic parkway. In another study, he considered the recovery rate of patients with a window view of deciduous trees as compared to those with a view of a brown brick wall. He found the tree view had faster postoperative recovery, fewer negative evaluations by nurses, and fewer doses of narcotic pain killers (cf. Ulrich, 1983).

Realistic conditions also entail connection to questions of public policy. By considering the range of policy decisions in which aesthetic issues come into to play, researchers may find interesting and relevant directions for applied study. Such a strategy may help overcome the prominent concern among environmental design researchers about the applicability gap, or how to get designers to use the research findings. By directing research to a public policy concern and applying the findings toward the development of urban design policy and controls (cf. Nasar, 1987), one sets the conditions that the design must satisfy.

In conclusion, despite some limitations, the research record indicates the presence of common preferences and processes underlying aesthetic response to the built environment. The evidence suggests some broad (and generally accepted) directions for design and a set of environmental and human characteristics worth further attention. For design application, more realistic research conditions are needed, and studies must also more directly grapple with pragmatic concerns such as specific stimulus conditions associated with preference or preferred constructs. Pursuit of applicability need not sacrifice theory. With carefully chosen research questions and methods, the findings can continue to advance theory, practice, and, ultimately, the quality of our built surroundings.

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Cultural Aspects of Workplace Organization and Space

CRAIG ZIMRING and DITA PEATROSS

The culture of white-collar work organizations has recently received considerable attention in the popular and scholarly press. On one hand, the increasing globalization of business makes understanding the role of *national culture* for workers and markets critically important. On the other, *organizational and corporate culture* has been extensively studied as a way of understanding the attitudes, views, and daily behaviors of a company or department that go beyond formal organizational structures or ideologies. As businesses attempt to reduce their formal bureaucracies and become more flexible, the ability to influence their own culture takes on special urgency (Kilmann, Saxton, & Serpa, 1985; Peters & Waterman, 1982).

In this chapter, we use a more general framework for “culture”—one that embraces both national and organizational culture—to develop a clearer understanding of the relationships of organizations to their physical settings. Culture, defined as identifiable patterns of design, organizational rules and structures, cognitive schemata, and behaviors, helps illuminate these relationships and serves as an integrating framework for theory, research, methods, and applied design and organizational development.

In the first section, we discuss the various meanings of organizational and national culture. We then consider symbolic identification and commu-

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nication. Finally, we describe these aspects in the context of a Japanese–American workplace. Although we develop a framework that can be applied to organizational culture more generally, we focus primarily on Japanese and U.S. workplaces and cultures because of the current interest in Japanese business practices and relatively large amount of available material. In addition, because of the claims by many management theorists that the culture of Japanese organizations is a direct consequence of national values of loyalty, group decision-making, and face-to-face contact, comparison of Japanese and American cultures allows us to examine more clearly the links between organizational and national cultures (Ruch, 1984).

WHAT IS “CULTURE”?

A CRITIQUE OF INSTITUTIONAL RATIONALITY OR MORE EFFECTIVE CONTROL?

The term “culture” provides a sort of disciplinary Rorschach test, a veritable psychological test of personal interpretation that reflects the user’s professional and theoretical orientation. Indeed, an early search of the anthropological literature uncovered at least 164 different definitions of the term (Kroeber & Kluckhohn, 1952; see also Lawrence’s discussion of definitions of culture in Chapter 2, this volume). The distortions resulting from the appropriation in management of this already ambiguous term have resulted in even less clarity.

Loosely speaking, organizational culture is a subset of general culture, or “the way we do things around here.” Organizational culture is the “glue that binds the organization together.” As a concept, organizational culture allows the consideration of a wide range of issues that have received less attention in traditional management studies, such as meanings, history, and physical artifacts. However, cultural approaches have been adopted for instrumental reasons as well. Much of the focus on organizational culture has come from two distinct but related concerns for organizational development: increasing the adaptability of business to changing external market conditions and developing less bureaucratic ways of coordinating and integrating internal activity. Conceptually, many definitions of culture focus on the cognitive schemata that people bring to the setting that influence these goals.

For instance, the most commonly cited definition of organizational culture clearly expresses these concerns (Schein, 1985):

[Organizational culture is the] pattern of basic assumptions that the group has invented, discovered, or developed in learning to cope with its problems of external adaptation or internal integration, and that worked well enough to be valid, and therefore to be taught to new members as the correct way to perceive, think and feel in relation to those problems. (p. 9)

While Schein's definition is intended to be descriptive rather than a tool for manipulation, it can be used for this as well. Rather than diffusing control, the making of culture can become a technology for extending central control to elements that have proven resilient to influence by classical management techniques (Peters, 1988). For instance, many consultants advocate the development of strong top-down ideologies aimed at controlling every aspect of a worker's life, such as values, beliefs, social relationships, and everyday behavior (Adams & Ingersoll, 1990; Peters, 1988). For many observers, this seems to be one of the most important lessons from Japanese management (Ouchi, 1981).

An important aspect of this latter view of culture is that it can be used to more effectively implement strategic decisions. The development of strategy is a different task than implementing it. Whereas *strategy* can be formulated by a few people as an analytic task, the *implementation* of strategy usually requires active involvement by a wider range of people and can be sabotaged by a hostile subculture. Hence, culture—individuals' and subgroups' schemata, organizational rules and structures, actual practices, and material *milieux*—can help or hinder organizational policy and functioning by influencing whether strategies are actually adopted in daily organizational functioning.

However, some researchers see a focus on culture as a critique of normative rationality rather than as this kind of extension of it (Adams & Ingersoll, 1990). For example, they argue that cultural approaches are an acknowledgment that it is impossible for managers to consciously take complete control of all aspects of organizations. Attempts at total control often have serious organizational and personal costs. Instead, cultures are generated by the values and backgrounds people bring to the setting and the interactions and rituals they have there. Many researchers thus see organizations themselves *as* cultures, as systems of knowledge or patterns of symbolic discourse. In this sense, organizations may be said to be social constructions with rules and symbol systems that can be analyzed and interpreted (Morgan, 1986).

CULTURE AS A VARIABLE

Smircich (1983) provided a useful typology of alternative concepts of organizational culture. She also argued that there are two basic cultural approaches that arise from different ideological positions. On the one hand are those who study culture as a *variable*, and on the other are those who take culture as a *central metaphor*. For example, comparing the values and practices of managers in different countries falls in the first category and is an active area of study (see for example, Adler, 1986; Glaser, 1971; Globokar, 1988; Hofstede, 1980, 1983, 1985). For these studies, culture is an independent variable, presumably brought to an organization by the managers'

membership in a national or ethnic group, such as being French or German. This type of belongingness results in a set of *cognitions* shared by constituents of that social unit (Cooke & Rousseau, 1988).

Such an approach has many attractions. It fits the implicit model brought to this work by many psychologically oriented researchers that behavior can be causally linked to preexisting cognitive structures and is presumably relatively easily measured through questionnaires or interviews. In addition, the role of national culture can be directly understood: Participants in work organizations behave in certain ways because they think like "Japanese" or "Americans."

By contrast, the culture-as-central-metaphor approach often sees organizations *as* cultures. Corporate cultures are often seen as resulting from some specified antecedent, such as the founder's initial ideologies or some contingencies in the market (Calori & Sarnin, 1991). These researchers attempt to discover the exterior conditions that produce specific cultures. In Chapter 2 in this volume, Lawrence calls this a *theory of culture* rather than culture as an *independent variable*.

Our own approach is a hybrid of these positions. Whereas we agree that there is a fundamental role for cognitive schemata in understanding organizations, relying solely on this aspect of culture makes it difficult to understand the role of space and physical structure for organizational cultures. Design not only responds to individual sense-making; it also reflects and generates broader organizational relationships and patterns of communication. It is particularly this problem of linking the individual and small group to the collective that is our focus in this chapter.

We do, however, see national culture as an independent variable that affects work life and influences the specific culture of an organization. For instance, Japanese and Americans bring different schemas, or cultural "mentalities," to a job that influence the cues they seek to understand status, the prediction of people with whom they expect to confer, and many other aspects of work life that are outside formal organizational rules and may not be explicitly obvious. At the same time, however, organizations are constantly socially renegotiated and reconstructed through daily interactions in the workplace and subjection to outside influences. There implies, then, a continual "flexing" of a net composed of cultural and structural elements, each with varying degree of influence. While offices are often designed to reflect one or more views of an appropriate social order, the office design in turn influences the rituals, communications, and perceptions of the people working in them.

We view workplace culture as an interrelated system of four elements that help clarify the relationship between work and physical setting: (1) *workplace design*, and particularly two aspects of design—elements that affect the probability of encounter and those that affect the distribution of symbolic aspects of design; (2) *organizational rules and structures*, and particularly rules governing how work is carried out in terms of the distribution of

power and of responsibility; (3) *individual and group schemas* about social relationships and work processes, which we presume result from both pre-existing ethnic characteristics and group interactions in a specific setting; and (4) behaviors such as *patterns of actual encounter* in the workplace and patterns of *meaningful communication*. These four elements are discussed in more detail later in the chapter. These elements reflect what Rapoport (1990) calls the ideational aspects of culture as well as its specific expression.

In the next two sections we examine the relationship of these four cultural elements to the development or maintenance of symbolic identification and to design for communication and innovation.

SYMBOLIC IDENTIFICATION IN THE WORKPLACE

Although the workplace design literature often stresses instrumental aspects of offices such as layout, office technology, and ergonomics (Harris, Engen, & Fitch, 1991), many design decisions are actually driven by systems of meaning. Duffy (1969, 1974), for example, found symbolic qualities, by which he meant expressions of relative status, to be "more critical than the operational [concerns]" in affecting the layout of offices (Duffy, 1974, p. 234). While his argument regarding criticality is debatable, it is a fact that status and other aspects of meaning are often overriding issues in office design (Gagliardi, 1990).

We extend the notion of symbolics to encompass not only *how* people are distinguished by value but *who* they identify with. In the next subsection, we suggest that distinctions in symbolic identification can be usefully extended to office design. We incorporate some concepts from anthropology that have not been dealt with before in terms of their implications for office design. We build on the idea of symbolic identification to propose that national value differences on the distribution of power and propensity for individualism or collectivism also have design implications, although power and collectivism have somewhat different physical correlates. The thrust of this section is that cultures can be analyzed in terms of their patterns of symbolic identification, as defined by schemas and organizational rules and structures, and that these patterns are useful tools in designing offices. Moreover, office design can be a useful tool in changing or mediating these characteristics.

DIAGNOSING ORGANIZATIONS: MECHANISTIC AND ORGANIC SOLIDARITY AND FRAMES AND ATTRIBUTES

Durkheim (1938) suggested that a major problem for industrial society was to create social solidarity in institutions and professions that were becoming increasingly differentiated and specialized. He proposed that effective, "organic" solidarity in a modern industrial society is based on interde-

pendence and an acceptance of differences, rather than on common ideology. For example, workers and managers may not share a belief system but still recognize the necessity of each other and coordinate their activities as a consequence. By contrast, he argued that in traditional societies, common views provided "mechanistic" solidarity.

This problem resonates in the contemporary office. While the professional and functional divisions in offices are increasingly specialized, business problems require cross-disciplinary collaboration. Major organizations ranging from IBM to GM to the World Bank are attempting to improve their internal coordination by shifting to a more organic system of problem-oriented groups rather than traditionally defined hierarchies and more mechanical, professional, or functional classifications. These changes are intended to integrate functions such as marketing, design, and strategic planning and to create flatter organizational "pyramids." For example, IBM recently eliminated several levels of middle management and moved major marketing decisions from headquarters to regional offices. In general, IBM is attempting to move from a "role-defined" system to one that responds more flexibly to changing business conditions.

Such changes represent a shift to a different cultural system with a different symbolic identification: Workers are asked to identify with a work group (such as "the Saturn project") more strongly than with a professional label ("engineer"). These two modes of symbolic identification—with a task-oriented grouping versus an abstract categorical label—are fundamentally cultural foci. In analyzing Japanese culture, for example, the anthropologist Nakane (1970) argues that symbolic identification can be considered as *frame-oriented* or *attribute-oriented*. She argues that Japanese culture is frame-oriented in that Japanese people tend to identify with a family or business grouping rather than with an abstract role or label such as "father" or "vice president." American culture, on the other hand, is more attribute- or role-oriented. Nakane suggests that historical antecedents have a lot to do with such identities. The Japanese frame orientation is related both to Japan's feudal history, which focused on family relationships, and to its post-World War II development, which turned kinship groupings into large corporate conglomerates.

One's symbolic affiliation has a strong impact on behavior. For instance, Nakane argues that within the family, a frame-oriented Japanese woman will take on different roles as circumstances demand because of her commitment to the unit, whereas an attribute-oriented Indian woman will be more bound by specific abstract roles with strict requirements, such as "daughter-in-law." In the office, a Japanese employee assumes many different roles over the course of a career, or even simultaneously, whereas U.S. professional workers tend to define themselves as "accountants" or "engineers," with quite specific rules of behavior and responsibility (Harris, 1983). For the organization, the frame/attribute distinction reflects the flexibility of job descriptions and the linear or nonlinear direction of career paths. Ouchi

(1981) and others found that Japanese companies, as well as some successful U.S. companies, have nonspecific career paths, slow promotion, and flexible job descriptions (Lifson, 1981; Lincoln, Olson, & Hanada, 1978; Ouchi, 1981; Rohlen, 1976).

It is interesting that a distinction similar to frame and attribute was made by Douglas (1982) in regard to primitive cultures. She described their symbol systems along dimensions of "grid" and "group," with grid referring to orientation toward more abstract, formal roles, whereas group reflects an orientation toward spatially identifiable tribes, families, or societies.

Although the analysis by Nakane suggests important ways of differentiating national cultures, these dimensions offer useful descriptors of organizational cultures as well. Frame versus attribute orientations characterize both the schema of individual workers and the organizational rules and structure, although the relationship between these is often complex. Schema might be regarded as the culturally ingrained predispositions that guide people in making decisions about whom to consult when encountering problems, what they consider appropriate work behavior, and how *they* define their job responsibilities. People with frame orientations might be said to focus on the needs of the organizations to which they belong, with roles that are locally defined and renegotiated depending on the specific culture of the organization. Attribute orientations are more abstract and are typically based on written rules or guidelines. Such an orientation is often inculcated through professional training and maintained through remote regulating bodies or professional organizations. Another way of situating this issue is to categorize it as local or global affiliation.

We suggest that frame and attribute orientations vary along a continuum and thus may be expressed differently at different levels within an organization. At IBM, for example, there is considerable identification with the corporation as a whole. Many workers intend to stay with IBM for life or for a long period, and almost all chairpersons have risen from within (Rodgers, 1969). However, despite IBM's recent attempt at cultural change, a successful manager may move rapidly through specific jobs, but remain primarily a "financial analyst" rather than a member of the "mainframe group" or "software division." This is reflected in office design. IBM's space standards dictate similar offices companywide that reflect an occupant's attributes, rather than leaving decisions to specific units, which might set more "frame"-oriented standards.

DESIGNING OFFICES FOR SOLIDARITY AND FOR FRAMES AND ATTRIBUTES

How does the frame/attribute distinction relate to design? Hillier and his colleagues have argued that frame and attribute orientations can be thought of as being *spatial* or *transpatial* (Hillier & Hanson, 1984). A frame orientation is more likely to be reflected in physically identifiable boundaries, to be spatial, whereas an attribute orientation is more likely to be

abstract or without an identifiable spatial locus. For example, IBM software producers are likely to be spatially grouped but are, at the same time, members of the American Software Association, which is not spatially focused. We suggest that an organization with a frame orientation is more likely to require frequent face-to-face contact for the constant negotiation of activities and behaviors, because there are fewer well-established, accepted rules of behavior. In more explicit terms, layouts that bring people into contact matter more for frame-oriented, spatial organizations.

The frame/attribute distinction is useful for organizational analysis prior to design and can inform ultimate design decisions. For instance, we recently participated in the planning of the new headquarters of a major multinational corporation. In their U.S. headquarters, they are organized in regional groups, such as "Africa" and "Asia," as well as in functional categories, such as "accounting." The regional groups were frame-oriented in that they were problem-focused; individuals adopted different tasks as needs required. Their recent move, however, to a new complex with large undivided floors and a combination of cellular and open workstations resulted in a loss of identity for the regional groups. No longer were there physical boundaries around groups and, with the open landscape, no common entries that provided symbolic "front doors" or opportunities for casual contact. Whereas typical architectural programming practice suggested that we focus on communication needs, our analysis in terms of symbolic orientation motivated us to question how we might use design to increase group identity. The more attribute-oriented functional departments such as accounting were less concerned about group identification, perhaps because identity was preestablished by a common professional background, as well as common tasks and procedures.

We are suggesting that symbolic identification of this nature is an important aspect of the schema of an organization's members, as well as of organizational rules and description. Office design in part, therefore, provides a symbolic function over and above the disbursement of status symbols. The visual and physical accessibility of managers can help cement group allegiances. In addition, identifiable boundaries and opportunities for face-to-face contact reinforce this kind of symbolic identification.

DIAGNOSING ORGANIZATIONS: COLLECTIVISM/INDIVIDUALISM AND POWER DISTANCE

Closely related to the frame/attribute distinction, and perhaps constituted within it, are culturally inculcated value differences regarding the appropriate distribution of power and the suitable degree of individualism or collectivism. In our studies of Japanese-American workplaces, a favorite aphorism has repeatedly surfaced: "the nail that sticks up gets beaten down." The pressures for conformity in a Japanese company are quite differ-

ent from the high rewards for individual achievement in many U.S. companies. In Japan, it is often embarrassing, even painful, to be seen as promoting the individual rather than the group. At the same time, however, strategic decisions are made by top executives. Indeed, two additional dimensions along which cultures in general may differ is their vertical differentiation—the extent to which power “pyramids” in a hierarchical fashion—and their horizontal differentiation, the extent to which responsibility rests with individuals or is broadly invested in groups. These dimensions have been termed “power distance” and “individualism/collectivism” (Hofstede, 1980, 1983, 1985).

In a large international survey of work-related values that polled 116,000 IBM employees at all levels in 50 countries, Hofstede (1980, 1983, 1985) found that, *on average*, these two dimensions were key discriminators of national cultures. (Although Hofstede’s work has generally been supported by other studies, it reflects the values of people in a single corporation and rests on a questionnaire administered only in English, raising some questions about potential cultural bias [R. Broadwater, personal communication].)

Hofstede found regional clusters of countries with common characteristics. For example, the Scandinavian countries tended to have small power distance and high individualism; in other words, power was distributed rather than concentrated, but individualism was highly valued. Developing countries such as Indonesia, Ecuador, and Guatemala had large power distance (power in the hands of a few) and low individualism. France, Spain, and Italy had large power distance and high individualism. Japan was moderately high in power distance and very low in individualism; the United States was somewhat lower, although still moderate, in power distance and the highest on individualism in the sample of 50 countries.

We tentatively suggest that these tendencies are implicit within the frame/attribute distinction made earlier. To the extent that appropriate responsibility for taking action is broadly distributed, collectivism is high. If responsibility is vested in specific individuals for specific tasks, individualism is high. We suggest that frame-oriented cultures, with a spatial locus, may more easily maintain an emphasis on collectivism. Individualism does not necessarily need a spatial focus to thrive; a transpatial attachment to others would suffice. Individuals with clearly defined roles and the ability to act independently can connect with others through abstract rules, written material, and other media that do not necessarily require spatial contact. Direct spatial contact helps coordinate action, especially if action is not defined by explicit rules and if other aspects of the culture allow for meaningful communication.

By contrast, the dimension of *distribution of power*, high or low, concentrated or distributed, is perhaps more loosely related to frame and attribute orientation. As we have mentioned, Hofstede (1983) found that both frame-

oriented Americans and attribute-oriented Japanese tended to concentrate power at the top levels of an organization. Still, the more distributed power is, the more dependent it may be on local contacts, negotiations, and coordination in order to sustain it.

The differences between individualism/collectivism and ideal power distance are important in understanding the relationship between office design and culture. Collectivism and broad distribution of power are not synonymous, regardless of the connection to frame orientation suggested here. In fact, they were negatively correlated in Hofstede's studies. This seems to fit, however, with the common experience in many organizations that while broad "input" to decisions may be solicited or negotiated, decision-making is actually centralized. In Japan, for instance, middle managers use the process called *ringi* to develop proposals. Every middle manager must comment on the proposal, but decisions are ultimately made by a select group of upper managers, which, however, maintains close symbolic contacts with those below (Harris, 1983).

DESIGNING OFFICES FOR COLLECTIVISM/INDIVIDUALISM AND POWER DISTANCE

Although only a small number of studies empirically document national differences in office design, many cultural observers have noted significant national variations. For instance, although American offices vary greatly, on average they appear to be more physically subdivided than Japanese offices in the same industry type. As mentioned earlier, at Mitsubishi's Japanese headquarters, even the chairman of the board sits at an open desk on a large open office floor (Yoshino & Lifson, 1986). Other researchers have noted that shared offices are more common in Italy than in the United States (Scuri, 1990) and that German offices have even more differentiation than their U.S. counterparts (Ettinger-Brickman, Jockusch, & Kleinefenn, 1986). The empirical evidence for these comparisons is meager, however. A thorough international survey of office designs would be very helpful in understanding cultural impacts on workplace design.

Some of these national differences can be understood by links between design and the distribution of responsibility and authority. Broadly distributed responsibility—collectivism—appears to be related to layouts that bring people into physical contact through visibility or interaction resulting from daily use of the facility, as in the offices of the frame-oriented Japanese. Presumably this is because these layouts allow opportunities for casual interaction. More concentrated responsibility, such as in U.S. or Italian offices, seems to be related to more segregated layouts. Integration of people physically would be unnecessary if responsibility was vested in only a few. As mentioned earlier, *the distribution of responsibility* seems to be expressed *spatially*, with broad division of responsibility being necessarily tied to greater spatial integration.

However, defining "integration" in offices is an important theoretical and technical task. In developing *space syntax* theory, Hillier and Hanson (1984) have argued that the layout of buildings both reflects and influences relationships between categories of people in a setting. In particular, layouts can be defined in terms of their topological characteristics, such as the relative depth of specific spaces from the outside or some other key point, their relative accessibility from all other spaces, and whether passage through them controls access to other spaces.

Space syntax is attractive because of the relative theoretical sophistication it brings to the problem, its technical clarity—well-established empirical methods have been developed—and the growing body of empirical research extending it. *Integration*, a statistic that reflects the accessibility of a space to all other spaces in the system, has proven to be a good predictor of where people will be found in cities and buildings. In particular, more integrated spaces are more likely to have the presence of "people walking" (Hillier, Grajewski, & Peponis, 1987; Peponis, 1985).

Thus, *global integration*—accessibility to the entire system—is conducive to the generation of casual contacts with people away from one's immediate workstation and appears to be related to the opportunity to establish greater overall coordination. By contrast, *local integration* through visual access may be more related to the immediate processes of supervision and comparison with others because it offers a more focused arena for visual, auditory, and physical accessibility. Local integration may, however, work to the detriment of an organization-wide frame orientation. How local versus global integration relates to the distribution of responsibility is another important question that is yet to be resolved.

The distribution of *power*—vertical differentiation—focuses on elements that convey meanings such as *symbols* and *spatial layout*. In the United States, power is often reflected in the quality of office furnishings or the relative expense of an executive's company car. For instance, in his study of a large insurance company, Mazumdar (1988) found that employees judged other employees' status by very subtle signs such as the type of desk or number of bookcases provided.

While these materializations of power are perhaps the more obvious status indicators, location within the overall spatial configuration also powerfully expresses distinction and differentiation (also noted by Mazumdar, 1988). In both Japan and the United States, of course, layout plays a strong symbolic role. In Japan, however, status is represented through physical position on an open floor, with all managers at the head of identical work tables and subordinates arrayed before them in order of decreasing seniority (Yoshino & Lifson, 1986). In Atlanta, the new Landmark Center office building has been specifically designed to provide eight, rather than four, high-status corner offices on each floor. In the United States, with power distance equal to Japan's (both high), but with a much higher value put on individualism, physical separation from the more instrumental workings of the organi-

zation *and* distinguished furnishings denotes status. For example, the chief executive officer of Coca Cola is located on the top floor of the world headquarters building and has a grand piano in the foyer of his office.

Relative location within a layout may serve a symbolic function by signifying the role of the individual vis-à-vis the group, but it also serves to reinforce collectivism or individuality through the mechanics of everyday tasks, by creating visual and auditory conditions. Visual and auditory accessibility can both symbolize and reinforce "groupness." In a more open setting, models of appropriate behavior and roles can be more implicitly advertised.

SUMMARY: A FRAMEWORK FOR UNDERSTANDING THE ROLE OF DESIGN FOR SYMBOLIC IDENTIFICATION

Orientations that groups have toward frame or attribute and their values regarding the distribution of power and responsibility have important design implications. Frame orientations call for designs that both create and maintain internal solidarity through at least two means: increased face-to-face contact and creating boundaries and differences from other groups. Attribute-oriented cultures are less dependent on design to maintain solidarity because they depend on more formal rules. Spatial integration is important for systems that emphasize collective responsibility, whereas individually focused systems allow separation. Finally, systems with high power differentials focus on the expression of symbols, rather than on the more integrating aspects of space.

Prior to design, an organization and the individuals within it can be diagnosed in terms of their relative position in regard to frame/attribute orientation, individual/collective disposition, and high/low power distance. While these are presently rather broad and simplistic categorizations, they offer signposts for exploring these issues in systematic ways. Knowing the national culture of individual workers and managers suggests specific strategic issues to probe during programming. Design solutions that incorporate their symbolic identification can then be proposed, and fits between individual and group schemas, organizational structure, and layouts can be negotiated.

We have found that identifying *spatial and symbolic misfits* can be an important role for consultants. For example, it may be significant for an organization attempting to create a frame-based culture to understand that a highly segregated layout may sabotage this goal.

A framework for considering the relationship between design, power distance, and individualism is illustrated in Figure 1. As we have suggested, however, power distance is principally expressed symbolically, whereas individuality/collectivism is principally expressed spatially. Both organizational and national cultures differ on these dimensions.

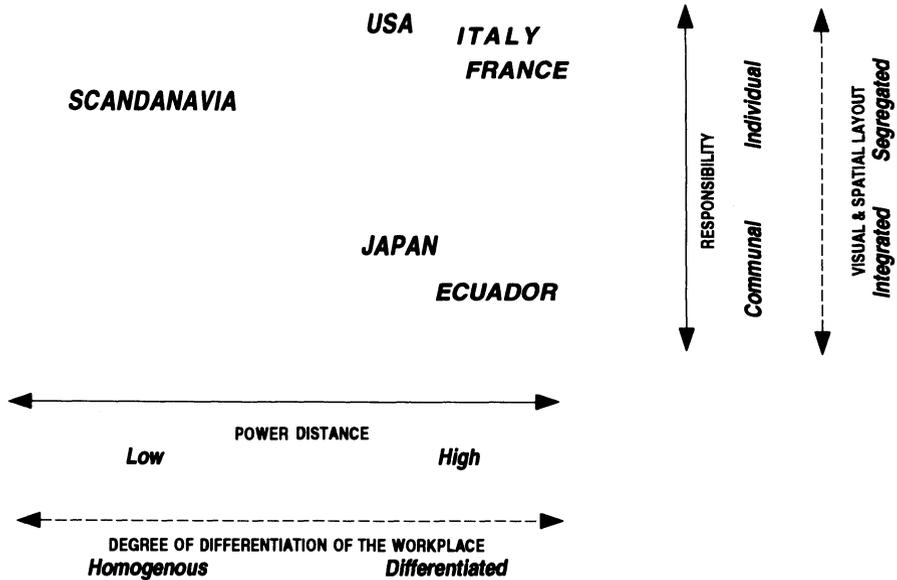


FIGURE 1. Hofstede's dimensions of power distance and individualism can have distinct spatial implications and may apply to organizational as well as national culture. Power distance is related to workplace differentiation, whereas individualism is related to segregation of spatial layout.

CULTURAL ISSUES IN COMMUNICATION IN THE WORKPLACE

The symbolic identification of individuals or groups might be regarded as culturally inherent predispositions for the more instrumental workings of organizations. In other words, symbolic identification provides the preparatory groundwork for the nitty-gritty of daily work life. It portends, in some ways, the general patterns of communication, control, and decision-making that will operate in the actual workplace. A cultural perspective helps clarify these relationships in at least two ways: (1) different general cultural patterns of communication can be identified, and (2) different impacts of a given physical arrangement on different cultures can be described.

DIRECTION AND STRUCTURE OF COMMUNICATION

Different national and organizational cultures emphasize diverse directions and patterns of communication. Different frame / attribute orientations also affect the patterns that will prevail. To some extent, management theorists have defined organizational types *in terms of* communications patterns. Additionally, some patterns appear to predict companies' success in certain business conditions. For example, in a classic study that launched the now-

dominant school of organizational studies called "contingency theory," Lawrence and Lorsch (1967) found that successful firms in rapidly changing industries, such as electronics, intentionally developed more "organic" management organizations. These contained many ad hoc structures such as task forces and task teams that seek help from a wide range of people at different levels, both inside and outside the core group. Firms in dynamic industries were most likely to also be internally differentiated. For example, companies in rapidly changing industries might have flexible and organic research and development departments but highly structured and controlled mechanistic accounting departments. Firms in more predictable industries, such as paper, developed highly structured "mechanistic" organizations where jobs were broken down into routine tasks and communication followed strict hierarchical spans of control. Most communication was vertical, flowing from supervisor to subordinate.

While several studies have shown that successful companies, regardless of nationality, respond similarly to the contingencies of market conditions, Japanese firms, as a whole, appear to be more "organic" than most U.S. firms, with open job descriptions, flexible lines of communication, and a practice of broad internal consultation before action (Ouchi, 1981; Pascale, 1978; Pascale & Athos, 1981; Ruch, 1984; Yoshino & Lifson, 1986). This has been regarded by some as the source of their seeming success under varying business conditions. It appears, then, that both the direction and structure of communication can be described in cultural terms.

MODES OF COMMUNICATION

Cultures may also vary in the mode of communication that individuals and organizations favor. For instance, Hall (1976) argues that the Japanese are a high-context, information-based society relying on preprogrammed information in the receiver and in the setting, rather than in the transmitted message. A low context society, like the United States, relies more on the message itself for information than on the receiver or setting, and hence could more effectively rely on written communication (and, presumably, electronic mail).

In a detailed study of Japanese trading companies, Yoshino and Lifson (1986) found similar high context patterns of communication. They noted that the long period of Japanese isolation from the outside world resulted in a language that was highly idiosyncratic. The Japanese share so many endogamous characteristics, uncontaminated by outside influences, that nuances suffice for language. Nonverbal cues, such as facial expression and body language, become as important as words and, indeed, often take their place. This implies a reliance on face-to-face communications and the ability to visually "read" other people, a reliance that often handicaps the Japanese in distal communications with outsiders (Nakane, 1970). Wallin (1976) notes

that the Confucian concepts of correctness and subtle cues that dictate appropriate interpersonal relations in the East are often misinterpreted outside that specific milieu.

Studies of cultural differences in actual communication behavior have provided equivocal results. Pascale (1978; Pascale & Athos, 1981), for example, studied 261 operating units of American and Japanese companies in both Japan and the United States. He asked managers to report on their decision-making style, such as the involvement of workers in end decisions, and developed innovative measures for gauging reliance on written communication by measuring the thickness of managers' correspondence files. He found few cultural differences, although Japanese managers relied more on face-to-face contact than did Americans, who depended more heavily on the written word. In light of these mixed findings, more definitive cross-national studies of preferred communication modes would be very helpful in advancing office design and research.

Ekuan (1982) is one of the few researchers who has attempted to link national communication modes to workplace design. In a questionnaire study, he explored attitudes toward functional versus aesthetic qualities, preferences for private versus group offices, face-to-face versus spatial distance, and the integration of work and home life. Polling 532 Japanese and 103 U.S. office workers, he found that the Japanese, in comparison to the Americans, were more interested in cleanliness than in quality of decor, were not as bothered by noise, were more participatory in meetings, and were more focused on human relationships than on "work process" as influences on work effectiveness. His research implies that attitudinal factors toward modes of communication have physical implications.

A WORKING MODEL OF CULTURE AND COMMUNICATION

To briefly summarize, the assumption that underlies much office planning—that encounter leads to communication—is oversimplified. The research literature fails to support this relationship and fails to account for cultural variations and the symbolic identification of individuals and groups. Rather, a somewhat different view is needed of the role of design in incorporating cultural multiplicity in the workplace.

We have argued that organizational and national cultures can be distinguished in terms of their pattern of communication and in their means of control. We have also noted that cultures can also be characterized in terms of (1) underlying organizational rules and structures about the nature of tasks; (2) the schemas of management, workers, and designers about the appropriate nature of work; (3) physical setting; and (4) behaviors such as encounter and communication.

Implicitly acknowledged in this model are the cultural variations in symbolic identification. For example, individuals may see their role as work-

ing independently or as seeking broad communal participation. If they seek input, they will attempt to create encounters of some kind: written, electronic, auditory, or face-to-face. Similarly, organizational rules may dictate or preclude such encounters, no matter how individuals may view their jobs, although such discrepancies can create conflict.

In addition, schemas and organizational rules and structures will affect the predominant direction of communication (vertical versus horizontal); mode of communication (written communication, informal face-to-face encounters, formal meetings); group sizes involved with decision-making (individual, pairs, larger groups); the nature of people involved with decision-making (collective versus individual); and the mode of supervision and control exercised (direct, indirect).

The prospect of cultural difference raises many interesting, and as yet unresolved, questions. Can stable cultural patterns be discerned in the use of different kinds of accessibility—visual, auditory, and physical? How do these change when culture changes, or can they be used to change culture?

AN EXAMPLE OF CULTURAL DIFFERENCES IN A WORKPLACE

Few studies have addressed how societal culture and corporate culture may be integrated or related to the design of the workplace or how design may be used to mediate cultural differences. The studies we have reviewed do, however, suggest that cultures can be defined and studied in terms of types of rules and structures, symbolic identification elements, schemas, and kinds of physical settings. These issues become clearer if we describe a small study we completed recently.

The application of our framework to a U.S. regional office of a *shoga shosha*, a Japanese trading company, reveals several of the principles described in this chapter. We were curious whether the frame-oriented Japanese would have different kinds of workspaces than attribute-oriented Americans and wanted to look at the impact of organizational rules and structure, layout, and schema on encounter and communication. We were also interested in whether the high power distance/high communality Japanese would focus on spatial strategies of symbolic identification in ways different from the high power distance/high individuality Americans. Also, we hypothesized that the space under study, which was largely designed by the Japanese managing director, would reflect Japanese organizational rules and structures, with visual and auditory access providing opportunities for control and coordination for the presumably frame-based organization.

Finally, we were interested in the spatial dynamics of *cultural integration*. Since most studies exploring national culture in work settings have compared single culture settings, we were curious how multicultural relationships would be played out in workplace design.

METHODS AND RESEARCH DESIGN

Data about schemas, organizational rules and structures, and behavior were collected through on-site visits and observations, supplemented by interviews, behavior mapping, and a questionnaire. The questionnaire and tracking maps were analyzed for an overall view of communication type and pattern; the behavior maps were analyzed for frequency of behaviors and were correlated with the syntactic integration of the space. We made isovist studies of the plan from various points to assess the relative degrees of visual exposure and accessibility operating in the physical environment. ("Isovists" are the 360-degree views people have from given points to a setting; Benedikt, 1979.)

Office layout was analyzed using "space syntax" techniques (Hillier & Hanson, 1984), although the complete results are not reported here. As noted earlier, space syntax theory suggests that the subdivision and accessibility (integration) of space contributes to the differentiation and control of communication between social groups and generates the probability of social encounters.

FINDINGS

Organizational Rules and Structure. The corporation studied is a wholly owned subsidiary of one of the largest of Japan's *soga shosha*, dealing in commodities such as food and steel. This particular office was selected partly because it is a mini-branch that has been considered one of the most successful at developing new business and human resources. The subsidiary is committed to an American market base and acknowledges the uneasy alliance that exists between Japanese top management and American personnel.

Of the 22 persons employed, the general manager (GM) and two of the line managers are rotational Japanese, spending several years in the United States. The remainder are U.S. managers and support staff. Departments are grouped by commodity. All occupy an L-shaped open area with 42-inch-high panels throughout, except for 54-inch-high panels lining the corridors and 60-inch-high glazed partitions around the senior American managers' workstations. In true frame-oriented Japanese fashion, there are no job descriptions and duties are loosely defined: Any person, regardless of rank, may be called upon to service a client or take a phone call. While the GM makes final decisions (high power distance) in concert with his superiors in Japan, he professes a belief in consensual decisions. Little emphasis is seemingly placed on rank, with everyone, except the GM, being addressed by first name.

Design and Layout. Syntactic analysis of the layout reveals that the GM's office as well as the area directly outside it are among the most integrated

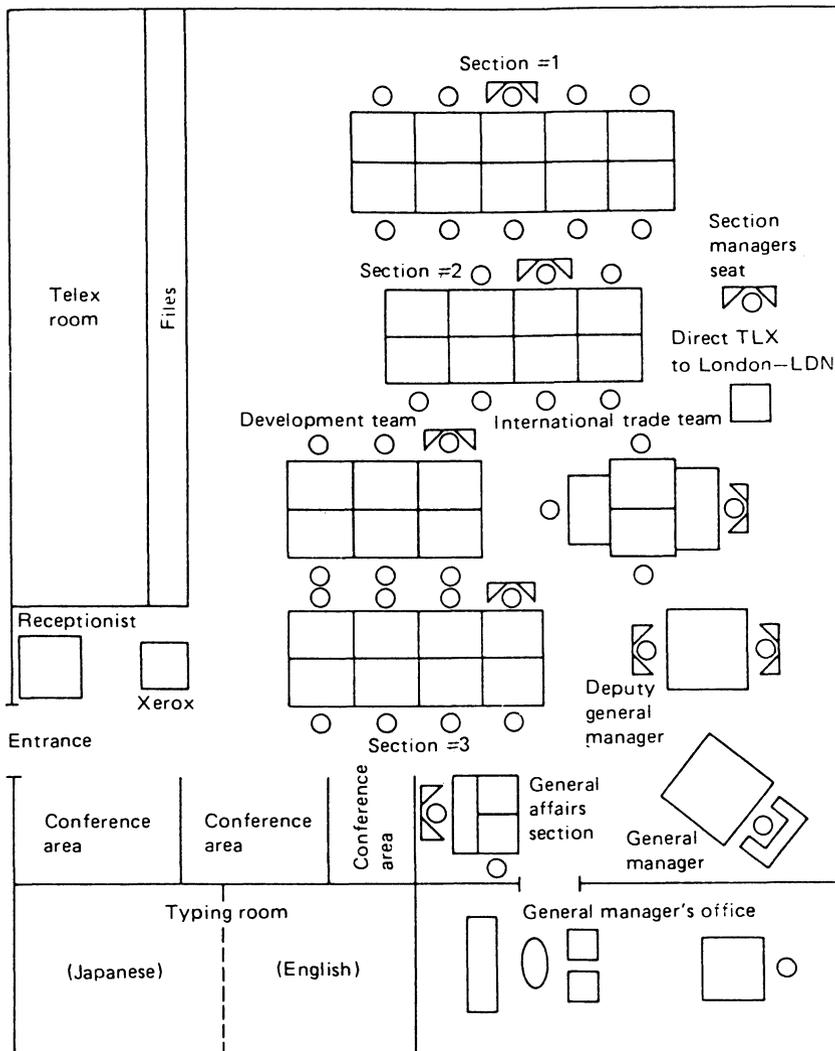


FIGURE 2. The layout of the U.S. regional office of the Japanese trading company strongly resembled a traditional Japanese *bu*.

spaces. This pattern, and indeed the floor plan itself, are remarkably similar to that of a typical *bu*, or department, in Japan (see Figures 2 and 3). The GM's office in both is among the most integrated spaces. Integration values of the spaces occupied by managers and workers in the American plan suggest that the Japanese GM and assistant general managers (AGMs) are located in more integrated space than is typical in most American firms,



FIGURE 3. The GM could usually survey the workgroup office from his glass-walled office; most of the other workstations were designed using 42-inch partitions, even for most of the high-level workers.

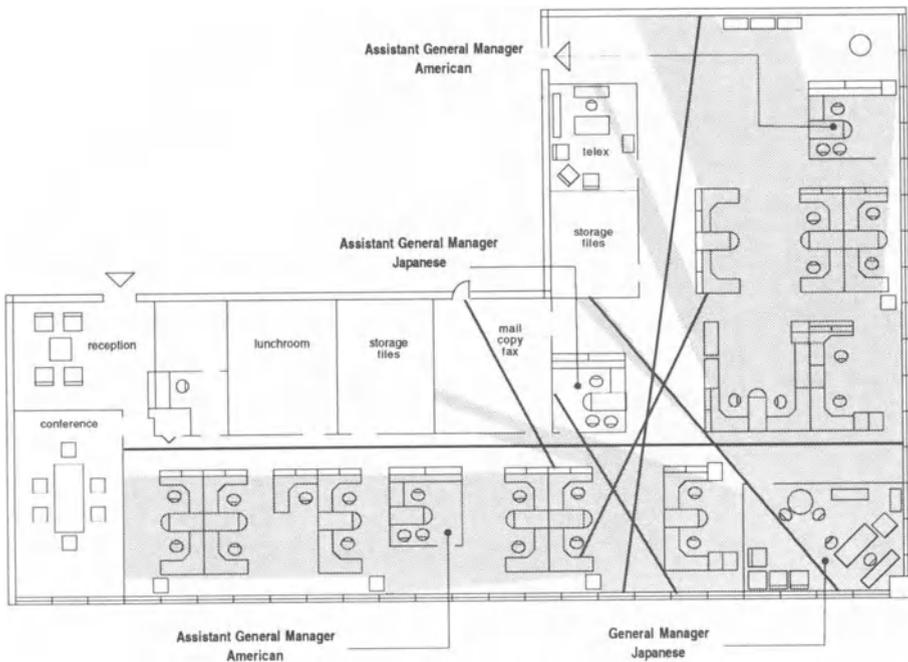


FIGURE 4. The Japanese GM could see almost the entire office from his glass-walled office (as shown by the shaded area reflecting the isovist from his desk). The most integrated area, indicated by the dark lines (the 10% integration core), included his office as well. This area is where people are most likely to be found. By contrast, the American AGMs were in the most segregated location.

where persons at this level would be more likely to occupy more segregated space.

Isovisits are what people can see from a given vantage point, such as the GM's desk. Analysis of several isovists from key points suggested that visual accessibility by supervisors may control or regulate social interactions in this space. The isovists also underscored the relative equality of all workers in terms of visibility. This is illustrated in Figure 4. The GM's glass-enclosed office in the crux of the "L" gave him visual access to both arms of the plan while at the same time visually exposing him to all employees. This visual equality, comparable to that in a Japanese *bu*, had at least one consequence that was observed: the GM kept "In," "Out," "Mail," and "Urgent" boxes on his desk. The office "norm," set overtly by the GM, was that business is immediately attended to. The GM's response was seen and matched by all and thereby implicitly set collective office policy.

All hierarchical levels were equally visually accessible because of the low 42-inch panels, although the 60-inch smoked glass panels of the (American) AGMs controlled this somewhat better. The knowledge of others and

the attendant loss of privacy thus worked both up and down the hierarchical ladder.

Encounter. An analysis of movement trackings reflected the pattern of activity that we would expect in a frame-based and communally oriented culture. The trackings indicated that the GM is interrupted on an average of four times every half hour, and sometimes more, by people at all levels in the organization. Every employee, regardless of rank, had physical access to him at any time. Indeed, the accessibility of the GM was also affirmed by questionnaire responses, which indicated that the GM is the person most interacted with each day.

The trackings also indicated the relative use of peripheral office spaces such as the lounge and copy room by workers. The Japanese visit with one another for long periods at one of their workstations and always went out for a long lunch. The American line and staff workers made far more use of the lounge and copy room for quick chats with one another and for the recognized breaks of the day.

Status and Symbolic Identification. The symbolic image cues of the furnishings themselves and their arrangement signified an office clearly set up for the transaction of business activity, where efficiency and access to information are primary concerns. The spatial configuration was actually a tribute to the powers of negotiation between the Japanese GM and the senior American AGM with whom he coordinated the interior space planning. It managed, however, to very nicely incorporate the different cultural needs. While the GM wanted a completely open office, as in a Japanese *bu*, the AGM wanted enclosed offices for all line managers. A compromise was finally reached: The AGMs, because of their long tenure with the firm, were given symbolic semienclosed cubicles with higher smoked glass partitions, but all other workstations were open. The GM also "allowed" the higher partitions along the circulation zones to give a modicum of privacy from passersby. He placed himself in a glass walled office in the crux of the "L," which gave him the visual access and exposure he needed.

As noted, for the Japanese status appeared to be associated with integrated rather than segregated space, a reversal of the generic American pattern. However, the American AGMs tended to locate themselves in more segregated spaces but still within their commodity grouping. The Japanese line managers, along with the Japanese-American female staff, occupied the "heart" of the office near the integrated core, while the American line managers occupied more segregated spaces. Other symbolic status distinctions were evident through the quality and quantity of the furnishings, with the GM having the most distinction and the AGMs the next; all the rest of the employees were undifferentiated, with no person having more or fewer furnishings than any other person, regardless of rank. These findings sug-

gest that both structural and furniture configurations can be “manipulated” to achieve the integrative qualities desired for particular symbolic identifications while still achieving an overall look of conformity and equality. Furniture products thus appear to be an important agent for accommodating worker’s perception of the space. The shared workstations and the visual accessibility of the GM implies an interconnectedness of employees grouped around a particular commodity while at the same time supports the flexibility of tasks.

DISCUSSION

The results of this exploratory study suggest a hybrid organization palatable to both the Japanese and the Americans who work there—an organization neither wholly Japanese nor wholly American but where a successful working alliance between the two, perhaps serendipitously, is attained. On the one hand was a spatial configuration and furniture arrangement highly familiar to the Japanese. It supported a high-context, information-based society where everyone knew everyone else’s business and where the highly visible space provided an interpretive climate for the visually reliant Japanese. There were enough subtle cues to indicate rank and order, but operationally and symbolically the physical environment accommodated and emphasized organizational functioning over individual functioning, collectivity over individuality. On the other hand, the space contained enough symbols of hierarchy, individuality, and opportunities for privacy to instill familiarity in the Americans. In short, the hybrid environment adequately supported both frame- and attribute-oriented persons and emphasized collectivism while still supporting a desire for individualism.

A visitor to this office felt a relaxed, friendly atmosphere with a lot of activity where people appeared to be interactive. However, the general hubbub of the office, coupled with the lack of strong statistical correlation between space and behaviors, suggests a “virtual” community whereby individuals are enough aware of each other through daily physical contact that the lack of an affinity based on ideological consensus is not problematic. This seemed to be a setting where the spatial characteristics helped create a useful operating level of organic solidarity that allowed coordination. It functioned without the extensive rules that sometimes occur in U.S. companies and without the common “mental programming” from common national background or professional training.

The setting also appears to be one in which control was based on reciprocal visual access. However, the rules of control were based on a system of “negative feedback,” where comments about behavior were only made when someone exceeded acceptable limits, rather than regarding specific

rules about what to do. Workers were free to behave in different ways and only received a reproving glare when behaving as if they were neglecting work. This encouraged people to withhold or screen their behaviors with others. Employees went to great lengths in the open atmosphere to achieve some visual privacy from the GM for personal phone calls and conversations. Reluctant to leave their desk (everyone was supposed to be working), they engaged in elaborate "play acting": One individual hid behind a computer to make private phone calls, looking at the screen and hitting keys occasionally; others studiously took notes while conducting personal calls on the phone or "regulated" their personal calls and conversations for times when the GM was out of the office.

This space seemed to be successful in achieving the organization's goals. While the organization as a whole seemed tailored to the frame orientation of the Japanese GM, it allowed people to recognize that they all "belonged" to this organization, even while it perhaps failed to generate the ideological cohesion that might be possible through increased informal socialization between the two cultures. While the lack of a common ideology might have been a source of friction in relations between the Japanese and American subcultures in the office, the office was neither Japanese enough to alienate the Americans, nor American enough to disenfranchise the Japanese. It offered a place where cultures integrated well enough to avoid overt friction.

How the corporation achieved this delicate balance between two cultures may have been planned or unplanned, but the dynamics of the equilibrium were impressive. The implicit control over individual behaviors evidenced by the strong visual access of members was balanced by task autonomy and job flexibility; the subtle status cues evident in furniture arrangement and type were neutralized by the apparent egalitarianism and accessibility of organization members, particularly the GM: and the general interactive behaviors in the office offered enough of a sense of community that the lack of solidarity based on ideological consensus was not problematic. This is a case where the physical setting helped mediate what could be potentially divisive issues and whereby the physical structure, the interactive environment, and symbolic attributes helped to diffuse rather than obliterate ethnic cultural differences. These variables in turn might be regarded as the agents of change and the regulators of organizational climate.

This study offers a small example of how one may approach an investigation of culture in the workplace. The methods allowed us to identify cultural variants in terms of symbolic identification, communication, control, and decision-making. It allowed us to identify the spatial dimension and physical accoutrements that may influence cultural integration or conflict in the workplace. It goes without saying that the framework and methodology must be tested with more cases and office types.

IMPLICATIONS FOR FUTURE THEORY, METHODS, RESEARCH, AND UTILIZATION

Different national and corporate cultures have different spatial and symbolic languages. Where there is a need to integrate different cultures and perspectives, the office planner, designer, or client needs to ask several questions about both of these cultural languages as part of programming a major design or renovation:

1. What are the dominant cultures and subcultures in terms of rules, schemas, and physical settings? What potential conflicts are present?
2. In particular, do workers have schemas that are frame- or attribute-oriented, high or low power distance, individual or communal? Do the organizational rules and structures have a similar or different pattern?
3. How does the physical structure fit the rules and schemas? For example, is there a fit between local and global layout and symbolic differentiation between rules and schemas?
4. What is the desired pattern of communication? What is the pattern of encounter?

In general, the planner, designer, or client may adopt a *strong culture* approach, where a single dominant culture is intended to pervade, or a *subculture* approach that supports the integration of multiple subcultures while allowing their difference. This seems akin to Durkheim's (1938) distinction between mechanistic versus organic solidarity. In a strong culture approach, as advocated by Peters and Waterman (1982) and others, every effort is made to align rules, organizational structure, and setting to create a single dominant theme. There is no informal culture or active subculture. While this view is much in vogue with organizational theorists, we have attempted to show the need for a subcultural approach that incorporates rather than eliminates the multiple aspects of different cultures.

National and organizational issues are of considerable importance for the design of multicultural workplaces, yet there have been relatively few studies exploring these themes. Several topics appear to be particularly important for further study:

1. Are there reliable national office design differences that parallel the national culture differences in schema discovered by Hofstede and others? What is the role of organizational rules and structures in understanding these design differences?
2. Do different modes of communication portend different types of office environments? For example, can the Japanese reliance on face-to-face contact be melded with an American reliance on written communication through office design?

3. Are power differences actually expressed symbolically and communality differences expressed spatially? For instance, can we use symbolic clues to represent power but use design to support patterns of communal responsibility-sharing?
4. Can we use office design to help support organizational change? For instance, can we use design to help bring about more frame-based organizational patterns?
5. What are the cultural impacts on office design? A thorough international survey of office layouts and designs is needed for a complete understanding of cultural impacts in office environments.
6. Can we employ office design to help mediate cultural conflict? Case studies of successful and unsuccessful attempts to do so would be extremely useful.

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Meta-Analysis for Environment–Behavior and Design Research, Illuminated with a Study of Lighting Level Effects on Office Task Performance

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THE DREAM OF COMBINING STUDY INFORMATION: META- ANALYSIS AS A TOOL FOR EB AND DESIGN RESEARCH

The dream of improving environmental design by collecting and examining the results of independent studies is as old as the field of environment and behavior. In her study of playgrounds, Lady Allen of Hurtwood (1969) asked: “[W]hy [are] so many expensive mistakes . . . made over and over again? One reason may be that there is no central body whose job it is to collect experience and research throughout the world, digest it, and make it

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readily available to architects and planners" (quoted in Sommer, 1972, p. 102). These and other authors have proposed a central repository for building designs, complemented with evaluations of the finished products. However, once these evaluation studies are collected, exactly how would they be combined or analyzed to determine what works and what does not? In other environment–behavior (EB) research areas, how might we quantitatively assess the outcome of any large or small series of studies on a given topic?

META-ANALYSIS

Brief History and Definition. One method for combining research results toward better buildings and toward a more complete understanding of EB relations, meta-analysis, has been available by that name for more than a decade and a half (Glass, 1976) and in similar forms for decades before that (cf. Rosenthal, 1991). The origins of meta-analysis were in agriculture, where in one early study (Lush, 1931), the correlations between initial weights of steers and their subsequent weight gains were available for six samples of steers; the investigator sought to compute the average correlation across the six samples. Social scientists turned to meta-analysis as a potential salve for two forms of malaise (Rosenthal, 1991). First, critics within and without social science have criticized its lack of cumulative efforts to solve issues; sometimes it seems as if every social scientist has done one or two studies on an issue that no other social scientist has researched. Second, the discoveries made by social scientists have been ridiculed in some quarters for being trivial in magnitude, having only managed to account for very small portions of the complete explanation for the phenomena they studied. Meta-analysis, for reasons this chapter will describe, is a useful medicine for both these maladies. In fact, the committed meta-analyst views both maladies as psychosomatic—more imagined than real.

After 60 years of evolution, most of it recent, meta-analysis today may be formally defined as a collection of statistical techniques for systematically and quantitatively combining the results of independent research studies in an effort to reach a general conclusion about a specific conceptual hypothesis. Meta-analysis is appropriate whenever "a series of studies has been identified that all address an identical conceptual hypothesis" (Cooper, 1984, p. 82).

The important difference between meta-analysis and most inferential statistical procedures is the level of analysis. Usually, primary-level inferential statistics is employed merely to estimate the likelihood that the independent variable has some (greater than zero) influence; if so, the variable is said to be statistically significant. Primary-level statistics can be used to estimate effect size in single studies, not merely whether its influence is non-zero, but this use has been less common until recently. Meta-analysis also

examines both whether a variable's influence is greater than zero and the magnitude of its influence on another variable, but these questions are investigated across a collection of studies rather than in a single study. Simply put, meta-analysis does anything that primary-level statistics does (e.g., computes descriptive statistics, examines variability, or investigates predictor-criterion relations), but it does so for a group of studies.

Combining Studies of Environmental Designs. Meta-analysis can be used in a manner similar to that envisioned by Lady Hurtwood, that is, to summarize the degree to which different environmental designs are effective or satisfactory. To do so, the meta-analyst needs a series of postoccupancy evaluations (POEs) of a particular building type or design (cf. Wener, 1989) that includes (1) information about how the designs differ in some measurable way and (2) reliable measures of the effectiveness or satisfactoriness of each design. One would then be able to make statements of the following form: "Based on x studies including y participants, children rate adventure playgrounds as more fun than traditional playgrounds and this is a strong effect," or "Open offices produce more work-irrelevant communication than walled offices, but this is only a weak effect."

In *Psychological Abstracts* from 1983 to 1990, there were over 700 references to meta-analysis. However, it has yet to be used in architectural research. We could locate no meta-analyses in the computerized version of *Psychological Abstracts* that compared different building types, features, or designs.

Combining Studies of EB Processes. Meta-analysis may also be used by EB researchers who direct their efforts at understanding behavior processes rather than particular building types or designs. For example, one could combine the many studies of high density on social relations to estimate the magnitude of the former's influence on the latter. In fact, Mullen and Felleman (1990) did just that in order to estimate the magnitude of the psychological effects of assigning three students to two-person rooms in university dormitories. Based on 10 studies that examined the responses of 2400 students, they found that "tripling" had the largest negative effects on students' ratings, such as their perceptions of their rooms, their satisfaction with their rooms, and crowdedness ($r = 0.44$). The effect of tripling on their health-related behaviors and grades were smaller ($r = 0.18$) but still significant.

Hines, Hungerford, and Tomera (1986-87) report a meta-analysis of many studies of influences on responsible environmental behaviors (e.g., knowledge of issues and action strategies, incentives, locus of control, attitudes, verbal commitment, sense of responsibility, and others). The strongest of the 15 presumed influences on responsible environmental behavior examined was appeals ($r = 0.71$, based on 16 hypothesis tests), followed by incentives offers ($r = 0.69$, based on 47 hypothesis tests), obtaining verbal

commitments ($r = 0.49$, 6 hypothesis tests), and providing useful information ($r = 0.47$, 8 hypothesis tests). In general, demographic indicators such as age, gender, income, and educational level were weaker influences ($r = 0.08$ to $r = 0.18$).

The All-Purpose Research-Summarizing Tool Box. Meta-analysis is equally adept at combining a series of POEs (i.e., building- or design-oriented questions) or combining a series of crowding (or other behavior-oriented) studies. Meta-analysis is a family of statistical procedures. Depending on which meta-analytic procedure is selected, a variety of questions can be served by it as long as the basic data are available.

What are the "basic data"? In his seminal work on meta-analysis, Glass (1976) distinguished among *primary analysis* (the original data collection in any typical scientific study), *secondary analysis* (reanalysis of that study's data by another researcher, perhaps for a different purpose), and *meta-analysis* (the analysis of the data from more than one study). Thus, the basic data for a meta-analysis are the results of at least two studies (but usually many more) that address the same conceptual question. These might be any of the questions we see examined in EB journals: Do postmodern facades communicate the architect's intended message to lay observers? Do jails without walls reduce inmate aggression? What is the effect of illumination level on office work performance? Once again, meta-analysis yields both a yes-no answer and a how-much answer to such questions. It uses studies as data points, much as primary studies use individual participant's actions or attitudes as data points. Its special talent is the combination of seemingly disparate data analyses: One study may report a hypothesis test that uses Pearson's correlation coefficient, another may use a t -test, while a third uses a χ^2 analysis. As long as all three studies examined the same basic question, meta-analysis will yield an overall average answer to the question all three studies posed. Just as social scientists trust the responses of a sample of research participants more than the response of any one of them, meta-analysts trust the results of a sample of studies more than any one of them.

Which purposes does meta-analysis serve? There are two answers to this question, both accurate but different in scope. One answer is that meta-analysis uses a variety of computational procedures to accomplish one or more of three tasks (Mullen, 1989). Just as in primary-level analyses, these tasks are to examine the central tendency and variability of the data points and prediction (i.e., the relation to or difference from some other variable of interest). The central tendency in a meta-analysis typically would be a mean effect size (as compared to the mean of a particular variable in a primary-level study). Variability in a meta-analysis refers to the probability that the studies included come from the same population or are significantly heterogeneous (as compared to a standard deviation or range). Prediction in a meta-analysis refers to the extent to which an effect size or significance level

reliably varies in relation to other variables of interest (just as in primary-level analyses).

Another three-part response to the question overlaps with the response just outlined, but may serve to further illuminate the issue. First, meta-analysis aims to *summarize relations* between two variables, that is, estimate the strength of the link between them. This is the appropriate approach when a certain relation between variables has already been established (or is at least assumed and discussed in the literature), such as that between density and performance. Since (or, more accurately, *despite*) the Hawthorne studies in the 1920s, many lighting professionals have assumed that more illumination will lead to more productivity.

Second, meta-analysis can be used to *establish relations* between variables, that is, to demonstrate that two variables are related. This is similar to the first function (summarizing relations) and is computed in the same way, but in this case the purpose is to determine whether a certain relation, one that has not been previously established, exists. As in ordinary scientific research, some previously untested hypothesis is examined. For example, does high density in libraries lead to shorter visits by patrons?

Third, meta-analysis can *identify moderator or mediator variables*, that is, factors that affect the relations between two other variables (cf. Evans & Lepore, Chapter 8, this volume). This approach is appropriate when the investigator suspects that some third variable influences the relation between two variables of prime interest. For example, if higher density increases self-reported crowding for women but not for men, then gender is a moderator variable (see Figure 1). Or, if higher levels of illumination are shown to increase arousal, and increased arousal is shown to increase performance, then arousal is said to mediate the illumination–performance relation.

The illustrative study described later in this chapter speaks to all these purposes. Others (e.g., Fiske, 1983; Strube & Hartmann, 1983) have pointed that meta-analysis can also have important indirect purposes. It can help to direct future research more efficiently, that is, help to better identify the most-needed next step in a research program; it can improve the basis for policy decisions; it helps disseminate research conclusions to wider audiences; and it encourages researchers to pay closer attention to methodological issues such as categorization and operationalization of variables and to theoretical issues such as concept definition and the clear statement of hypotheses. We hope the illustrative study to follow serves some of these indirect purposes.

META-ANALYTIC VERSUS NARRATIVE INTEGRATION APPROACHES

To discover what existing research says about questions such as those described here, we traditionally “review the literature.” The traditional, or

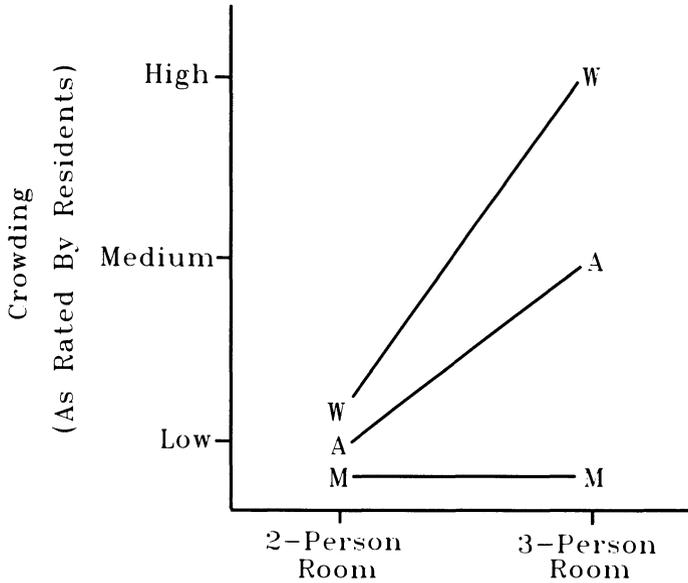


FIGURE 1. Gender moderates crowding in dormitories: Men (M) feel no more crowded in 3-person than in 2-person rooms, but women (W) do; A represents the average of men and women (hypothetical data, but consistent with Aiello, Baum, and Gormley, 1981, and other studies).

narrative, approach to literature reviews is a qualitative method. The best of these assemble virtually every known empirical study on the question, list the studies' independent and dependent measures, tote up the significance levels, and thoughtfully integrate and report conclusions. An excellent example of this approach was Sundstrom's (1978) review of research to that date on the effects of crowding and density. Most narrative reviews, however, fail to match those standards, and reviewers often draw incorrect conclusions.

Meta-analysis is another way to systematically review the literature, but with more precision and a different goal, one that is usually more appropriate. Its ability to estimate the *magnitude* of a variable's influence means that it is more suitable in practical situations, such as making building design decisions, than either the traditional narrative review, which provides no quantitative estimate or primary-level inferential statistics that merely estimate, one study at a time, the odds that an influence is greater than zero. Narrative reviews, even when conscientiously performed, do not estimate magnitude of effect; the tote-up of asterisks that signify significance levels can lead the reviewer to an inappropriate conclusion.

A CENTRAL CONCEPT: EFFECT SIZE

The magnitude of a relation between two variables—let's say between the amount of user involvement in a building design and subsequent satisfaction of employees who work in that building—is called *effect size*. Effect size is the *degree* to which the null hypothesis is false. Effect size varies from nothing—the presumed influence has absolutely no effect on the outcome—to everything—the presumed influence (e.g., user involvement) completely determines the outcome variable (e.g., greater employee performance).

Effect size may be numerically expressed in any of several equivalent ways. However, it is probably best expressed as the Pearson correlation coefficient r (Rosnow & Rosenthal, 1988). The Pearson correlation coefficient is the most sensible choice because it varies from 0 to 1, where 0 indicates no effect, 1 (although never found in practice) would indicate omnipotence for the influence, and values between 0 and 1 indicate increasing magnitudes of the effect. The use of a common metric, which can be computed from the disparate statistical outcomes of different studies (e.g., t or χ^2 or F values to the Pearson r) enables direct comparisons of the influence's importance in different studies. It is also useful when considering a binomial effect-size display (BESD), discussed later.

What Is a Sizable Effect Size? By a growing consensus based on the work of Cohen (1977, 1988), effect sizes may be loosely classified as small, medium, or large. These guidelines require adjustment for different research questions and different areas of inquiry, but in rough terms $r = 0.10$ is a "small" effect, $r = 0.30$ is a "medium" effect, and $r = 0.50$ is a "strong" effect. If 0.30 sounds like a small number for a "medium" effect size (reinforcing this perception is the fact that a "medium" effect accounts for only 9% of the variance in the outcome variable), it may be helpful to provide a tangible example. Cohen (1988) used data on the heights of girls to illustrate typical effect sizes in an everyday phenomenon. The effect size associated with the difference between the average heights of 15- and 16-year-old girls is 0.12, a small effect. The effect size for the average difference in heights between 14- and 18-year-old girls is 0.24, and that for the average difference between 13- and 18-year-old girls is 0.37 (see also Figure 2).

These figures offer an easily envisioned image of the relation between actual effects (i.e., height increases as a function of age) and effect size expressed in terms of r . A small effect is one that is real but barely perceptible, and a large effect is obvious to all. The figures also show that the effect of a presumed influence depends on which levels or amount of the influence are compared. In Cohen's example, the effect of age on height is not uniform, but varies widely depending on the age range considered. Over a few months, it is probably close to 0. Over the entire span of childhood, it is probably close to 1. Across adulthood, it presumably is small again. An

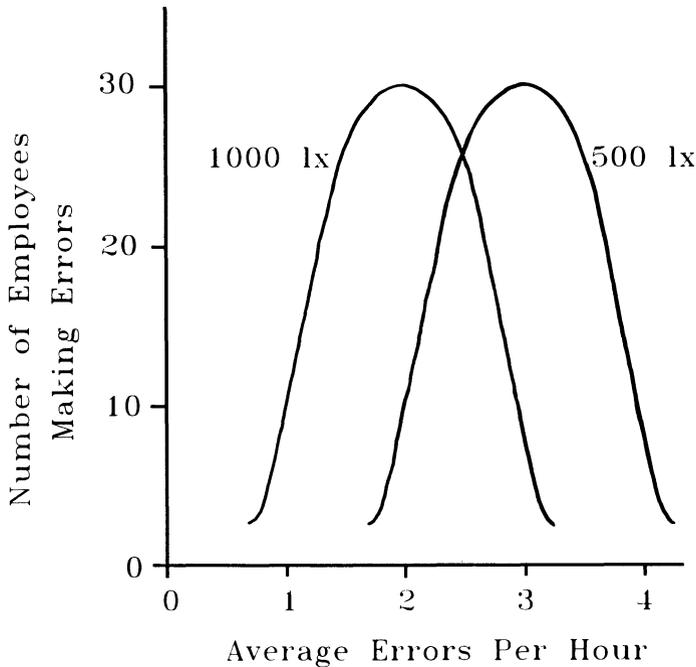


FIGURE 2. Hypothetical data on the frequency of errors committed under 500 lx versus 1000 lx illuminance. The effect size (r) for the data depicted would be about 0.49.

important conclusion is that effect size may vary dramatically across different increments or ranges of the presumed influence.

As an aside, these observations help to explain some of the problems that social scientists face. On the one hand, they are criticized for uncovering “small” effects (especially when geneticists claim to be “unravelling the very stuff of life” and nuclear physicists say they are “discovering the very nature of matter”). On the other hand, if they report a large effect (equivalent, say, to the discovery that the average 18-year-old is taller than the average 14-year-old), they are ridiculed for wasting time and effort to discover what is obvious to everyone.

There are two resolutions to this apparent dilemma. One is that meta-analysis does not merely find that an influence is present (e.g., that 15-year-olds are taller than 14-year-olds); it indicates the exact size of the effect. Everyone may know that 15-year-olds are taller on average, but everyone does *not* know the magnitude of the effect. The second resolution lies in the important realization that small effects are not necessarily unimportant effects. To illustrate this, Rosenthal (1991) recounts the story of a major medical discovery, the drug propranolol. Compared to a placebo, propranolol had such a significant effect in a 2-year study of over 2000 patients that the U.S. National Heart, Lung, and Blood Institute halted the study: It decided

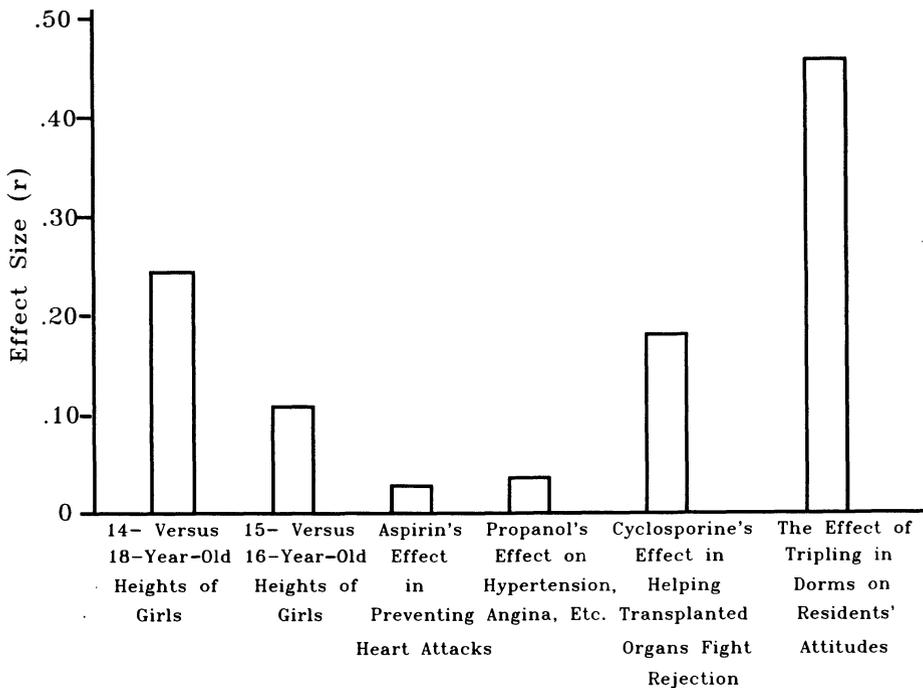


FIGURE 3. Sample effect sizes for various phenomena, based on actual data (see text for more details).

that giving placebos to some patients was unethical because it deprived them of such a beneficial new drug. And what effect size did propranolol have? Was it 0.80? 0.50? 0.30? 0.15? When the researchers' statistics were translated into effect size, it turned out to be 0.04, or less than *half* of a "small" effect. Propranolol, in sum, accounted for 2% of the variance in patient health.

This is not an unusual or specially selected result. In a later article, Rosenthal (1990) recounts other major medical discoveries and their effect sizes: The effect of aspirin on preventing heart attacks in a study of 22,000 physicians was 0.03 (this study was also halted for the same ethical reason); the effect of cyclosporine on preventing the body's rejection of transplant organs (the most important recent medical breakthrough, according to a survey of distinguished physicians attending the Center for Advanced Study in Behavioral Sciences at Stanford) was 0.19 (see Figure 3).

Effect Size and Practice: The Binomial Effect-Size Distribution. The results of these studies are not described to demean the importance of the medical discoveries they report; rather, they are meant to show that small effect sizes

Post-occupancy Evaluation Outcome

		Satisfied	Unsatisfied
Office Design	Traditional	35%	65%
	New	65%	35%

FIGURE 4. A binomial effect-size display for a hypothetical new office design that shifts client satisfaction from 35% to 65%. This large shift has an effect size of 0.30.

are not without practical importance. What, indeed, would be the practical impact of a given effect size?

Rosenthal (1991) offers the BESD as a way of illustrating the improvement or change that would be wrought by various effect sizes. When r is used to express effect size, the BESD is very simple to compute: An effect size of .xy will be associated with an improvement or change in the outcome of xy%. For example, translated to architectural practice, if some new design principle is found to have a "small" effect ($r = 0.10$) in improving the number of building users who are satisfied, the satisfaction rate of structures using the new principle will improve from 45% to 55%. These percentage changes are exact when the change is balanced at 50%, such as a change from 35% to 65%. When they are not, effect size will be approximate (e.g., for a change from 20% to 30%, the effect size is 0.115 rather than 0.10; Cohen, 1988). If the new principle has a "medium" effect size ($r = 0.30$), the satisfaction rate will improve from, say, 35% to 65% (Rosenthal, 1991). We trust the reader will agree that a "medium" effect (0.30) has a very important practical impact (see Figure 4).

Effect Size, Sample Size, and Significance. As noted earlier, significance level says nothing about the *magnitude of the differences* or effect, only about the odds that the difference or effect is real (i.e., exists in the whole population from which the sample was drawn). Effect size, on the other hand, is not the likelihood that a difference exists, but the *magnitude of the influence*. A significant probability level may be obtained even when the actual effect is very small if a large number of observations are made. In numerical terms, an effect that is statistically significant ($p = 0.049$) may have a small effect size ($r = 0.052$) when the sample size is large (.us; $n = 1000$). The same significance level ($p = 0.049$) indicates a very large effect size ($r = 0.95$) when the sample size is very small ($n = 3$). In general (Rosenthal, 1991):

$$\text{test of significance} = \text{effect size} \times \text{size of the study}$$

This equation may be rewritten:

$$\text{effect size} = \text{test of significance} / \text{size of the study}$$

A larger sample size does carry with it greater certainty about the exact size of the effect, just as an average based on a large sample has a smaller standard deviation than one based on a small sample. However, the large sample size and statistical significance do not mean that the effect size is any larger or more important than one found in a study with a small sample, even an effect size with statistically insignificant results. In fact, a significant result uncovered with a small sample size suggests the presence of an influence with a large effect size.

A similar scenario may be constructed for the opposite form of divergence between effect size and a test of significance. Let's say that only 10 libraries that vary in, say, degree of fenestration, are available for a study to determine how windows are related to patron length of stay. The small sample size means the study has limited power to discover a weak but true relation; the researcher is less likely to find a *statistically* significant relation between degree of fenestration and length of stay. However, to conclude that windows have no effect would be incorrect. It may be that a substantial effect exists (and its size can even be calculated), suggesting that windows have considerable *practical* significance as an influence on patron length of stay.

It remains true that an effect size derived from such a small sample must be viewed with caution; it will be less stable (have less certainty attached to its precise magnitude) than an effect size derived from a study of 100 libraries. However, it would be more reasonable to conclude, based on the data available, that windows *do* have an effect on patron length of stay, although this estimate includes some uncertainty about its exact size, than to conclude that windows have *no* effect.

In sum, probability levels are sample-size dependent. Those based on large or small samples are often interpreted incorrectly (i.e., that they do indicate true difference when they do not—known as a Type I error—or that they do not indicate a true difference when they do—a Type II error). When sample sizes are very large, a trivial difference (in practical terms) will be statistically significant. Thus, probability levels provide the answer to a question that is not, on reflection, the one usually asked in EB research (i.e., whether an effect is present or not). From the policy- and practice-minded perspective of many EB researchers and their clients, effect size (the *magnitude* of the influence) is the more appropriate answer to the question of whether a given environmental design or feature influences a given behavioral (or cognitive or emotional) outcome. Effect size *can* be calculated from primary-level inferential statistics alone, but it often is not. Meta-analysts place effect size at center stage and, better yet, base the estimate of effect size

on multiple studies, so that confidence in the accuracy of the effect size estimate is improved.

CRITICISMS OF META-ANALYSIS

Is meta-analysis as wonderful as (we hope) it sounds? Several objections to meta-analysis are often heard almost as soon as a skeptic hears about the technique. Mullen (1989) and Rosenthal (1991) have provided lists of most often asked "questions" (translation: veiled criticisms) and answers. We summarize some of these briefly.

First, isn't the combining of different studies in meta-analysis adding "apples and oranges"? Most studies do employ at least slightly different measures of both the presumed influences and the outcomes. Generous criteria for inclusion in the meta-analysis do tend to lead to the inclusion of measures that do not really belong together, but they also provide more data points. However, if a slight variety of methods yields similar effect sizes, we can infer that the influence under scrutiny is likely to be *robust*, that is, relatively impervious to variations in measurement method, type of statistical analysis, and other procedural vagaries. Narrow criteria for inclusion tend to avoid "apples and oranges," but yield fewer data points, a less stable effect size, and less power to detect real but small effects.

In brief, the issue of which studies to include must be dealt with carefully, depending on the question at hand, the nature of the measures, and the number of relevant studies at hand. This care must extend to conclusions drawn from the results of the meta-analysis. It is very important to remember that this issue is identical in traditional narrative literature reviews; it is a problem not only in meta-analysis, but also in any approach to reviewing.

Second, isn't a large number of studies necessary to do a meta-analysis? No. Meta-analysis can be done, and can yield useful results, with just two studies. (Of course, a larger database will yield a more stable estimate of effect size.)

Third, related to the above, isn't this research topic too new for meta-analysis? No. True, the final answer will not be produced by an early meta-analysis, if it ever will be, but an early meta-analysis serves as an important estimate of typical outcomes, which can serve in turn as the basis for power considerations in the design of future studies (see Cohen, 1988), in the variability in the effect size, and as a guide to potential moderator variables.

Fourth, doesn't meta-analysis suffer from the "garbage in, garbage out" problem? As noted earlier, it can. Just as in the traditional review, the reviewer must screen out any real garbage at the study selection stage. If most of the studies in an area are garbage, which is not very likely, perhaps the only appropriate review is one that says so and calls for better research.

Some meta-analysts (e.g., Glass, McGaw, & Smith, 1981) argue that as many studies should be included as possible. They believe that because evaluators of research quality do not strongly agree with one another (Coo-

per, 1984, pp. 63–64), because poor design characteristics of different studies can “cancel out” each other, and because a priori judgments of research quality by an individual meta-analyst are subject to biases and predispositions, studies should not be discarded.

Glass et al. (1981) hasten to add that they support the ideal of quality research; they merely find reliable measurement of research quality problematic. To be constructive, they propose empirical tests of potential or alleged flaws in design quality. For example, the meta-analyst may find (as we did, in the study to follow) that some studies report how long participants were allowed to adapt to the lighting conditions and others do not. Instead of discarding studies that do not report the length of an adaptation period (if there was one), Glass et al. advocate treating “reporting” versus “not reporting” as a potential moderator variable. If this “flaw” makes a real difference, effect sizes will significantly differ in the two conditions and the reporting versus nonreporting of an adaptation period will be revealed as a significant moderator variable; if reporting adaptation periods makes no real difference, then this particular “flaw” is more accurately considered an indication of the influence’s robustness across variations in experimental procedure and report writing than a flaw that makes some studies “garbage.”

Ultimately, the question is: What is “garbage”? In general, it does *not* consist of procedures or analyses that are arguable or at least modestly defensible. It *does* consist of outright errors in data analysis, such as incorrectly computed descriptive or primary-level inferential statistics. Even this “garbage” can be salvaged by the diligent meta-analyst who is able to obtain the raw data (or simple descriptive statistics such as means, standard deviations, and sample sizes) from the original researcher. The meta-analyst who is confident that different studies deviate in a particular and clear manner from experimental design perfection can choose to weight studies by their quality: Perfect studies might be weighted 1, so-so studies given perhaps a 0.5 weight, and hopeless studies can be weighted 0, which is equivalent to ignoring them (Rosenthal, 1991). One investigation actually compared the effect size reached when poor studies were deliberately included versus when they were excluded (Landman & Dawes, 1982). The results based on 281 “good” hypothesis tests (defined in this case as a hypothesis test in which a control group was used) found an average effect size of 0.78; the average effect size based on 833 hypothesis tests in “bad” studies (no control group was used) was 0.68. Thus, the inclusion of “garbage” studies did little to change the average effect size.

Fifth, should meta-analysis be used on a topic where there is no particular controversy? Yes. It can be used to resolve controversy, but even in an area with none, its use is appropriate: Meta-analysis may uncover an effect no one had noticed, show that a widely agreed-upon effect is actually weak, or reveal that opposite effects are being reported by different researchers. In short, meta-analysis may reveal that controversy *should* have been present.

Sixth, can causal relations be inferred from a meta-analysis? In a strict

sense, no, and according to Mullen (1989), some commentators say “never.” However, in the sense that meta-analysis can eliminate—given an adequate set of studies to work from—many potential variables as alternative causes of the phenomenon in question, meta-analysis can establish that a causal connection is highly likely (Mullen, 1989). One key factor is whether the studies examined in the meta-analysis themselves meet the standard criteria for claiming they have discovered a causal link.

Seventh, isn't any single numerical index too simple to describe a complex relation between an influence and its outcome? This is true if the meta-analyst fails to highlight the *range* of the influence investigated. As shown earlier, effect size may vary across different increments of the influence variable. This would also be a valid charge if meta-analysis relied only on unfocused or diffuse tests of the hypothesis, that is, tests involving more than one degree of freedom (i.e., a simultaneous test of multiple levels of the presumed influence). However, focused tests (comparisons of just two levels of the influence) and comparisons at different increments of the influence allow for a series of effect sizes that more accurately describes the relation between influence and outcome.

Doesn't a single number, or even a series of them, gloss over important details? Yes, but once again the intent of every review (narrative or quantitative) is to summarize and hence “gloss over” details. Reviews aim to provide a clear and concise statement about the issue in question. Even so, the investigation of moderator variables in meta-analysis gives the opportunity to examine as many “but it depends on . . .” possibilities that the detail advocate wishes.

Eighth, sometimes the data points in a meta-analysis (studies or hypothesis tests) are not independent; they should be independent in a proper analysis. Typical forms of nonindependence in the present context include two hypothesis tests performed on the same sample of people or buildings, or several studies done by one researcher in one lab with one procedure. Combining such hypotheses and studies leaves the meta-analyst uneasy because it is possible that something about the sample, lab, researcher, or procedure *besides* the factor at issue influences the effect size estimate. Simple and complex solutions to the problem have been proposed (cf. Rosenthal, 1991). The simplest method (and the one we use later) is essentially to average the several effect sizes and treat the average as one effect size to be combined with those from other studies.

Research on this question suggests that nonindependence may not matter very much after all. Landman and Dawes (1982) computed average effect sizes using the study as the unit of analysis versus the hypothesis test as the unit of analysis for a large set of studies on the effectiveness of psychotherapy. For one method, effect size was found to be 0.78; for the other method it was 0.90. Either way, this is a very substantial effect.

As noted, another source of nonindependence stems from multiple

studies done by one investigative team in one lab. For various reasons, the results emanating from such a situation may be less heterogeneous than they would be if the studies had been done by a variety of researchers. Fortunately, at least one study (Rosenthal, 1991) shows that effect size computed by combining all studies and effect size computed by combining effect sizes from each lab (i.e., by averaging effect size within each lab and then combining those averages) are virtually identical.

Ninth, isn't it the case that by examining many studies, the meta-analyst guarantees that a significant result will be found? The answer hinges on what is meant by "significant." The large sample size obtained when many studies are combined does increase the chance of rejecting the null hypothesis. However, rejection of the null hypothesis does not necessarily imply that the associated effect size is large. Adding more studies will not lead to an increase in the estimated effect size. If, in reality, a presumed influence has no effect on the outcome, a huge number of studies will not help to reject the null hypothesis falsely. In fact, by examining a large number of studies, the meta-analyst reduces the odds of an incorrect conclusion about effect size; instead, it will yield a more accurate estimate of the true effect size.

Tenth, what about studies that were completed, but showed null results and therefore were less likely to be published? These studies would therefore be less likely to be included in a meta-analysis, but if they were included, the estimated effect size would be smaller. Could many investigations that failed to find a significant result be languishing in the offices of their authors? Do published studies considerably overrepresent the true strength of various phenomena?

Meta-analysts have paid specific attention to this problem. Rosenthal (1991) has called this the "file drawer" problem. If a reviewer wishes to completely and accurately summarize *all* the research bearing on a topic, every study (including those with null results sitting in file drawers) should be included. But it is clearly difficult or impossible to retrieve all file drawer studies (even when attempts are made, as they should be, to locate such studies).

Note that this is a problem for all reviewers, whether they use traditional or meta-analytic approaches. However, in an attempt to compensate for the existence of uncoverable file drawer studies, Rosenthal (1991) suggested formulae to compute the fail-safe N (or FSN), which estimates how many null-result studies would have to exist in file drawers somewhere before a combined probability level established in a meta-analysis based on *published* studies was reduced to the edge of significance ($p = 0.05$). In general, when the influence under scrutiny is barely significant, only a few null result studies would have to exist (i.e., a small FSN) before the probability level attached to the influence would sink to the edge of nonsignificance. Conversely, when published studies indicate a very significant effect, a very large number of null-result studies (i.e., a large FSN) would have to be

TABLE 1. Quality Standards for Meta-Analytic Research (Based on Bullock and Svyantek, 1985)

Use a theoretical model as the basis of the research and test hypotheses from that model.
Precisely identify the area of research.
Include all available studies, not merely published studies.
Avoid selecting studies based on their rigor, age, or stage of publication.
List studies included, or make such a list available.
Select and code variables on theoretical grounds, not convenience.
Carefully document the coding scheme and how any difficulties in applying it were resolved, including how missing data were handled.
Use multiple raters to apply the coding scheme and provide interrater reliability estimates.
Report all variables analyzed to allow estimates of whether significant findings might have capitalized on chance.
Publish or make available the data set used in the analysis.
Consider alternative explanations for the findings.
Limit generalizations to the specific domain studied.
Report the study's characteristics (such as laboratory or field-based research, single-family or multiple-unit dwellings, elementary or secondary schools) to clarify the nature and limits of the domain analyzed.
Report the study in sufficient detail to permit replication.

gathering dust before the influence's combined probability was reduced to $p = 0.05$.

These ten criticisms, in our opinion, are better viewed as a list of legitimate concerns rather than as fatal flaws. The careful meta-analyst can overcome each of them. Just as any other tool, however, meta-analysis can be abused and misused. We advocate it as clearly superior to traditional ways of summarizing research literature if it is properly employed. Besides the standard references on meta-analysis (Cooper, 1984; Glass et al., 1981; Hunter, Schmidt, & Jackson, 1982; Mullen, 1989; Rosenthal, 1991), articles by Bullock and Svyantek (1985) and Rothstein and McDaniel (1989) provide convenient checklists for evaluating the adequacy of published meta-analyses (see Table 1). The same checklist can serve as a set of guidelines for conducting a meta-analysis.

Meta-analysts are not infallible, nor is meta-analysis itself. As Rosenthal (1991), a pioneer meta-analyst, has observed:

Our procedures are not perfect, we can use them inappropriately, and we will make mistakes. Nevertheless, the alternative to the systematic, explicit, quantitative procedures to be described is even less perfect, even more likely to be used inappropriately, and even more likely to lead us to error. (p. 11)

Generally, this is because judgments of a body of research based on a narrative or qualitative approach are more likely to be affected by inadvertent biases, preferences, selective attention, and idiosyncratic weighting of studies than are judgments based on a quantitative approach. The best way to minimize any problems arising from a meta-analysis is to fully describe all

procedures used and all decision rules used, with rationales for each choice (Rothstein & McDaniel, 1989).

Confirmation That Meta-Analysis Is Superior. Cooper and Rosenthal (1980) even went to the trouble of performing an experiment to demonstrate this point empirically. The subjects, 41 faculty members and graduate students, were given seven studies to examine. All seven studies investigated gender differences in task persistence. On a random basis, some subjects were assigned to a meta-analysis condition and some to a traditional narrative condition.

Subjects in the meta-analysis condition were taught its basic procedures and were told to use them to reach their conclusion; the others were asked to use standard qualitative, interpretive literature review methods. All subjects were asked to conclude whether the seven studies, as a whole, supported the conclusion that females were more task-persistent than males. The seven studies did show a clear female superiority, and 73% of the novice meta-analysts correctly reached this conclusion. Of the traditional reviewers, only 32% reached the correct conclusion. This difference was significant ($p < 0.005$). We calculated the effect size for the difference in methods and found it to be 0.41. In sum, the Cooper and Rosenthal study supports the contention that meta-analysis produces more accurate conclusions about what a collection of studies is trying to tell us than the traditional narrative review.¹

AN ILLUSTRATIVE STUDY: LIGHT LEVELS AND PERFORMANCE

As noted earlier, many research areas in environment and behavior might have been used as examples in this chapter. All one needs are at least two studies that (1) deal with a particular issue, (2) employ quantitative measures, and (3) report primary-level inferential statistics or at least means and standard deviations for outcome measures. We could combine POEs, studies of open versus closed offices, or experiments on landscape perception. We chose lighting levels in relation to the performance of office-related tasks, but the principles may be applied to any EB research question.

THE BACKGROUND: HAWTHORNE'S LEGACY

Ever since the Hawthorne studies, there has been controversy about performance and light level (illuminance). The original studies (see Figure 5)

¹For us, the frightening numbers in the Cooper–Rosenthal study are not that only 73% of those who used meta-analysis reached the presumably correct solution—this is bad enough, although we must recall that none of the subjects had any experience with meta-analysis—but that over two-thirds (68%) of the traditional reviewers reached the presumably wrong conclusion! What does this say about conventional “wisdom” in the behavioral sciences, which is largely based on narrative reviews? Even worse, what about conclusions reached by architects who make an important decision after reading only one or two informal case studies?

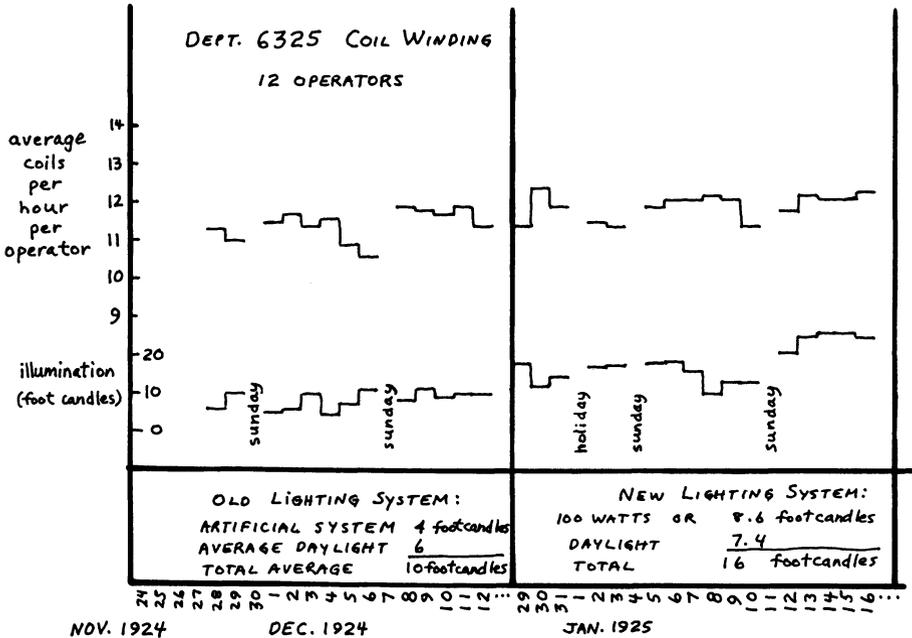


FIGURE 5. Sample of the original (pre-)Hawthorne lighting data (redrawn from the original graphs).

were conducted from 1924 to 1927 at the Hawthorne plant (see Snow, 1927), before the studies that comprise the famous book by Roethlisberger and Dickson (1939). These “pre-Hawthorne” illumination experiments stimulated the later (1927–1932) studies reported by Roethlisberger and Dickson: Their results were mystifying. Production in three departments responded differently to progressive increases in illumination. Production randomly fluctuated in one department; in the other two it generally increased, but erratically so. Two further series of studies were done, and again the results were unexpected; performance in one department even rose as illumination declined, until the workers could barely see, at which point production did decline (Landsberger, 1958). One interpretation of these results holds that the physical environment has no direct effect on human behavior; the first author has suggested elsewhere that environmental psychology was held back 30 years in its development by this belief (Gifford, 1987).

In contrast to the apparent message of the Hawthorne studies is the popular belief that more light does lead to more work (Veitch, Hine, & Gifford, 1993). Its acceptance by professionals is indicated by the steady increase in Illuminating Engineering Society of North America (IESNA)-recommended illuminance levels from 1942 to 1981 (Pansky, 1985; Snow,

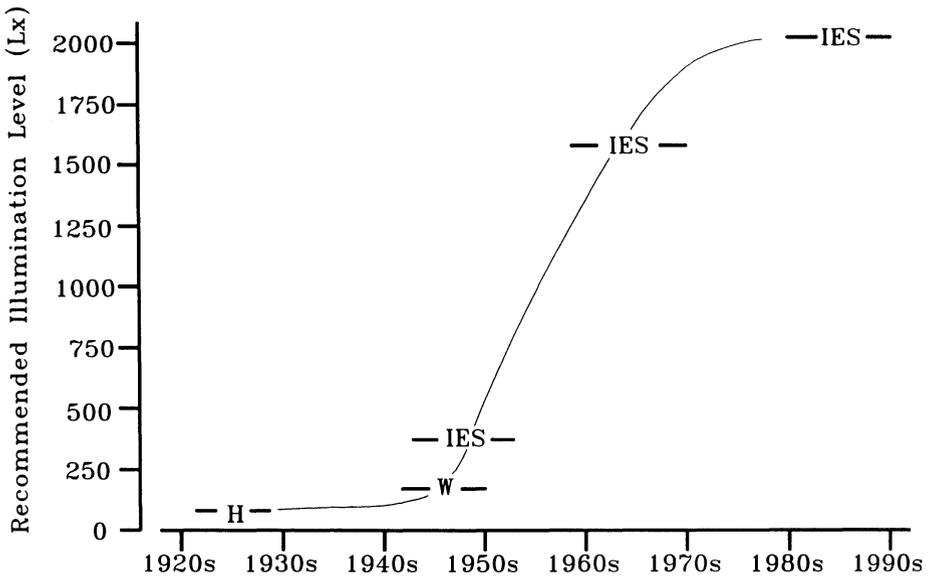


FIGURE 6. Recommended illumination levels for an average adult who performs “close work” in an office (based on Pansky, 1985). W is Westinghouse’s “good practice” level; IES is the North American Illuminating Engineering Society’s recommended levels, although after the 1950s these depend on type of task, importance of task, reflectance of the background, and employee age. The levels depicted are for situations that require more illuminance. H depicts typical installed factory lighting in the 1920s (Snow, 1927).

1927, see Figure 6).² Today it is almost unbelievable that at the time of the Hawthorne studies recommended illumination levels were so low. Snow (1927) says, in describing a factory study of the day, that “the original level of intensity of artificial illumination (7 footcandles) was *well above* factory lighting characteristic of the United States” (p. 238; emphases ours; 7 footcandles is about 70 lx). Inspection of Figure 5 shows that in one pre-Hawthorne study only four footcandles were provided by the standard lighting system, with an additional six coming from daylight, for a total of ten footcandles (100 lx). In Europe, however, lighting level recommendations are considerably lower (Belcher, 1985). For example, the IES in the United Kingdom suggests 500 lx for general office work, but IESNA suggests 750 lx. In more specialized settings (e.g., drafting offices or sewing rooms), IESNA’s suggestions are three to five times higher than IESUK’s.

The results from experimental studies of realistic work tasks have been

²This belief may not, however, be shared by the general population. We recently surveyed the lighting beliefs of over 1000 social science undergraduates at the University of Victoria (Veitch, Hine, & Gifford, 1993). The statement “Brighter light leads to greater productivity,” was accepted by 25% and rejected by 55%; 20% said they didn’t know.

equivocal. For example, Gifford (1988) found no statistically significant main effect of illuminance on the quantity of written communication (although time spent writing significantly declined over time at the lower of two illuminance levels), whereas Hughes and McNelis (1978) found that increasing illuminance improved the speed and accuracy of clerical workers.

The issue has obvious practical implications. If increases in illuminance improve worker performance, then light levels above the minimum necessary for vision alone ought to be maintained in workplaces. However, if there is little benefit to higher levels of illuminance, then perhaps lighting levels should be reduced in the interests of energy efficiency and global environmental concerns.

REFINING THE HYPOTHESIS

Before conducting the literature search, criteria was selected for picking the "apples and oranges" included in this study. We decided to consider only task-performance measures for our dependent variable. Studies of visual performance, visual fatigue, mood, satisfaction, or preference were excluded. The study originally sought to include both office and industrial tasks for two separate meta-analyses. However, very few (one or two) industrial task studies that fit other criteria (e.g., that appropriate statistics were reported) could be located, so the analysis to follow focuses only on office tasks.

Incidentally, as much as we would have liked to include the original "pre-Hawthorne" lighting studies (even though they examine industrial rather than office tasks), we could not. We obtained copies of the original graphs and tables, but they report only means, not standard deviations or other measures of variance in performance.

The precise meaning of the independent variable, illuminance level, was clarified next. The meta-analysis procedure requires focused comparisons between levels of illumination, so a decision about which illumination ranges would constitute these levels was necessary. The decision was based on IESNA recommendations (Illuminating Engineering Society of North America, 1987) for performance of (1) tasks of high contrast or large size and (2) tasks of medium contrast or small size. These two task categories broadly fit the tasks we had previously targeted. The IESNA recommendations each have three levels (high, medium, and low); the medium levels of the two recommendations just listed were chosen as cutoff points. This resulted in the following tripartite classification of illuminance level: Below 300 lx was defined as low, 300–750 lx was defined as medium, and above 750 lx was defined as high.

The final stage of preparations included the specification of a hypothesis. The Hawthorne studies suggest that light levels are not linearly related to work output, although the Hawthorne studies were done in an industrial

setting, not an office setting. Professionals such as those in IESNA appear to believe that more illuminance leads to more work. Formal theory in this area is not well developed. Gifford (1988) reviewed the literature and hypothesized, based on studies of nonhuman mammals, that light acts as a general arousal agent. His results supported the hypothesis. Apparently, the Yerkes-Dodson law applies: for low to moderate increases in arousal level, performance should increase. Assuming illumination is a mild rather than strong arousal agent for humans who are already awake and working, increased arousal should lead to increased output. Therefore, this study proceeded with the intent of testing this explicit hypothesis: Greater illuminance increases performance.

METHOD

Literature Search. The studies included in the review were identified by:

1. On-line computer searches. Three on-line databases were searched: PSYCLIT (CD-Rom), PSYCINFO (DIALOG), and Occupational Safety and Health (DIALOG). The keywords used were "illumination" and "performance."
2. Reference tracking. To locate research that was not included in the computer databases (e.g., older studies, studies published in non-psychological journals, etc.), we examined the bibliographies of all retrieved studies.
3. Previous reviews. Previous reviews of illumination / performance research (e.g., Boyce, 1981; Megaw & Bellamy, 1983; Sundstrom, 1987) were scanned for relevant references.
4. Written requests. Requests for recent and unpublished studies were sent to some of the few researchers who have an established and continued interest in light and human behavior. They were M. Clay Belcher of Kansas City University, Stuart Kaye of the University of Manitoba, Robert Marans of the University of Michigan, and Dale Tiller of the National Research Council of Canada. This was done because these researchers were most likely to have comprehensive knowledge of existing studies that fit within the boundaries of this review.
5. Textbooks. Surveys of human factors research by Kantowitz and Sorkin (1983) and McCormick (1976) were searched.

Relevance Criteria. To be included in the present review, studies were required to satisfy three main criteria. First, they had to include, as a dependent variable, a performance measure of a "realistic" task that might be performed in an office setting. Studies that used artificial or contrived tasks (e.g., the Landolt ring task) were excluded. This decision was made in order

to maximize face validity for generalizability to everyday settings. Second, studies had to include a focused comparison (or include sufficient statistical information for us to construct such a comparison) of performance at more than one level of illumination. Conclusions about the effect of illumination quantity must be based on comparisons of at least two different levels of light. Finally, the comparison had to involve at least two of the three ranges of illumination (i.e., low, medium, and high) outlined earlier. Thus, studies that compared high versus low, medium versus low, or high versus medium were included in the review. Those that compared illuminances within the same range (e.g., illuminances that both fell within the low category) were not included.

Unit of Analysis. Following the conventions suggested by Cooper (1984), a shifting unit of analysis approach was adopted. That is, for some purposes, the *study* was the unit of analysis, but for other purposes each *hypothesis test* (in studies that reported multiple hypothesis tests) was used as the unit of analysis. To minimize violations of data independence (i.e., similarities in findings that may result from an investigation by the same researcher in the same lab using similar subjects, etc.), the study was used as the unit of analysis for the calculation of combined probabilities and effect sizes. When the study was used as the unit of analysis and it included multiple tests of the same hypothesis, each hypothesis test was weighted so that it contributed only one data point to the analysis. Thus, if a study included three tests of the same hypothesis, the results of each test were weighted by one-third.³

However, when examining whether the relation between illumination and performance was moderated by specific study characteristics (e.g., research design, sample attributes, and so on), the unit of analysis was the hypothesis test. If a study included two tests of the same hypothesis, it would contribute two data points to the moderator analysts. This practice increases the power of the statistical analysis and ensures that no information is lost when methodological comparisons are made (see Cooper, 1984).

Study Characteristics Retrieved. The following information was retrieved from each study, if it was available:

1. General characteristics
 - a. year of publication
 - b. lamp type
 - c. lamp location
 - d. adaptation time for participants to adjust to the lighting
2. Independent variable manipulation (e.g., high versus low, medium versus low, or high versus medium)
3. Dependent measure (e.g., reading speed, amount written, etc.)

³Because correlation coefficients cannot be added and subtracted like ordinary numbers, effect sizes were transformed into Fisher Z_r s, as they must be, prior to weighting.

4. Factors that might influence generalizability
 - a. sample characteristics (e.g., size, gender, and age)
 - b. location of study (e.g., university, country)
5. Statistics
 - a. test used
 - b. significance of the test
 - c. effect size
 - d. direction of relation
 - e. degrees of freedom
6. Other factors that threaten the validity of the study (e.g., potential flaws in the experiment's design or the data analysis, such as confounding illumination level with lamp type)

Information from the studies was coded by two raters. In the few instances where information was coded differently, the raters conferred and agreed on a single coding.

Statistical Conventions. All the statistical analyses were performed with Mullen's (1989) software for meta-analysis. Six steps were involved, as follows:

1. *Combined probabilities.* Combined probabilities for the entire set of studies and various subgroupings were computed using Stouffer's (1949) "adding Zs" method:

$$z = \frac{\sum w_j z_j}{\sqrt{\sum w_j^2}}$$

where w_j = the weight assigned to hypothesis test j , and Z_j = the Z associated with the significance level of study j .

The p value corresponding to the combined Z reflects the likelihood that the observed results could have occurred by chance, given that the null hypothesis was true for each of the original studies.

To avoid introducing unnecessary subjectivity into the analysis (see Cooper, 1984), studies were *not* weighted by our own judgment of their quality, although this is sometimes done.

2. *Fail-Safe N.* The Fail-Safe N (FSN) statistic was developed in response to the "file drawer" problem discussed earlier. It represents the number of null-summing studies that would be needed to raise the combined probability above 0.05 (i.e., to make the combined probability nonsignificant). "Null-summing" studies are those that report zero or slight positive or slight negative effect sizes, so that their collective effect size would average close to zero:

$$FSN_{(p=.05)} = \left(\frac{\sum Z_j}{1.645} \right)^2 - k$$

where $Z_j = Z$ associated with the significance level of study j , and $k =$ number of studies in the meta-analysis.

Rosenthal (1979, cited in Cooper, 1984) proposed a standard for confidence that a finding is adequately insulated from the "file drawer" problem. This standard, which is arbitrary but appears reasonable, is that confidence is established if the FSN is greater than 5 times the number of retrieved studies, plus 10.

3. *Combined effect sizes.* Effect size represents the strength of relation between two variables (in this case, illumination and performance). A variety of effect size indices exist (e.g., R^2 , η^2 , Cohen's d , etc.). However, as noted earlier, most of these indices are difficult to grasp intuitively. The Pearson correlation coefficient, with its easily understood 0 to 1 scale, was adopted as the standard effect size measure (see Rosnow & Rosenthal, 1988).

Combined effect sizes were computed using the following formula:

$$\text{combined } z_r = \frac{\sum w_j z r_j}{\sum w_j}$$

where $w_j =$ weight assigned to the results of study j , and $Zr_j = Z_r$ associated with the effect size for study j .

Note that because the sampling distribution of r is non-normal, all effect sizes must be standardized (i.e., transformed into Z_r s) before they are used in the formula. The resulting combined Z_r is transformed back into r following the computation.

4. *Heterogeneity analysis.* To determine whether the variance among effect sizes across studies was significantly different than expected from sampling error, a heterogeneity analysis, or diffuse comparison of effect sizes, was performed:

$$\chi^2_{(k-1)} = \sum (N_j - 3)(Zr_j - \bar{Z}_r)^2$$

where $N_j = N$ associated with hypothesis test j , $Zr_j =$ Fisher Z_r associated with test j , $\bar{Z}_r =$ mean Z_r , and $k =$ number of studies.

5. *Moderator search.* If the heterogeneity test is significant, one reason may be that some other influence alters or moderates the relation between the independent and dependent variables. Therefore, whenever the heterogeneity was significantly large, a search for factors that might moderate the relation between illumination and performance was conducted. Using the hypothesis test as the unit of analysis, focused comparisons of effect sizes for different levels of potential moderators were computed:

$$z = \frac{\sum \lambda_j Zr_j}{\sqrt{\sum \frac{\lambda_j^2}{N_j - 3}}}$$

where λ_j = contrast weight assigned to results of hypothesis test j , $Zr_j = Zr$ associated with the effect size of hypothesis j , and N_j = sample size associated with hypothesis j .

A significant p -value indicates that the effect sizes covaried significantly at different levels of the specified moderator.

6. *Combined probabilities for moderator subgroups.* In cases where effect sizes varied significantly at different levels of a moderator, combined probabilities were recalculated to determine if the relation between illumination and performance was significant at each level of the moderator. This procedure is known as *blocking* (Mullen, 1989).

RESULTS

General Description of Study Characteristics. Eleven articles that satisfied the relevance criteria were included in the review (Bennett, 1986; Gifford, 1988; Rose & Rostas, 1946; Simonson & Brozek, 1948; Smith & Rea, 1982; Tinker, 1939, 1943, 1951, 1952, 1959; Veitch, 1990). The mean year of report appearance was 1962.18 ($SD = 20.02$). The average number of subjects per hypothesis test (of which there were 31 in the 11 articles) was 72.84 ($SD = 111.81$). Nine of the eleven articles reported that university undergraduates were used as subjects. The office tasks investigated included reading, typing, writing, clerical work, letter recognition, and others. The weighted averages of the illuminances used in the eleven studies for low, medium, and high levels were 70, 468, and 1962 lx, respectively.

About 52% of the hypothesis tests (16) involved comparisons between high and low illuminances, and about 40% (13) compared medium and low illuminances. Two hypothesis tests that compared high and medium illuminances were located. Three studies reported using fluorescent lamps, one reported using incandescent lamps, and two reported using both types. Five articles did not report lamp type, and six did not report the amount of time participants were given to adapt to the experimental environment.

Of the 31 hypothesis tests performed in the 11 articles, 20 outcomes were in the direction of the hypothesis and 10 were in the opposite direction. One null result was found: The means of the two comparison groups were identical. Ten of the hypothesis tests (nine of those confirmed the hypothesis and one of those disconfirmed it) were statistically significant ($p < 0.05$, 1-tailed).

Probability Analyses. The combined probability associated with all 11 studies was 0.000000014, suggesting that the likelihood that the series of observed results could have occurred by chance is extremely low. The *FSN* (i.e., the number of null-summing studies needed to raise the observed probability above 0.05) was 94.69, well above Rosenthal's suggested tolerance criterion for null results. The null form of the hypothesis that more illumination yields greater performance is clearly rejected. The next analysis estimates the size of the effect.

Effect Size Analyses. The simple outcome of the study in effect size terms is that based on 31 hypothesis tests that averaged about 73 subjects per test, the overall effect of illumination on office productivity is 0.18.

The Search for Significant Moderators. The diffuse comparison of effect sizes revealed, however, that the effect sizes found in the different studies were significantly heterogeneous [$\chi^2(10) = 59.04, p < 0.001$]. Using the hypothesis test as the unit of analysis, a search for variables that might alter the illuminance–performance relation was performed. (Such a search may seem appropriate only when effect sizes are significantly heterogeneous, which suggests that some key variable is acting as a moderator, but Mullen (1989, pp. 102–103) argues that moderator searches should be undertaken even in the absence of significant heterogeneity if the meta-analyst has a theory-driven reason for looking.) The relations between effect size and six potential moderators (illuminance levels compared, type of lighting used, nature of the performance task, amount of time the participants were given to adapt to the experimental environment, age of the participants, and date of the study) were examined. As Rosenthal (1991) and others recommend, these tests were weighted by sample size on the assumption that studies employing larger samples yield more stable and accurate effect sizes and therefore deserve greater weighting.

Four moderators (type of lighting, type of task, age of the subjects, and date of the study) did not significantly alter the illumination–performance relations. That is, approximately the same effect size would hold across the variations of these aspects of the context that were examined in the studies included in this meta-analysis. The results for two potential moderators were more interesting.

1. *Illuminance level contrasts.* Three types of illuminance level contrasts were identified: contrasts between performance under (1) high versus low, (2) medium versus low, and (3) high versus medium levels of illumination. The moderation question here is whether the size of the contrast would influence the effect size found. In general, one would certainly expect that it would: Comparing, say, 1000 lx with 1100 lx would not likely yield much of an effect size, whereas comparing 10 lx with 1000 lx would likely yield the near-maximum effect size associated with the light quantity–performance relation.

In this study, the average effect size was 0.25 ($k = 16$) for hypothesis tests involving high versus low contrasts, 0.14 ($k = 13$) for tests of medium versus low contrasts, and 0.19 ($n = 2$) for high versus medium contrasts. Focused comparisons of these contrasts (i.e., medium-low versus medium-high contrasts, medium-high versus high-low contrasts, and medium-low versus high-low contrasts) yielded Z s of 0.32, 1.60, and 1.58, respectively.⁴

⁴In general, analyses of independent variables (IVs) that are naturally continuous should treat them as continuous; to categorize naturally continuous variables, such as lighting levels, is to

The first is clearly not significant; the latter two have p s of 0.055 and 0.057. Apparently, low (average of 70 lx) versus medium (average of 468 lx) levels of lighting make little difference in performance, but higher levels (average of 1962 lx) produce (marginally) significantly greater performance than that produced by low and medium levels. The suggestion is that the light quantity–performance relation is not the smooth, linearly increasing one suggested by the overall effect size (r) of 0.18, but may contain a “step” or sudden increase between medium and higher light levels.

2. *Adaptation time.* The hypothesis tests were grouped into three categories: (1) those involving a 15-minute adaptation period, (2) those involving 2- to 5-minute adaptation period, and (3) those with no reported adaptation period.⁵ The mean effect size was 0.14 ($k = 6$) for the 15-minute group, 0.13 ($k = 3$) for the 2- to 5-minute group, and 0.23 ($k = 22$) for the group of tests with no reported adaptation period. Thus, the effect size for no reported adaptation period is larger than for brief or longer adaptation periods. When effect sizes were *not* weighted by sample size, they were 0.22, 0.13, and -0.01 , respectively. Either way, a trend toward smaller effect sizes with increasing adaptation time is apparent. More studies that report and/or vary the adaptation period would increase confidence in this result.

To determine whether the relation between illuminance and performance was significant for each level of adaptation time, a new set of combined probabilities were computed. The combined results were significant for all three levels: tests with no reported adaptation period ($p < 0.001$, $FSN = 231.39$), tests reporting 2- to 5-minute adaptation periods ($p < 0.001$, $FSN = 10.71$), and tests reporting a 15-minute adaptation period ($p < 0.001$, $FSN = -1.84$). Thus, the relation between illuminance and performance holds *within* each group of hypothesis tests concerning adaptation period (rs of 0.23, 0.14, and 0.13) as well as for the entire sample of them ($r = .18$).

DISCUSSION

The results of the meta-analysis clearly support the hypothesis that more illumination leads to greater performance of office tasks. In Cohen's (1988) terms, the effect is between small and medium in size. In practical

discard useful information. However, recall that our hypothesis specifically aimed to compare the three categories of lighting levels that IESNA uses in its handbook; hence our decision to compare categories. Nevertheless, we did create a continuous variable to determine whether, in this case, the result we report changed. This might be done in any of several ways. Because comparisons rather than absolute lighting levels are used in these analyses, we chose to create a continuous variable by subtracting the lower from the higher lighting level used in each study. Varying light level differences could then be correlated with performance variations. The r in this exercise was 0.18 (ns), so in this instance treating the IV as a continuous variable did not alter the results.

⁵Note that the collection of tests in the latter category may include studies that did not utilize an adaptation period and also studies that used an adaptation period but failed to report doing so.

terms, the results suggest that with a shift from low lighting (around 70 lx) to medium lighting (around 450 lx), office productivity would increase by about 14%. A shift from 450 lx to about 2000 lx would mean an increase of about 19%. An increase from about 70 lx to about 2000 lx would suggest an increase of about 25%.

Two important qualifications must attend these conclusions. First, the causal form of the statements just made depends on the degree to which the studies included in the meta-analysis met standard criteria for the attribution of causality, such as random assignment of participants to conditions and experimenter control of independent variables.

Second, the moderator analysis suggests that when subjects are given more time to adapt to the experimental conditions, the relation between illuminance and performance declines slightly. Most office workers, of course, spend extended periods at work. In the real world, the adaptation period is built into the workaday schedule, a fact often overlooked in brief experiments. Thus, rather than justifying high illuminances in offices, the results of our meta-analysis may imply that lower illuminances in offices would not impair performance.

This is the place for a related plea. Research on the lighting–performance issue is not as sparse as it might appear from this review. The problem is that numerous studies that we located could not be included because reports failed to include very basic information such as basic descriptive or primary-level inferential statistics. Even the classic Hawthorne studies are guilty of this. Authors, please report means and standard deviations, sample sizes, F , t , and χ^2 values. Reviewers and editors, insist that authors do so.

IMPLICATIONS FOR FUTURE THEORY, METHODS, RESEARCH, AND UTILIZATION

Why does more light lead to more productivity? If adaptation reduces this effect, why? The arousal explanation offered when the hypotheses were advanced (cf. Gifford, 1988) is consistent with both patterns. Arousal increases human performance in many activities, particularly when (1) arousal moves from low to medium levels and (2) the task is not particularly difficult. Routine office conditions typically fit both these provisos. After humans adapt to a higher level of stimulation, however, performance may not increase as quickly.

What might this mean for lighting practice, if further research confirms these findings? Simply increasing illumination may have only short-term gains, while costs of the increased illumination would remain higher. Leaving illumination levels low may not allow for at least short-term increases in performance. One possibility is to vary light levels with the established activity patterns in the office: Move them higher during slow times, and reduce them when the office is already humming.

The design literature is replete with wistful statements about data banks for design. Through centralized repositories, the dream is to somehow avoid reinventing the wheel. What is usually missing from the dreams is a mechanism for actually integrating the design studies that have been contributed. Assuming that postoccupancy evaluations have at least simple numeric measures, such as satisfaction ratings, meta-analysis can be that mechanism. It is admirably suited to summarizing the results of POEs or comparing a sample of designs with feature X with another sample of buildings with feature Y. It will say not only which is better, but also how much better it is.

Similar practical advantages can result from a meta-analysis involving EB processes. What is the size of the effect on satisfaction associated with moving from an open plan office into one with four solid walls? How much greater is a person's sense of control when room temperature is regulated by occupants of a room rather than someone or something a few rooms or buildings away? (Incidentally, in the province where we live, the temperature in government offices several hundred miles from the capital city is controlled from headquarters by a computer program.)

Theory, research, and practice should (and sometimes do) form an intimate circle. If our finding that increased light levels do enhance office performance is confirmed, it will change both lighting practice and theory. If design practice changes because of artistic, economic, or technological forces, meta-analysis can evaluate the behavioral and psychological effects of those changes. Advances in design or EB theory have in the past and will again alter design practice; once more, properly executed meta-analyses will produce excellent measures of the nature and magnitude of those changes.

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Moderating and Mediating Processes in Environment–Behavior Research

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Many environment–behavior (EB) researchers are interested in the effects of the physical environment on human behavior. However, many researchers appreciate the theoretical and methodological importance of scrutinizing other variables that can intercede in the EB relation (Evans & Cohen, 1987; Moore, 1988; Wachs, 1986; Wohlwill, 1983). Typically, one speaks of other variables that can *moderate* or *mediate* EB relations. Moderator variables are “third” variables that *alter* or *qualify* EB relations. In contrast, mediator variables interpret, or *explain*, EB relations.

The goal of this chapter is to describe some of the conceptual and analytic implications of the distinction between moderator and mediator variables in the field of environment and behavior. We provide examples of these unique processes and discuss the analytic requirements of testing the processes. In addition, we highlight methodological prerequisites for studying moderation versus mediation. Finally, we discuss causal interpretation in moderator and mediator models, respectively.

The terms moderator and mediator are often used interchangeably in the literature, reflecting an underlying confusion about the distinction be-

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tween moderator and mediator variables and their roles (Baron & Kenny, 1986). Moderation and mediation, however, are quite distinct processes, and theory often presupposes one or the other type of process in linking human behavior to environmental factors. Furthermore, because there are different analytic requirements for testing the unique processes of moderation versus mediation, certain methodological prerequisites should be adhered to in designing studies that specify either (or both) moderating and mediating processes in EB research. Thus a clear understanding of the distinction between moderating and mediating processes can inform research design and measurement approaches.

The distinction between moderator and mediator functions of variables also might guide more exploratory, or post hoc, analyses of data. For example, testing potential moderating effects of variables might reveal certain subsamples that are particularly vulnerable or resilient to environmental factors. Such findings might lead investigators to further posit situational or personal factors that can explain the subgroup differences. Alternatively, such findings may guide future research on why/how the EB link is conditional. Moderation findings can also have useful policy implications by identifying "at-risk" populations (Wohlwill & Heft, 1987).

Tests of potential mediators can be similarly fruitful. For example, two factors that appear to be outcomes of an environmental factor may be causally linked. Thus, environmental factor A may be observed to influence outcomes B and C. Mediation analyses might reveal that A only influences C through its effects on B, thus providing a potential explanation of the effects of A on C (Moore, 1988; Wachs, 1986).

MODERATION

TYPES OF MODERATION

For ease of presentation, this discussion will begin with three-variable examples of moderation. These variables include an independent (usually environmental factor), dependent (usually a behavioral or psychological factor), and a third, or moderator, variable. We recognize, however, that higher-order moderator effects (i.e., multiway interactions) can be specified. We discuss these more complex models later in the chapter.

In its basic form, a *moderator variable* is one that interacts with an independent variable to influence an outcome. Schematically, this relation can be depicted as in Figure 1. This figure suggests that the EB relation is dependent upon, or conditioned by, the presence of a moderator variable. This can be interpreted in a variety of ways depending upon the specification of the moderator function. There are four typical types of moderator functions:

1. The environment affects behavior in opposite ways for different levels of the moderator (crossover interaction).

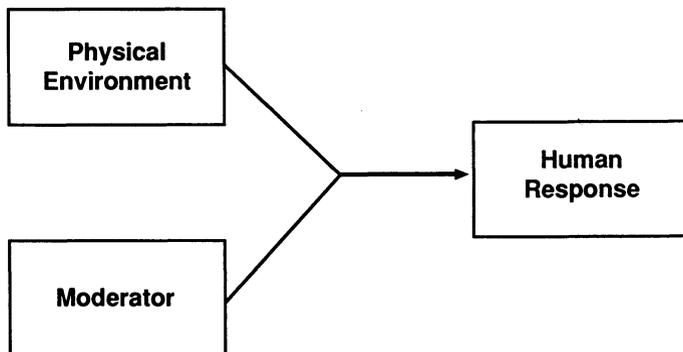


FIGURE 1. A schematic diagram of a moderating process.

2. The relation between the environment and behavior is stronger (amplification effect) at one level of the moderator than at another level.
3. The relation between the environment and behavior is weaker (attenuation effect) at one level of the moderator than at another level.
4. The environment only has an effect in the presence of the moderator.

An example of each of these types of moderator processes follows. For more details on the analytical procedures for testing moderators, see Appendix A.

The first type of moderator function, which results in opposing relations between the environment and behavior for different subgroups, is rarely observed. Analytically, this type of effect is known as a crossover, or disordinal, interaction. Plotting the relation between the environment and behavior for different levels of the moderator should result ideally in two overlapping lines, or at least two lines sloping in opposite directions. For example, higher levels of environmental stimulation may be associated with greater preference for individuals who are high sensation-seekers, whereas the opposite pattern would be predicted for the subset of individuals who are low sensation-seekers (Figure 2; Mehrabian & Russell, 1970). In this example, the individual tendency to seek out high versus low levels of sensation moderates the relation between levels of ambient stimulation and preference.

The importance of equal cell sizes across levels of the moderator can be understood in the context of the preceding example of a crossover interaction. Specifically, a disproportionately large number of high sensation-seekers in a sample could obscure the interaction effect and lead to an erroneous conclusion that greater levels of ambient stimulation increase preference.¹

The second and third types of moderator functions specify subgroups that are more (or less) strongly affected by the independent variable than other subgroups. The moderator variable defines the subgroups on the basis of such factors as personal traits or attributes (e.g., gender, race, neurot-

¹See Broadbent (1985) for an additional discussion of the importance of equal cell size in factorial designs.

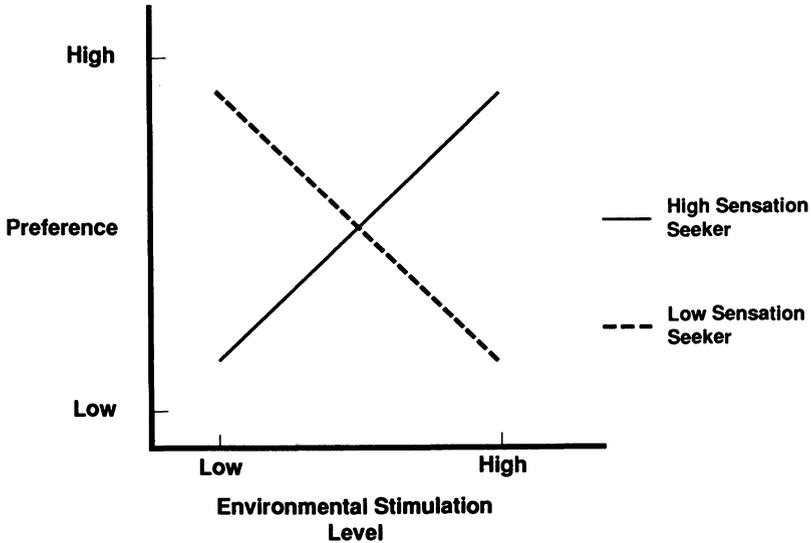


FIGURE 2. An illustration of a disordinal (crossover) interaction.

icism); sociocultural context (e.g., social class, culture); physical environmental factors (e.g., residential density, degree of privacy); or psychosocial factors (e.g., availability of social support, exposure to stressful life events). A positive interaction indicates an amplification effect, whereas a negative interaction indicates an attenuation effect of a moderator. Amplification and attenuation effects are observed often in environmental stress research.

As an example of a positive, amplifying interactive effect, noise appears to heighten physiological arousal. The addition of physically or cognitively demanding tasks appears to significantly amplify the arousal-inducing properties of noise (Evans & Cohen, 1987; see Figure 3).

As an example of an attenuating interactive effect, Lepore, Evans, and Schneider (1991) observed that under relatively short durations of crowded living (2 months), the positive relation between crowding and psychological distress was weaker among individuals with high levels of perceived social support than among individuals with relatively low levels of perceived social support. Thus social support appears to have attenuated, or "buffered," the effects of relatively short-term crowding on psychological distress.

In instances of amplification or attenuation effects of moderators, the independent variable effects the outcome in a constant direction (positive or negative), but the strength of the relation depends on the level of the moderator variable. In contrast, a fourth type of interaction is indicated by an effect of the independent variable only at one level of the moderator (e.g., present/absent; high/low). In other words, the moderator acts as a trigger or on-off switch. For example, Evans, Jacobs, Dooley, and Catalano (1987)

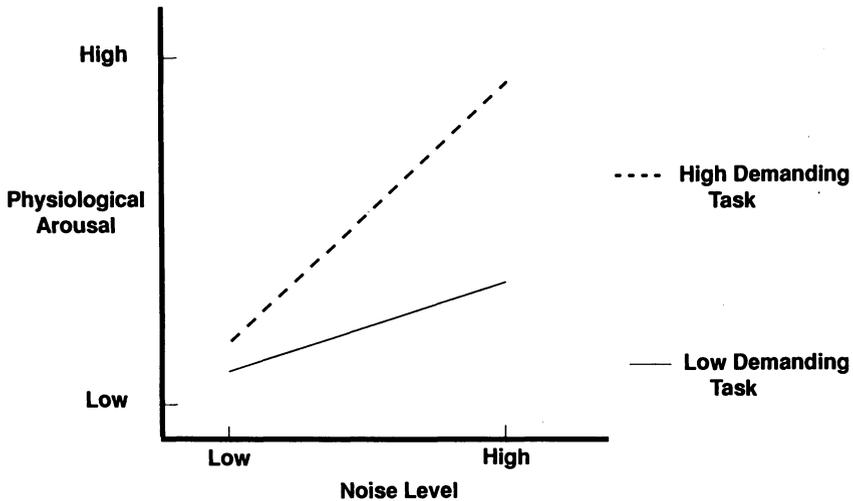


FIGURE 3. An illustration of an amplification or potentiation interaction.

found that exposure to higher levels of pollution was associated with greater levels of psychological distress in individuals who had recently experienced other stressors (e.g., familial and financial strains) but not among individuals who had not recently experienced additional stressors. Stressful life events appeared to have triggered individuals' reactions to air pollution: Air pollution was associated with higher levels of psychological distress only among individuals who had exposure to both air pollution *and* stressful events. An idealized representation of an on-off interaction is depicted in Figure 4.

The moderating effects of stressful events on the pollution-distress relation illustrate how moderator variables can qualify findings or explain unexpected findings. Counter to the expectation of many environmental groups and environmental researchers, empirical studies have revealed that air pollution has a negligible or nonexistent association with mental health among representative samples of the public (Evans, Colome, & Shearer, 1988). However, on the basis of Evans and colleagues' (1987) data it would be incorrect to assume, theoretically or with regard to policy, that air pollution is irrelevant to mental health. Rather, the evidence suggests that for certain subgroups of people (e.g., those under high stress), air pollution can adversely affect mental health.

The finding that air pollution levels predict psychological distress only among the subset of individuals facing other stressful events may also help explain why air pollution has negligible effects on mental health in general population sample studies (Evans & Jacobs, 1982). Stressful life events are rather infrequent in the general population (Lazarus & Folkman, 1984), thus diminishing the probability of sampling individuals who have experienced

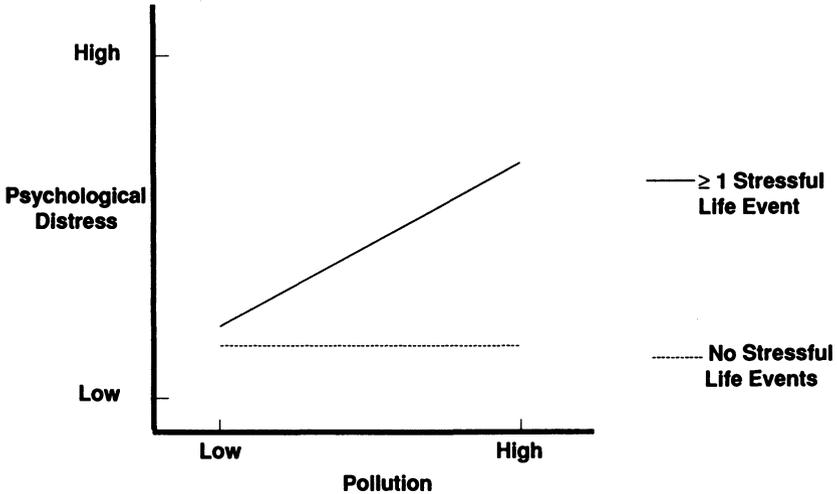


FIGURE 4. An illustration of an on-off interaction.

both stressful life events and high levels of pollution. Under such conditions, it is understandable that in the general population the adverse psychological consequences of air pollution would be obscured. To observe whether stressful life events can trigger adverse psychological reactions to air pollution, it would be necessary to oversample individuals experiencing stressful life events. If the alternative approach, simple random sampling, is used, then very large numbers of respondents would have to be sampled to find a significant moderating effect of stressful events on pollution. This would be the case in most situations in which the moderator was a low frequency event, trait, or situation.

The preceding examples illustrate how the behavioral effects of environmental factors can be moderated by some other variables. However, environmental factors themselves can be moderators. For example, we have observed that the relation between daily hassles (a psychosocial stressor) and psychological distress is stronger among individuals from crowded homes than among individuals from relatively uncrowded homes (Lepore, Evans, & Palsane, 1991). That is, crowding appears to increase the negative effects of social hassles on psychological distress. In addition to a psychosocial and a physical variable interacting to affect health or well-being, two physical variables can interact. Perhaps the most commonplace example is the interactive effects of temperature and humidity on thermal comfort (Bell & Greene, 1982).

In conceptualizing moderators of the human-environment relationship, we can thus consider several different types of constructs that may alter this relation. Personal factors, psychosocial characteristics of the setting, or other

physical parameters can function to change the central environment-behavior relationship under scrutiny. It is also possible for various combinations of more than one moderator variable to interact with the physical environment to change human behavior. Higher-order moderation is discussed in the next section.

HIGHER-ORDER MODERATION

Higher-order moderator effects subdivide environmental effects into increasingly specific qualifications. The following hypothetical example suggests the complexity of studying multiple moderators, or higher-order interactive effects. Control in the workplace may moderate the adverse health effects of hazardous work environments. One way that greater job control might protect individuals from health hazards at work is to increase their ability to avoid hazards or to develop other viable coping strategies. Thus, people exposed to health hazards at work will have fewer health problems if they have high control than if they have low control. Job experience, however, might further moderate the interactive effects of workplace hazards and job control on health. For example, job control might only moderate the adverse health effects of work hazards after workers have had enough time to develop effective coping strategies (Frese, 1989). In other words, the moderating effects of control on work hazards and health are moderated by work experience (see Figure 5). Thus, perhaps only a very select group of workers, those with high control and time on the job, will be resilient to work hazards.

Individual differences in reactions to a particular environmental condition could also be influenced by the larger social and environmental context in which the individual lives (Cohen, Evans, Stokols, & Krantz, 1986; Stokols, 1987). Contextualism indicates higher-order, multiplicative effects from a network of interacting physical and sociocultural factors. Michelson's (1976) analyses of social class and life stage differences in reactions to different combinations of various urban structural characteristics (e.g., areal density, physical proximity to friends/kin, housing type) illustrate how contextual variables can modify the interactive effects of urban structural characteristics on health or well-being.

MEDIATION

TYPES OF MEDIATION

In moderator processes, it is ideal for the predictor and the third variable (moderator) to be independent (i.e., slight or no correlation). In contrast, *mediator models* specify an interdependent (i.e., correlated) relation between the predictor and the mediator. More specifically, the independent variable influences the mediator predictor variable, which, in turn, influences the

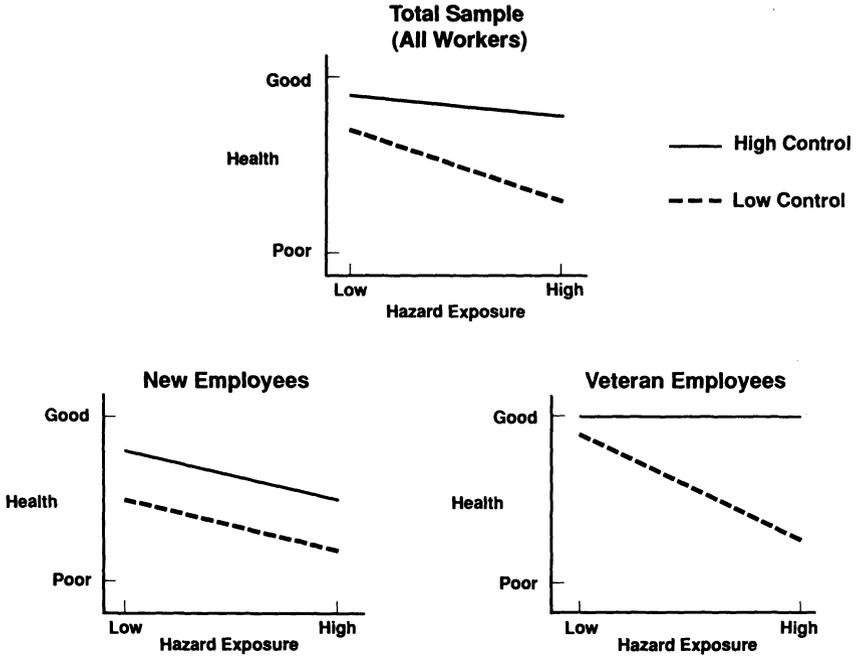


FIGURE 5. Higher-order moderation: In the total sample, higher work hazard exposure is somewhat associated with poorer health, but only among workers with low levels of job control. However, when the sample is further divided into new and veteran workers, the moderating effect of control on the hazard–health relation operates strongly for veteran workers only.

dependent variable. The mediator represents or is a measure of an intervening construct (see Figure 6). In a mediation analysis the focus is on describing the pathway from the environment to a human response.

There are two simple types of mediator functions:

1. The mediator fully explains the EB relation
2. The mediator partially explains the EB relation

An example of these two mediator processes follows. For more details on the analytic procedures for testing mediators, see Appendix B.

In the first type of simple mediator function, the EB relation is entirely *indirect*. An example of *full mediation* can be found in a study on crowding

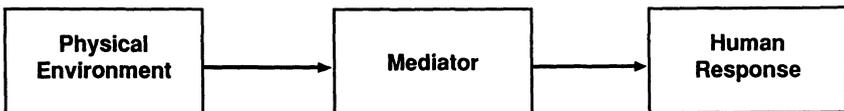


FIGURE 6. A schematic diagram of a mediation process.

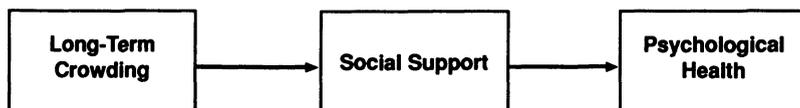


FIGURE 7. A mediation model of crowding and psychological health.

among male heads of household in India (Evans, Palsane, Lepore, & Martin, 1989). Men who had been living in crowded households for an average of 8 years perceived that they had less social support available to them than their counterparts who had been living in less crowded homes. The lower levels of social support among crowded residents, in turn, accounted for that group's higher levels of psychological distress relative to the uncrowded group. Mediation was demonstrated by showing that the positive association between crowding and psychological distress disappeared after partialling out the effects of social support. This analysis suggested that the pathway through which long-term crowding influenced psychological functioning was through its adverse effects on social support (Figure 7).

The second simple mediator function, *partial mediation*, occurs when an environmental factor has both direct and indirect (mediated) effects on a human response. As an example of this, Lepore and Evans (1991) found that chronic (lasting 8 months) residential density had direct effects on social support, as well as indirect effects through its influence on social withdrawal. Specifically, higher density was associated with lower social support from housemates, and higher density was associated with greater levels of social withdrawal from housemates, which, in turn, also predicted lower levels of social support from housemates. Partialling out the effects of social withdrawal substantially reduced the density–social support association, but density still remained significantly related to social support after partialling out the effects of social withdrawal. In other words, chronic residential density had both direct and indirect effects on social support (Figure 8).

Identifying variables that fully explain the relation between an environmental factor and a human response is rare. The more typical situation is identification of variables that only partially explain the EB relation. This is not surprising. Environmental variables frequently exert multiple influences on human behavior, and some of these effects may operate through different intervening factors (Moore, 1987). For example, the introduction of video display terminals (VDTs) into the workplace may reduce clerical workers' skill discretion, increase social isolation, and heighten feelings of monitoring and control by management (Johansson & Aronsson, 1984). These various processes could serve as psychosocial mediators of some of the suspected health and psychological effects associated with prolonged VDT use.

Alternatively, the physical environment may serve to mediate psychosocial variables. Wachs (1990), for example, found that the effects of social

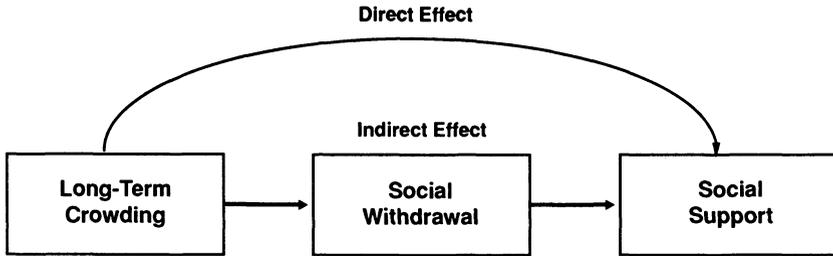


FIGURE 8. A schematic diagram of direct and indirect mediation processes.

characteristics of the home environment (e.g., parental responsiveness) on infant's play behaviors appeared to be mediated by physical factors in the home environment (e.g., noise, variety of toys and objects). Issues of whether the physical environment mediates effects of psychosocial environmental characteristics on behavior or whether physical environment effects on behavior are mediated by psychosocial variables are important and neglected theoretical and empirical issues (Moore, 1988; Wachs, 1990; Wohlwill & Heft, 1987). Moreover, EB relations often can be further reduced, revealing more complex micromediation processes. Such processes are discussed in the next section.

MULTIPLE MEDIATION

A variety of multilink, mediational processes can be specified by researchers in order to fully model EB relations. For example, in the India crowding study discussed earlier, we suggested that the chain linking crowding to social support to psychological distress can be extended by attempting to explain the inverse association between crowding and social support. We further argued that one reason that social support might deteriorate under crowded conditions is that people may socially withdraw as a way to cope with the unwanted social interactions and stimulation that can accompany crowding. As noted, subsequent research has provided only limited empirical evidence for the validity of this latter model (Lepore & Evans, 1991) because the effects of density on social support were only partially mediated by social withdrawal (see Figure 8).

Although causal reductions can continue ad nauseam, there is a practical side to micromediation analyses. Researchers interested in controlling human responses to environments, or policy-makers intervening to counteract some pathological consequences of environmental exposures, may not be able to alter the environment or a known mediating factor. In such situations, it might be more cost-effective to identify another link in the causal chain and to intervene at that link. Using chronic crowding as an example, it may be too costly or otherwise impossible to move people out of crowded

settings. Therefore, we might try to understand what it is about crowded environments that bring about the major undesirable consequences. We might discover that changes in social interaction patterns (e.g., withdrawal, diminished social support) explain one major undesirable consequence of chronic crowding, elevated psychological distress. There are now two variables—withdrawal and social support—that might be controlled in order to alleviate some of the adverse psychological consequences of chronic crowding. One might envision architectural modifications that interfere with the social process as one partial remedy for overcrowded residences. Moreover, we can speculate that if crowded residents learned to substitute another coping strategy (e.g., negotiation of space in the crowded environment) for withdrawal, then social support might not degenerate and leave people psychologically vulnerable.

RIVAL HYPOTHESES OF MEDIATOR PROCESSES

The analytic approach for testing mediation processes is correlational, rendering causal interpretations problematic. Four problems—reverse causality, reciprocal causation, feedback, and spuriousness—challenge our ability to model theoretically specified mediation processes. These problems are likely to arise frequently because interesting EB relations are not always as straightforward as those discussed thus far. Instead, we are sometimes faced with multicausal, nonrecursive associations between variables (Altman & Rogoff, 1987; Canter, 1977, 1991; Kessler, 1983, 1987; Moore, 1987, 1988; Proshansky, 1976).

Reverse causality occurs when the outcome affects the mediator, instead of the mediator affecting the outcome. For example, in looking back at the density, social support, and psychological distress example discussed earlier, perhaps density directly affects psychological health, which, in turn, diminishes social support. There are two general methodological strategies for dealing with reverse causality: prospective, longitudinal designs or cross-lagged panel designs. These are discussed in Appendix B.

Identifying or ruling out reciprocal causation between the outcome and the mediator presents a greater challenge than does reverse causation. Reciprocal causation occurs when the relation between the mediator and the outcome is bidirectional—the arrow between the mediator and the outcome points in both directions (see Figure 9). That is, the presumed mediator and outcome, respectively, affect one another. The aforementioned crowding, social support, and psychological distress model might reflect such a reciprocal causation process. As support diminishes under the press of chronic residential crowding, psychological distress increases. At the same time, increased psychological distress deteriorates social support among housemates. See Appendix B for a brief introduction to analyzing reciprocal causation.



FIGURE 9. A schematic diagram of reciprocal causation in a mediational model.

Another complex problem with mediational models is feedback. Feedback occurs when the mediator is affecting the outcome but changes in the outcome are, in turn, feeding back into the predictor (see Figure 10). People may respond to environmental conditions by modifying the environment according to their needs, purposes, or preferences. Such environmental alterations create new conditions in settings that subsequently affect behavior (Canter, 1977, 1991; Stokols, 1978, 1987). In the beginning of this chapter, we treated the environment primarily as an independent variable and human behavior as a dependent variable. With feedback processes the logic of mediation is the same, but the systems of operation include dynamically changing independent and dependent variables.

A potential type of cyclical, feedback-mediational process might explain littering behavior. The presence of trash on the ground may lead people to litter more (Geller, Witmer, & Tuso, 1977). The mediator could be feelings of alienation or disengagement from the environment. When people enter into a setting and see trash, perhaps they feel alienated and thus are more inclined to litter in that setting. The presence of litter, in turn, leads to more litter and trash in the setting. Canter's (1977, 1991) work in particular has emphasized the active, purposive use of settings. This perspective implies that normative, EB relations will be cyclical with multiple, feedback loops. Time series analysis of longitudinal data with multiple sampling points is one appropriate technique to analyze this type of process (Gottman, 1981; McCleary & Hay, 1980).

Spuriousness is another complication that can arise in mediational models. Spuriousness occurs when some unspecified variable influences the antecedent variable and the mediator, the mediator and the outcome, or all

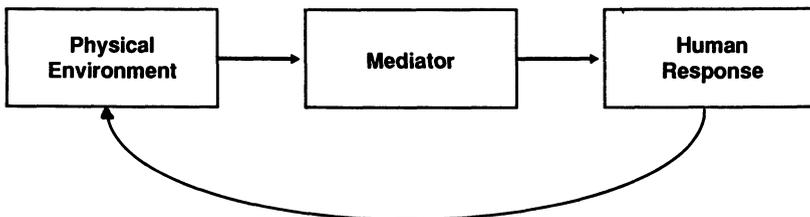


FIGURE 10. A schematic diagram of feedback in a mediational model.

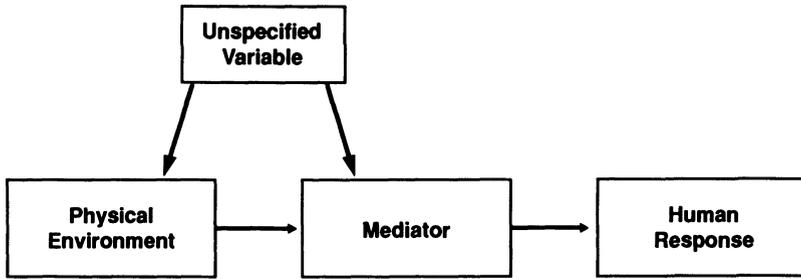


FIGURE 11. A schematic diagram of one type of spuriousness (see text for discussion of other types of spuriousness).

three. An example of the first type of spuriousness is shown in Figure 11. Spurious relations could look causal, when in fact associations between the variables of interest are an artifact of shared variance with another unspecified variable. For example, poverty might create a spurious relation between household crowding and social support. Poorer people may be forced to live in crowded homes and may also have less social support. Thus, an association would exist between crowding and social support that is simply an artifact of the underlying factor of poverty.

The best way to deal with spuriousness is to anticipate potentially spurious factors and build them into one's design and analysis. Of course, spurious factors are not always a priori specifiable. Partial solutions to the problem of spuriousness are outlined in Appendix B.

MIXING MODERATORS AND MEDIATORS

MEDIATED MODERATION

When we uncover differential sensitivity between persons to variation in environmental conditions or when we demonstrate multiplicative effects of two or more environmental conditions on human behavior, such interactive findings ought to encourage follow-up studies to explain why or how the interaction occurred. Such a search is for intervening, mediating processes that may account for the interaction. An interesting and often overlooked question when significant moderator effects are detected (i.e., statistically significant interaction) is what underlying process might explain the interaction. For example, it is possible that home ownership or length of residence interacts with certain neighborhood-scale planning variables (e.g., cul de sacs) to produce lower crime rates. This interactive effect could be explained by increased neighborhood vigilance and feelings of territorial control (Altman, 1975; Brown, 1987).

Probably the most in-depth analyses of explanatory processes for a

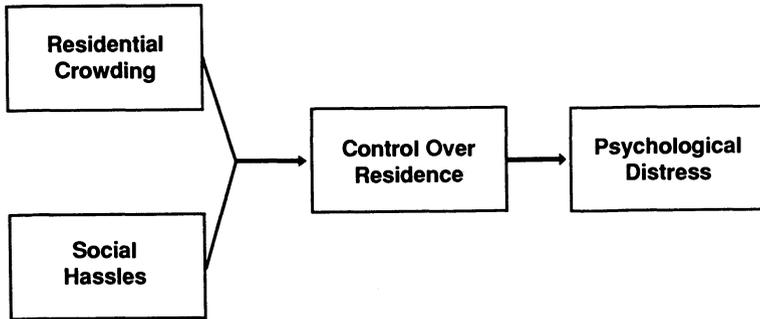


FIGURE 12. A schematic diagram of mediated moderation.

significant interactive effect have occurred in the social support and stress literature. The well-documented buffering effect of social support on relations between stressors and psychological distress (many stressors only have a negative psychological impact when social support is low or absent; Cohen & Wills, 1985) has generated an enormous amount of research to explain why and how social support apparently ameliorates the harmful effects of stressors on well-being. For example, psychological benefits of support might result from its effects on subjective appraisals of stressors, choice of coping strategies, or feelings of self-esteem and personal mastery (Cohen & Willis, 1985; Thoits, 1986). Figure 12 shows a schematic diagram of mediated moderation.

The same analytic approach applies to testing for mediated moderation as discussed earlier under mediator models of EB relations. One partials out the contribution of the hypothetical mediator to the association between the interactive term and the outcome. For example, in two distinct samples we found that domestic-social hassles were more strongly related to psychological distress for people living in crowded residences than for people living in relatively uncrowded residences (Lepore, Evans, & Palsane, 1991). That is, density appeared to moderate the effects of daily hassles within the home on psychological distress. In a secondary analysis of the hassles-by-crowding interaction, we found that the interactive effect disappeared after statistically adjusting for the effects of perceived control over the residential environment (Lepore, Evans, & Schneider, 1992). On the basis of this finding, we argued that hassles in crowded homes lowered individuals' perceived control because crowding constrains one's ability to avoid or escape from the hassles. Lower levels of control, in turn, could have increased psychological distress. Thus our analysis showed how a construct, perceived control, mediated the interactive effect of residential density and social hassles on psychological distress.

Another potentially fruitful application of mediated moderation analyses might be attempts to explain person-by-environment interactions.

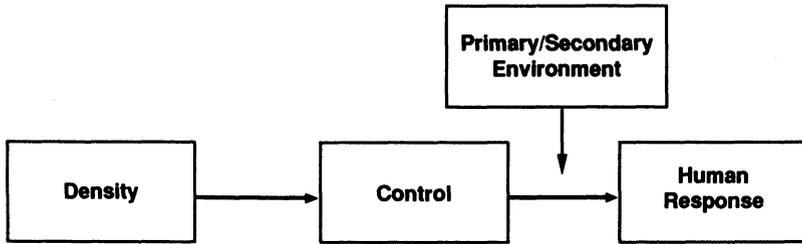


FIGURE 13. A reformulation of Stokols's (1976) primary / secondary theory of crowding in terms of moderated mediation.

The concept of individual differences (e.g., gender, personality, culture, stage in life cycle) in sensitivity to environmental conditions holds a central place in human–environment relations theory (Evans & Cohen, 1987; Moore, 1987). Yet there have been relatively few critical analyses of underlying models or processes to explain person-by-environment interactions. As an example, gender differences in reactions to occupational stressors may reflect variable resiliency caused by endocrinological status. Differential risk to suboptimal design as a function of stage in the life course might be explained by changes in control. More thought and empirical research on explanatory mechanisms for individual differences in EB relations is needed.

MODERATED MEDIATION

In addition to mediated moderation, moderated mediation also might be explored. In moderated mediation, each of the separate pathways, as depicted in Figure 6, would change as a function of some moderator variables. As shown in Figure 13, Stokols's (1976) theory of primary and secondary crowding can be cast in the moderated mediation framework. The intervening mechanism that accounts for the impacts of high density on human behavior may differ as a function of the type of environment. In the home or other primary setting, high density may disrupt the regulation of social interactions, resulting in undesirable consequences related to helplessness and loss of control over the environment. In secondary environments, interference with social regulation might be of lesser importance, perhaps because expectations or desires for control over the environment are less salient.

MODERATOR TO MEDIATOR SHIFT

Variables that intercede between the environment and behavior may occasionally shift in their status from a moderator to a mediator, or vice versa. For example, Lepore, Evans, and Schneider (1991) found that during

the first few months of occupancy, social support among housemates buffered individuals from the adverse psychological effects of household crowding. That is, social support was a moderator. However, after a period of approximately 8 months, social support was no longer a moderator of the crowding–distress relation. Moreover, higher household crowding was associated with lower levels of social support, which, in turn, were associated with higher levels of psychological distress. That is, social support became a mediator of the crowding–distress relation. This example not only illustrates how a variable can shift its role from a moderator to a mediator, but also demonstrates the conceptual importance of considering the temporal dimension in EB research (cf. Stokols, 1988).

IMPLICATIONS FOR FUTURE THEORY, METHODS, RESEARCH, AND UTILIZATION

There are several important conceptual implications of the moderator–mediator distinction for EB researchers. Confusion about moderator and mediator models of human–environment relationships has led to misspecification and incomplete testing of theory. For example, crowding researchers have posited control as an underlying, generative mechanism that might mediate or explain the negative consequences of high-density environments (Baron & Rodin, 1978; Schmidt & Keating, 1979). Yet this model has been tested primarily by looking at interactions between control and density. That is, levels of control have been shown to moderate or buffer the harmful effects of crowding (Langer & Saegert, 1977; Rodin, Solomon, & Metcalf, 1978; Sherrod, 1974), and individual differences in control-related beliefs also appear to interact with crowding (Baron, Mandel, Adams, & Griffen, 1976; McCallum, Rusbult, Hong, Walden, & Schopler, 1979). These results do *not* show that density causes low control or that the effects of density on behavioral outcomes are mediated by levels of control. Other studies have shown, more directly, that higher density is associated with reduced control (Baron et al., 1976; Rodin, 1976) and that the link between density and pathology is mediated by control (Fleming, Baum, & Weiss, 1987).²

A moderator analysis cannot directly test for an underlying, generative mechanism. A significant interaction finding can, however, allude to the operation of an underlying mediation process. For example, data showing that people with high needs for control respond more negatively to crowding in comparison to those with low needs for control (Burger, Oakman, & Bullard, 1983) certainly suggest that control-related processes may be an important underlying aspect of the density–pathology link.

²See Evans and Lepore (1992) for a critical analysis of the crowding literature in light of conceptual and analytical distinctions between moderator and mediator models.

We need to expand our thinking about the myriad ways in which the physical environment and behavior can be linked by considering different constellations of physical and psychosocial variables that can intercede in the EB relationship. Contextualism (Cohen et al., 1986; Stokols, 1987), for example, implies examination of the interacting effects of different settings on human health and behavior. Behavior in any given setting may be influenced by the permeability of the boundaries of the setting and its proximity to others, the spatial and temporal extent of participants' activity patterns, and the larger, sociopolitical context in which the setting is embedded (Michelson, 1976; Saegert & Winkel, 1990; Stokols, 1988). Noise exposure in one setting (e.g., school) interacts with exposure in another setting (e.g., home) to potentiate negative effects on children's reading skills (Cohen et al., 1986). Stress at work may "spill over" into the home, increasing tension and possibly increasing risk for disease (Eckenrode & Gore, 1990; Frankenhaeuser & Johansson, 1986). The clarity of setting boundaries and their permeability is an important and largely neglected theoretical concept that follows from the idea of treating other proximal physical settings as moderators of the particular environmental condition under examination (Bechtel, 1977; Stokols, 1987; Winkel, 1987).

More subtle implications of contextualism emanate from Brunswik's (1956) concept of probabilistic functionalism. When we isolate an environmental variable either experimentally or through analytic procedures, crucial moderators of the environment's impacts on human behavior may be eliminated. The isolated, decontextualized variable may no longer have any effects on behavior because it is no longer operating within its functional context (Petrinovich, 1979). This issue is particularly salient in occupational settings. Unfortunately, many ambient stressors at work coincide. Noise, vibration, high temperatures, and poor air quality often coexist in certain manufacturing processes, and recent evidence suggests that they have synergistic effects (Manninen, 1990). Some of the problems with open office settings may be created by the interactive effects of noise, crowding, lack of privacy, and certain ergonomic problems related to workspace configurations and, more recently, VDT use (Sundstrom, 1986; Wineman, 1982). Probably the most dramatic examples of the importance of multiple, environmental interactive effects come from the field of toxicology. Numerous agents are only toxic in the presence of another agent and vice versa.

Winkel (1985, 1987) discussed another subtle implication of decontextualizing environmental variables. Random assignment of persons to experimental conditions can inadvertently uncouple a target environmental variable from its natural ecological context. Self-selection into settings and the accompanying personal characteristics, purposive goals, and action plans may be an inextricable component of the EB interface (Canter, 1977, 1991). Self-selection out of settings (i.e., subject attrition) can be equally meaningful (Cohen et al., 1986; Winkel, 1987).

Insufficient thought about mediating processes also can lead to incor-

rect assumptions about the importance of an environmental variable on health and behavior. Many studies of stress and cardiovascular health control for smoking since this variable is a standard risk factor for disease. However, what if stress causes greater smoking (or reduced exercise, different dietary habits, etc.), which in turn may account for some of the pathological outcome (Johansson, Johnson, & Hall, 1991)?

Further thinking about moderators and mediators also may provide additional insight into data already collected. For example, Evans (1979) tested the arousal model of crowding by varying density and assessing blood pressure and simple and complex task performance. Density elevated blood pressure and caused errors in complex but not simple task performance. A better way to analyze these data might have been to look at the direct effects of crowding on blood pressure and complex task performance and then show that the effects of crowding on complex task performance were mediated by the physiological index of arousal (i.e., blood pressure). According to the arousal model of crowding, the link between density and task performance ought to be mediated by measures of arousal. Rather than using multiple dependent variables to indicate different dimensions of environmental impact, we should consider more carefully if some of the outcomes might better be conceptualized as mediators.

The principal objective of this chapter has been to highlight the conceptual and methodological distinctions between moderators and mediators in environment and behavior relations. Moderation occurs when the relations between the environment and behavior are altered by the presence of some other factor. Mediation occurs when the relation between the environment and behavior operates through one or more underlying variables. We have tried to show that awareness of these two processes is important both in thinking about EB relations and in designing appropriate research strategies.

The physical environment can play a direct, etiological role in human health and well-being; it can have indirect effects that are mediated by one or more underlying processes; it can have interactive effects wherein its impacts are conditioned by some other variable; or, conversely, it may itself function as the moderator, altering the influence of some other environmental or psychosocial variable on human behavior. Still more complex forms of human-environment relations are also possible and can be better understood by considering what type of moderating and mediating functions, respectively, the environment plays in the system under analysis. When multicausal, dynamic feedback processes are evident, we have cautioned that great care is required in applying routine statistical techniques. Although the concepts of mediating and moderating processes are conceptually and analytically distinct, it would be an error to think that they are unrelated. We have provided examples to show how the finding of a significant interaction may lead to interesting ideas about what underlying, mediational processes may explain why/how an interaction occurred. We also

have shown that some theoretical propositions can be understood as multiple, mediational processes at different levels of the moderator. Mediated moderation and moderated mediation are novel theoretical and analytical conceptualizations for environment and behavior researchers that might prove particularly valuable in trying to better understand the role of the physical environment in human behavior. Finally, we have provided an example of how a moderating variable can shift over time to become a mediator variable.

The distinction between moderator and mediator processes may prove valuable in specifying as well as testing theories. To specify that an environmental condition affects a particular psychological or sociological process implies a mediational test. Often, in the environment and behavior field, such a theoretical statement has been misspecified and then improperly tested in an interactive, moderator formulation. A significant interaction can never directly test for the operation of an underlying, mediational process. There can also be profound policy implications due to misunderstanding the respective roles of moderators and mediators in human–environment relations.

The concepts of moderation and mediation processes are central, albeit often implicit, in our conceptualizations and analyses of EB relations. Hopefully this chapter has made the importance of these two basic conceptualizations more salient.

APPENDIX A: ANALYSIS OF MODERATOR PROCESSES

The general requirements for testing different types of moderator effects are the same: observing a significant interaction between an independent and moderator variable. However, one needs to examine the direction of the interaction and plot it to interpret its nature and to determine whether it fits into one of the four models specified in this chapter (for details on plotting interactions see Aiken & West, 1991). At a minimum, one should examine the mean levels of the dependent variable at different levels of the independent and moderator variable, perhaps using median splits on the independent and moderator variables to define the different subgroups. This method is, however, less precise than using regression techniques for plotting different subgroup relations, and it should be reserved for descriptive purposes whenever possible. Because of space limitations we will not discuss further technical details of plotting interactions. Instead, we will highlight analytical issues that are important to consider when designing one's research and planning the measurement of variables and refer the reader to additional sources for more in-depth treatments and discussion of interactive effects.

The interaction between the moderator and the predictor can be directly

tested using analysis of variance (ANOVA) or multiple regression techniques. Comparisons of subgroups of correlations are not appropriate because such an analysis only contrasts the relative proportion of variance explained across groups rather than contrasting the respective slopes that describe the relation between the independent and dependent variable across subgroups (Cohen & Cohen, 1983).

In the ANOVA case, the separate main effects of the independent and moderator variable are first evaluated, followed by the test of the interaction. Some researchers utilize median splits or other categorizations of continuous data to create a categorical variable amenable to ANOVAs. This practice is not recommended because it results in considerable loss of statistical power, cannot estimate the true effect size of the interaction, and discards information (Cohen, 1983). When continuous data are available for the independent variable, moderator variable, or both, multiple regression analyses are the preferred method of analysis.

As in the ANOVA approach, the interaction term (now the multiplicative regression term) is examined after partialling out the main effects for the predictor and the moderator terms, respectively. Because the interaction term in a multiple regression analysis is the cross-product of the independent and moderator variable, the interaction term tends to be highly correlated with one or both of the individual terms. This problem of multicollinearity between the individual and multiplicative terms can compromise the accuracy of the interaction test. Some analysts have recommended a solution to this problem, which is to use "centered" or "deviation" scores in computing the cross-product term. Essentially, this procedure entails subtracting the mean of each independent factor from each individuals' score on the respective factor ($X - M$). The cross-product is then computed using these centered (around zero) variables. This procedure eliminates multicollinearity between the independent factors and the cross-product term without altering the relation between the independent factors and the outcome. For further details on this procedure see Aiken and West (1991), Cleary and Kessler (1982), Cohen and Cohen (1983), and Finney, Mitchell, Cronkite, and Moos (1984).

A subtle problem that can arise in the specification and testing of moderator hypotheses is covariation between the two or more variables that are hypothetically supposed to interact. One of the reasons that interaction terms are often statistically nonsignificant in field studies may be because there is covariation among the independent (predictor) variable and the hypothetical moderator. Person-by-environment fit or congruence analysis provides an instructive example. Although theoretically appealing, there is in fact little empirical evidence of statistically significant interactions between personality and workplace characteristics on health (Caplan, 1983). This may occur because for many work settings people self-select into them. As an illustration, hard-driving, competitive people on average probably

seek out different job characteristics than do noncompetitive individuals. The direction of the causal connection may work in the reverse as well. Characteristics of the work environment may influence personality. In both cases (and they are not mutually exclusive) a moderate to high degree of covariation could result between workplace environmental characteristics and personal factors (Moos, 1986).

A moderate degree of covariation may naturally occur between some environmental factors as well—for example, crowding and noise, high job demands and low decision latitude. Unless one experimentally uncouples this naturally occurring covariation or oversamples from situations in which the covariation is minimal, interaction analyses will lack sufficient power in many naturalistic settings to detect true interactive effects.

Unfortunately, tests for statistical interactions tend to have low statistical power for a host of reasons (Aiken & West, 1991; Cohen & Cohen, 1983). Some of the variation in the dependent variable that is explained by the interaction is already captured by the main effect test. Furthermore, additional statistical power is lost because measurement error in each of the individual factors (predictor and moderator) becomes compounded by combining them into an interaction term (Cronbach, 1991). To help compensate for this problem, highly reliable measures of each factor in an interactive design are desirable.

Nonlinear relations between the predictor and outcome or between the outcome and the moderator can also diminish statistical power. To deal with this issue, one should examine curvilinear interaction terms. For example, Parkes (1986) reasoned that workload demands would have an inverted U-shaped function in relation to job stress. She also predicted that the stress effects of workload would be moderated by individual differences (e.g., neuroticism). To test for this curvilinear interaction she formed the product term of the quadratic of workload and neuroticism scores. In this chapter we noted the importance of sample size in relation to statistical power and our ability to interpret interactive and main effects. Lack of an equal number of subjects in each cell of a factorial design can lead to misleading conclusions. This issue is also relevant to nonlinear interaction findings. If the interaction effect occurs at only one extreme of an environmental condition (e.g., only under very polluted conditions) or only for those who are very anxious, then unless an extreme groups design is employed, the number of exemplars of these extreme situations or persons will be too small in the sample to detect the interactive effect.

One way to improve the statistical power of interaction analyses is to use a priori, planned comparisons (Kirk, 1982). To utilize this technique one must have specific, a priori hypotheses regarding the expected means in the different cells created by the interaction (e.g., scores in cell C will be greater than those in cells A, B, and D in a 2×2 design and the latter three cells do not differ from one another). Bayesian approaches as well as changing the

Type 1 error rate are other options recently discussed in the statistical literature (Cronbach, 1987, 1991).

In addition to statistical procedures to enhance the power of interaction analyses, certain methodological and design solutions also can be helpful. Initially when exploring an interactive hypothesis, researchers should consider extreme groups designs. In extreme groups design, levels of each main effect variable (e.g., each of two environmental variables; each environmental and each person variable) are sampled systematically so as to increase the between-group variance as much as possible within each independent variable. Thus, for example, if one wanted to explore the hypothesis that noise and vibration interact to affect cardiovascular health among workers, then one should select workers in extremely noisy and in extremely quiet areas and those who encountered either very high or very low levels of vibration at their respective jobs. By increasing the between-group variance among the levels of each independent variable, a stronger test for both main and interactive effects occurs (Cronbach, 1991; Myers, 1989). Moreover, there is less misclassification error caused by assignment of individuals to a specific cell in a factorial design. Use of a median split for assignment to one level of a particular variable results in some individuals or situations being misclassified. This is less likely to occur when an extreme groups classification occurs (Wachs, 1991).

However, there is a down side to utilization of extreme groups experimental designs. The researcher's ability to generalize the interactive and main effect findings to other population groups is limited given that the sample selected only those from the extremes of the population. Staying with this example, it is not clear whether noise and vibration interact at moderate levels if we have only sampled extreme groups.

Just as the aggregation of measurement probes of psychological constructs reduces measurement error (Ghiselli, Campbell, & Zedeck, 1981), so too are multiple environmental assessments likely to lead to more reliable assessment and estimation of environmental conditions (Evans & Tafalla, 1987; Wachs, 1991). Multiple measurement points over time and space can enhance the accurate estimate of environmental quality. Furthermore, when human observers are used to measure environmental conditions (e.g., air quality), use of multiple observers as well as careful training procedures enhances measurement precision (Stewart, 1987). Reduction in measurement error can increase the statistical power of interaction analyses to an even greater extent than the improvement found for main effects estimates (Cronbach, 1991; Ghiselli et al., 1981).

Although the problem of insufficient power in interactional analyses often leads to nondetection of true interactive effects, there are also situations in which false positive decisions are made about interaction effects. An interaction can masquerade for unequal exposure to one or more of the two independent (predictor) variables. For example, a gender difference in reac-

tion to long-term crowding (Epstein, 1982) may in fact reflect gender differences in actual exposure to the effective independent variable, household density. The assumption that persons per room means the same thing across gender may not be correct. Men are often freer to leave the residence; may have more access to private, relatively shielded spaces; and may benefit from familial social conventions affording them some modicum of peace and quiet. Under these circumstances an apparent interaction between household crowding and gender on mental health may actually be created by a subtle confounding wherein males are exposed less often to crowding in high-density households. As another example, elevated annoyance responses of women to aircraft noise (Cohen & Weinstein, 1982), might in fact reflect greater time at home on average among women than men.

One final problem with interpreting moderator effects arises when the proposed moderator is a measured or an attribute variable, rather than a manipulated variable. Attribute variables, such as culture (Hall, 1966) or gender (Peterson, 1987), often are hypothesized to have moderating effects on EB relations. The problem with attribute variables is that they often may be proxies for some other, unspecified variable that is the true moderator. The attribute of marital status provides a good example of this problem. Many studies have shown that married people appear to be less emotionally disturbed by stressors than unmarried people (Kessler, 1979; Pearlin & Johnson, 1977). That is, marital status appears to moderate the effects of stressors on psychological disorder. However, as Kessler and Essex (1982) have noted, a variety of factors other than marriage per se may explain these findings. For instance, it is possible that married people have greater emotional resilience to stressors than nonmarried people. The intrapsychic resources of married people may explain both their tendency to become and remain married, as well as their ability to cope with stressors. Therefore the true moderator may be coping resources rather than marital status.

APPENDIX B: ANALYSIS OF MEDIATOR PROCESSES

As in the discussion of analyzing moderators, we will not attempt to explicate all of the technical details of analyzing mediators. We will cover basic assumptions that are relevant to consider during the research design and measurement development phases of one's research and indicate additional sources for more technical discussions.

DETECTING MEDIATION

Mediation analyses are generally conducted using hierarchical regression or analysis of covariance (ANCOVA) techniques. First, one has to establish that there is a main, or direct, effect of the independent variable on the

dependent variable as well as on the mediator. Second, there must be no interaction between the proposed mediator and the independent variable. Therefore, the interaction between the independent variable and the proposed mediator must be tested, even if one's model does not specify a moderator relation between the variables. The reason for testing the interaction is that the slopes of the functions relating the independent to the dependent variable must be the same at different levels of the proposed mediator (Cohen & Cohen, 1983). Third, the mediator must be correlated with the outcome. Fourth, when the effects of the independent variable are reevaluated after partialling out the effects of the mediator, the previously significant association between the independent and dependent variable should be significantly smaller or zero.

In the case of full mediation, the relation between the independent and dependent variable should go to zero in the fourth procedure. In the case of partial mediation, the relation between the independent and dependent variable will not go to zero, but there should be significant indirect effects of the independent variable on the dependent variable through the mediator (for analytic details on decomposing direct and indirect effects, see Alwin & Hauser, 1975; Cohen & Cohen, 1983; Kessler, 1983; and Sobel, 1982).

In mediation processes, the mediator is often a measured (e.g., attribute) rather than a manipulated variable. If there is too much random error in the mediator variable the relation between that variable and the independent and dependent variable will be greatly attenuated. This problem is compounded if the independent and dependent variables also are measured unreliably. Therefore, reliable measurement is critical in mediation tests. Use of multiple indicators of the variables of interest can help minimize error. If multiple indicators are available, then factor analysis can be used to derive reliable indicators of the variables of interest. Moreover, if multiple indicators are available, it is possible to simultaneously observe the reliability of each variable (i.e., the measurement model) and the structural relations (i.e., the path model) among them using structural equation modelling techniques (Judd & Kenny, 1981; Kessler, 1983; Loehlin, 1987). Rotton and colleagues (1990) provide further discussion of potential problems in self-report measurement of internal states as mediators of EB relations.

Another issue in the analysis of mediation processes is the assumption of linearity. The analytic approaches discussed thus far have all assumed linear functions between all of the variables. When this is not the case, adjustments have to be made using nonlinear terms (Cohen & Cohen, 1983; James & Brett, 1984).

REVERSE CAUSALITY

Perhaps the best approach to dealing with the issue of reverse causality between the mediator and the outcome is to utilize a prospective, longitudi-

nal research design. Measure the mediator and outcome variable prior to exposure to the independent variable (pre-post design, often with non-equivalent groups). For example, in the test of social support as a mediator in the crowding–distress relation, social support and psychological distress would be measured prior to residential occupancy. Next, measure the same variables at two subsequent time periods postoccupancy. Test for mediation by examining the association between crowding and psychological distress at time 3 while statistically controlling for psychological distress levels at time 1 (i.e., examine changes in psychological distress associated with crowding). Finally, test whether social support at time 2 mediates the relation between crowding and changes in distress from time 1 to time 3. This strategy helps to rule out the rival hypothesis of reverse causation from the outcome to the mediator because the social support variable was measured before the time 3 distress variable and the association between time 1 distress and social support is statistically controlled (i.e., by including time 1 distress in the equation). However, reverse causality is not entirely ruled out because there may be different autocorrelations across the variables over time.

Another, albeit less optimal, strategy to investigate reverse causality is to use cross-lagged panel analysis. Using this approach with the data set just described, one would examine the correlation between the time 2 mediator and the time 3 outcome and compare it with the correlation between the mediator at time 3 and the outcome at time 2. Ideally, the former correlation should be significant and larger than the latter correlation term, which should be nonsignificant. Unfortunately, cross-lagged panel analysis is subject to several statistical assumptions about the different variables that are often difficult to satisfy (Kenny, 1979; Rogosa, 1980).

RECIPROCAL CAUSALITY

Probably the best current technique for detecting reciprocal causal processes is through an analytic technique called two-stage, ordinary least squares regression. This technique, however, is difficult to conduct because it requires the use of instrumental variables. Instrumental variables are correlated with one of the variables in the relation (either the mediator or the outcome) but not with the other variable. Because the mediator and the outcome must be correlated, it is often quite difficult to find instrumental variables (James & Singh, 1978).

FEEDBACK

As noted in the body of this chapter, one way to deal with the complication of feedback is to utilize time series analysis. These techniques provide adjustment procedures to account for shifts in the correlations among vari-

ables over time. For two examples of time-series analyses in environment and behavior research see Carrere, Evans, and Stokols (1991) and Rotton and Frey (1985).

SPURIOUSNESS

As a partial solution to dealing with spuriousness, one can check for spuriousness between two factors by reversing the terms in a mediation analysis. In the crowding example, one could reverse the crowding and social support terms (i.e., regress distress onto social support after partialling out density). If the relation between crowding and support is a spurious one, then reversing the terms should knock out the relation between social support and distress (i.e., now crowding will appear to be a mediator of social support). However, if the relation between crowding and social support is not spurious, reversing the terms should leave a significant association between social support and psychological distress (cf. Evans et al., 1989, footnote 2).

Another approach involves a longitudinal, prospective design. Measure psychological distress and social support during initial occupancy and then repeat the measures of the same variables over time. Ideally one would observe no association between social support or psychological distress with crowding at the initial occupancy (time 1). This would suggest that people who selected into more crowded homes were not already somehow different than their uncrowded counterparts. The underlying logic to this analysis is that any spurious factor linking the independent variable to the mediator and the dependent variable would probably be present at the initial occupancy, thereby creating a spurious relation at that time. If, however, the associations between the independent factor and the mediator and outcome do not emerge until some time has passed, it is likely that the relations are truly causal rather than spurious. Of course, it is still possible that the spurious effect of an unspecified variable is latent, and this test could not rule out this possibility. In this case, additional evidence, such as reversing the terms in the mediation analysis, would help rule out spuriousness.

Finally, a third approach to detecting spuriousness is to utilize structural equation modelling to detect correlated error terms (Loehlin, 1987). Correlated error terms suggest the presence of one or more "third" variables that are driving the observed association.

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Developing and Utilizing Models of Resident Satisfaction

JAMES R. ANDERSON and SUE WEIDEMANN

TWO VIEWS OF RESEARCH UTILIZATION: THEORY DEVELOPMENT AND PROBLEM SOLUTION

Research information has traditionally been utilized in two distinct ways: for the development of theory and as the basis for the solution of specific problems. In fields such as psychology the emphasis has been primarily on research utilization for the continual development of theory. Yet in other fields such as engineering, emphasis has been primarily on utilizing research information for the solution of specific problems.¹

Some time ago, Rapoport (1974) reminded individuals interested in environment-behavior (EB) issues of the dichotomy that exists between using research information for the development of theory and using research information for the solution of specific problems. He argued both were important. In particular, he argued that any fully mature field of study must have individuals focusing upon both the development of theory and

¹The design professions have primarily used information, from research or any other source, as the inspiration for creativity as well as for problem solving.

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the solution of specific problems. He expressed concern because he saw an emphasis on problem solution at the expense of the development of theory within the fledgling field of EB studies.

Rapoport (1974) sensed that the developing field of EB studies was initially neglecting theory development and reminded us of its valuable characteristics. Theory combines, condenses, and organizes individual studies that might initially be seen as contradictory and conflicting. Theory synthesizes an amount of information from numerous studies that would otherwise be overwhelming. Theory makes possible easily grasped general rules and guidelines for the solution of individual problems.

However, it appears that within the field of EB studies, a focus on research utilization continues to emphasize the use of research information to solve specific problems. Moore (1986) stated that a concern for utilizing the products of research in problem-solving situations has dominated the field since its inception in the 1960s. In many cases, theory development is seen as an unrelated activity, an activity that delays problem solution.

In a review of EB case studies, Min (1988) looked for distinct approaches to research utilization. He expanded the three strategies identified by Seidel (1982) and identified six models of research utilization. These are shown in Figure 1, together with their defining activities. Min proposed that these six models of utilization could be represented by variation along four distinct dimensions. First, he suggested that studies vary in the degree that they seek to integrate the activities of research with the activities of design practice or environmental management. Second, he proposed that studies vary between having users and clients active or passive in the collection of data. The third dimension, proposed by Min, was the degree of involvement of the researcher in the specific environmental context. Finally, he proposed that studies vary between reliance upon existing information and the creation of new information.

Four comments can be made upon examination of Figure 1. First, this overview of distinct models of research utilization is a valuable reminder of the breadth of approaches to the phenomenon known as "research utilization." It becomes easier to understand why different authors may seem to contradict one another when discussing the broad topic of research utilization. With different definitions, objectives, and modes of operation, the possibility for confusion and contradictory advice is always present.

Second, the four dimensions along which the six models of research utilization are compared appear to covary as a set. That is, as you move from information retrieval systems to action research, there is a simultaneous increase in the generation of new knowledge that is achieved by an increasing involvement in the context by researchers, users, and clients, as well as by an increasing integration of research and practice activities. While it might be tempting to think of these six models as representing a six-point scale on this set of covariance dimensions, they do not fall in equally distanced intervals.

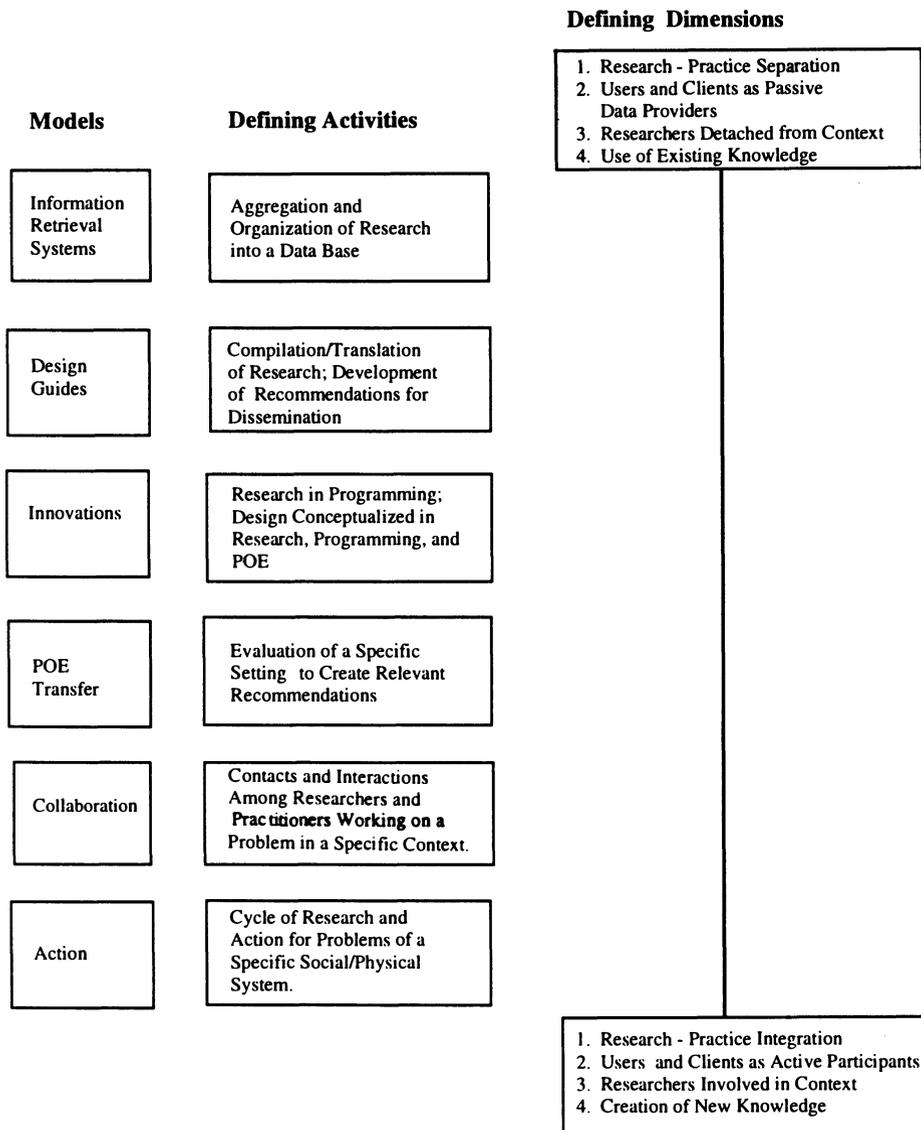


FIGURE 1. Models of research utilization based on Min (1988).

Third, for those models that rely on the creation of new information, there is no indication that the quality of research might vary among the six models. As these models are discussed in the literature, it seems to us that issues of reliability and validity do not receive equal attention in each of the models. There appears to be a diminishing concern for research methods and for the quality of research information in models of collaboration and action research (Rutledge, 1985).

Finally, the absence of any explicit mention of theory in Figure 1 is also worth noting. It reminds us that individuals involved in EB studies may still be neglecting this critical issue. The volumes of two important series of monographs (*Human Behavior and Environment* and this series, *Advances in Environment, Behavior, and Design*) and other individual monographs (e.g., Lang, 1987) show there has been continual development of substantive theory during the last two decades. Despite this, the models in Figure 1 do not show a direct link between theory and practice. There is no apparent recognition in the figure that the development of theory is a form of research utilization.

A concern for theory could be a fifth dimension that varies among the models of research utilization. The explicit identification of theory might begin to provide the balance between "practitioners tackling real problems" and "theoreticians and philosophers developing models" that Rapoport (1974, p. 124) brought to our attention almost two decades ago.

Theory need not be neglected at the expense of design creativity or problem solution. Specific design and management alternatives can be explored at the level of an individual site while more general and abstract theory is developed and tested. This is in part because both design and theory development can represent the use of inductive reasoning (Glaser & Strauss, 1967; Judd, Smith, & Kidder, 1991). They both are processes that can move from research information to conclusions. Where they differ seems to be in the level of abstraction of the conclusion (see Figure 2).

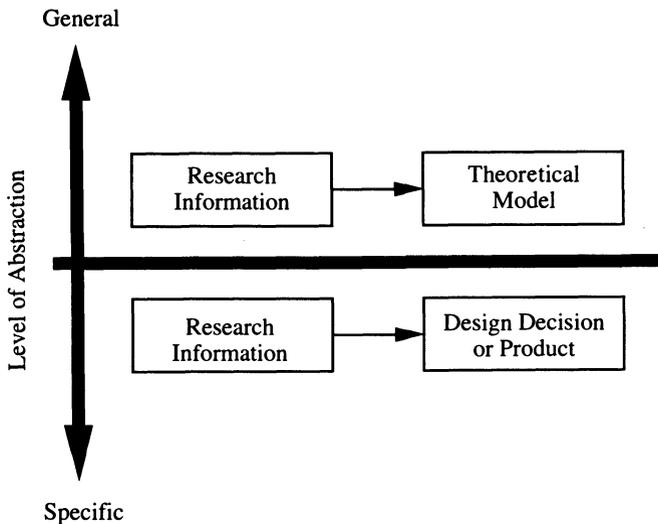


FIGURE 2. Theory development and design can both be seen as inductive processes at different levels of abstraction.

The remainder of this chapter will review briefly a two-decade program of research that has included attempts to utilize research information to develop theory and to solve problems. This diverse set of studies has provided a unique opportunity to think about the issue of research utilization in design and planning, and to do this on an ongoing basis. These lessons may guide others in their efforts to more effectively utilize research information and may stimulate issues for further consideration.

COMBINING PROBLEM SOLVING AND THEORY DEVELOPMENT: A PROGRAM OF RESEARCH

The authors, together with a number of colleagues over the years, have been involved in a program of research that examines residents' satisfaction with where they live.² Much of the research has been directed toward multi-family housing occupied by low- and moderate-income households. Two objectives have been generally present across the series of studies: (1) using the obtained data to develop a theoretical understanding of the sources of residents' satisfaction and (2) using the obtained data and developing theory to guide the solution of specific design and management problems at specific housing sites.

The initial research began in 1972 with a study whose objectives included understanding "user needs" and the development of research tools to evaluate multifamily housing. Since then a series of diverse studies has followed. Each of these studies has had a concern for theory development and testing as well as for problem solution, although the emphasis has varied from study to study.

SATISFACTION

In the initial study of 37 sites (Francescato, Weidemann, Anderson, & Chenoweth, 1979) it quickly became apparent that "user needs" was a very ambiguous concept. However, this term did suggest that the evaluation of housing should occur from the perspective of the user. Although it was recognized that there are many different users of housing, the primary user was seen as the resident.

When the focus is upon the resident, there is an intrinsic appeal to using satisfaction as a criterion for the evaluation of housing. It has a sense of face validity, a sense of summing up all of the unique problems and advantages that residents experience in the place where they live. It can be conceived of

²A list of colleagues directly contributing to this work includes our special mentor, Guido Francescato, as well as O. Ahlund, K. Anthony, B. Bain, D. Butterfield, R. Chenoweth, Y. Chen, S. Edwards, N. Kirk, C. Maattala, K. McDowell, P. O'Donnell, N. Perkins, R. Selby, R. Thorne, and T. Westover.

as the overall positive or negative response of an individual to their housing environment.

A thorough review of the literature concerned with satisfaction is not possible here. Still it should be pointed out that others have previously used satisfaction as a criterion concept. Schorr (1966) described studies of residential satisfaction as early as 1945 and reported that a number of housing characteristics had been shown to be related to housing satisfaction. In England, satisfaction was a criterion in a series of studies carried out by the Department of Environment (e.g., Griffin & Dickinson, 1971).

Concurrent with our own use of satisfaction as a criterion for housing evaluation, several other important studies occurred. Campbell, Converse, and Rodgers (1976) looked at housing satisfaction as one of the domains of life experience, where satisfaction with that domain might contribute to a person's quality of life. Growing from this were the more specific examinations of community satisfaction and housing satisfaction and the development of theoretical models of the sources of satisfaction (Marans, 1976; Marans & Rodgers, 1976; Morris, Crull, & Winter, 1976; Weiss, Burby, Kaiser, Donnelly, & Zehner, 1973; Zehner, 1977). These are discussed in more detail in Weidemann and Anderson (1985).

The use of satisfaction as a criterion variable is not limited to housing nor to built environments. Satisfaction is a concept that continues to appear in many fields. We have previously discussed the interest that some urban sociologists and geographers have had in the concept of satisfaction (Weidemann & Anderson, 1985). Additionally, landscape architects have used satisfaction as an outcome of visitor experiences in a number of different settings (e.g., Cartlidge, 1992; Weidemann, 1987).

Perhaps the most extensive and dynamic current literature is concerned with consumer satisfaction. In this field there are several models of satisfaction that have emerged. Some of these models view satisfaction as a static result, while others see it as dynamic process of interactions (Wilton & Nicosia, 1986). Customer satisfaction is seen as a subset of consumer satisfaction. Hanan and Karp (1989) describe it as a company's ultimate product and urge business management to commit to a program of "total customer satisfaction (TCS)" (p. 41). Large corporations, like IBM and Chase Manhattan Bank (Kohnke, 1990), have accepted this idea and are spending money to measure both the level of customer satisfaction and the sources of satisfaction and dissatisfaction.

A strong interest in the concept of patient satisfaction has developed within the medical community. For example, Swan, Sawyer, VanMatre, and McGee (1985) pointed out that hospital administrators frequently use patient satisfaction surveys as a guide to marketing strategies. Ross, Frommelt, Hazelwood, and Chang (1987) examined the role that patient expectations play in subsequent satisfaction with medical services. Rao and Rosenberg (1986) were concerned with satisfaction with dentists. Jensen and Miklovic (1986) were concerned with patient satisfaction with physicians.

In summary, satisfaction is a concept that has had considerable use in the evaluation of housing and other fields. This broad use demonstrates the appealing face validity of the concept and its utility in explaining the "success" of a range of phenomenon.

Criticisms of Satisfaction. Satisfaction is viewed by some as an inappropriate measure. Satisfaction is a subjective reflection of an objective condition, and skepticism about subjective measures still exists. However, Campbell et al. (1976) concluded after an extensive consideration of the reliability and validity of measures, comparisons between objective and subjective indicators of well-being, levels of reality of domains being assessed, analytic intentions, etc., that exaggerated skepticism of subjective responses is not warranted. Additionally, Francescato, Weidemann, and Anderson (1987) have noted five criticisms of satisfaction and provided a response to these. The criticisms are: (1) reported satisfaction tends to be positive, thus suggesting that everything is all right; (2) subjective measures of satisfaction may not correlate with objective measures of context and behavior; (3) the level of satisfaction of individuals varies over time; (4) satisfaction tends to be higher when individuals lack an awareness of "better" alternatives; and (5) fostering satisfaction, rather than attacking problems, may result in sub-optimal housing environments.

It is important to be aware of these limitations; however, it is clear that they do not prevent satisfaction from being a useful concept. In the same way that there are limitations to all research methods, there are limitations to the operationalization of all abstract concepts. What these criticisms point to is a need for research that specifically examines the validity of the criticisms and how that would impact the theoretical models.

A Definition of Satisfaction. In the literature that refers to satisfaction, there is generally little discussion of what satisfaction is conceptually thought to be. People often use the term as if all agree upon its nature and its theoretical linkages. Yet operational definitions of satisfaction vary widely, for example, in terms of level of specificity and type of measurement. This disparity often presents a dilemma in terms of understanding the body of literature. For example, conflicting results may simply be due to the use of different operational definitions. We feel that one must be explicit, both conceptually and operationally, when discussing or using the concept of satisfaction. Without such clarity by all, advances in the knowledge base and the development of theory will suffer.

We have felt that it is useful to define satisfaction, and residential satisfaction in particular, in terms of how individuals respond to objects and events that occur in the setting in which they live (Weidemann & Anderson, 1985). Psychology has defined three basic forms of human response: cognitive, emotional, and conative. That is, people can respond by knowing, feeling, or doing. With that repertoire of responses, satisfaction can be con-

ceived as the emotional response toward the housing environment. On the other hand, Fishbein and Ajzen (1975) described "attitude" to be a set of relationships among cognitive, emotional, and conative responses. More specifically, they feel that a behavioral response is influenced by one's beliefs about that behavior, an affective response, and intentions to behave.

We believe that it is possible to conceptually conceive of satisfaction as either an emotional, affective response to an object or event or to view satisfaction as an attitude, that is, the interrelationship of cognitive, emotional, and conative responses. In fact, we have done both (e.g., Francescato, Weidemann, & Anderson, 1990) and continue to explore these alternatives.

An Operational Measure of Satisfaction. Although the conceptual nature of satisfaction remains an issue, throughout this program of research there has been consistency in the operational measure of satisfaction. This measure of satisfaction has been an index, based upon the response to four questions, each measured on a five-point scale: (1) How long do you intend to live here? (2) Would you recommend this place to a friend looking for a place to live? (3) Would you move to another place like this? (4) How satisfied are you with living here, in general? These four items have generally been very highly correlated, with reliability measures of 0.80 or higher. Additionally, test-retest reliabilities of the four-item index has been generally high (e.g., $r = 0.87$; Anderson & Weidemann, 1979). Interestingly, these four items contain both an affective response and behavioral intentions with respect to the residence, two of the components of an attitude (Fishbein & Ajzen, 1975).

PROGRAM OF RESEARCH

Figure 3 summarizes the series of studies that have been undertaken in this program of research focused upon residents' satisfaction. The figure groups these studies in terms of whether they (1) were intended initially to examine theoretical or applied issues and (2) examined individual sites or multiple sites. In terms of Min's (1988) framework, all of these studies have been concerned with the creation of new knowledge and have involved users as active participants. However, they have varied in the degree to which there has been research/practice integration (the majority have not directly integrated these components).

Theoretical Issues, Multiple Sites. Beginning at the far left of Figure 3, the primary objectives of the 1972-1979 research (Francescato et al., 1979) were (1) to develop methods for evaluation of the housing environment, (2) to gain both descriptive information about numerous concepts hypothesized to be related to housing satisfaction, and (3) to gain a preliminary understanding of the nature of those relationships. It was particularly important in that initial work to sample diverse physical settings to ensure variability in po-

THEORETICAL ISSUES, METHODOLOGICAL ISSUES, MULTIPLE SITES	APPLIED ISSUES, SPECIFIC SITES	THEORETICAL ISSUES, MULTIPLE SITES	APPLIED ISSUES, MULTIPLE SITES
37 SITES, 23 CITIES, Francescato et al. 1979	JOLIET, Chenoweth, 1979	ELDERLY: SWEDEN & ILLINOIS. Lindström . 1986	CHICAGO. Weideman, 1986
	NORTH CHICAGO. Weidemann et al., 1983	ELDERLY: ILLINOIS, CANADA, & AUSTRALIA. Turnbull et al., 1983	CHAMPAIGN COUNTY. Selby et al., 1988
	DECATUR, Weidemann et al., 1982	DEVELOPMENTALLY DISABLED. Butterfield. 1984	ST. LOUIS. Weidemann et al., 1988
	AURORA, Anderson et al., 1986	PHYSICALLY DISABLED ADULTS. Anderson et al., 1990	
	SPRINGFIELD. Rose et al., 1990	SINGLE PARENTS. Anthony et al., 1990	
		KOREAN FAMILIES. Chin. 1989	

FIGURE 3. Studies included in a program of research in residents' satisfaction.

tentially important concepts. Relationships can only be detected if there is variance within the issues being examined. Thus, 37 housing sites (some award-winning, some nominated by housing authorities as bad examples) were selected as varying in physical design and program type in various parts of the United States. Although all sites were intended for low- and moderate-income persons, the samples did differ in terms of socioeconomic background and other demographic characteristics.

From that study of 37 sites, research instruments and a process of analysis were developed and an initial model of satisfaction was derived (Anderson & Weidemann, 1979). This model illustrated the strength of both direct and indirect predictors of satisfaction (Francescato et al., 1979; see Figure 4).

Applied Issues, Specific Sites. While a model of general issues is valuable for the development of stronger conceptual frameworks and specific hypotheses, it is also important to be able to relate such information to real situations. Upon completion of the initial study, we became more interested in how research information derived from postoccupancy evaluations could be used to make focused design, planning, and management recommendations for changes at a specific location.

Several studies were initiated by local housing authorities searching for information that could be helpful in solving specific problems. These studies provided opportunities to use both the conceptual model of residents' satisfaction and previously developed research procedures as the basis for problem solution activities.

In each of these studies, there was a strong concern for process. Figure 5 illustrates the process that was used in the study of Longview Place in

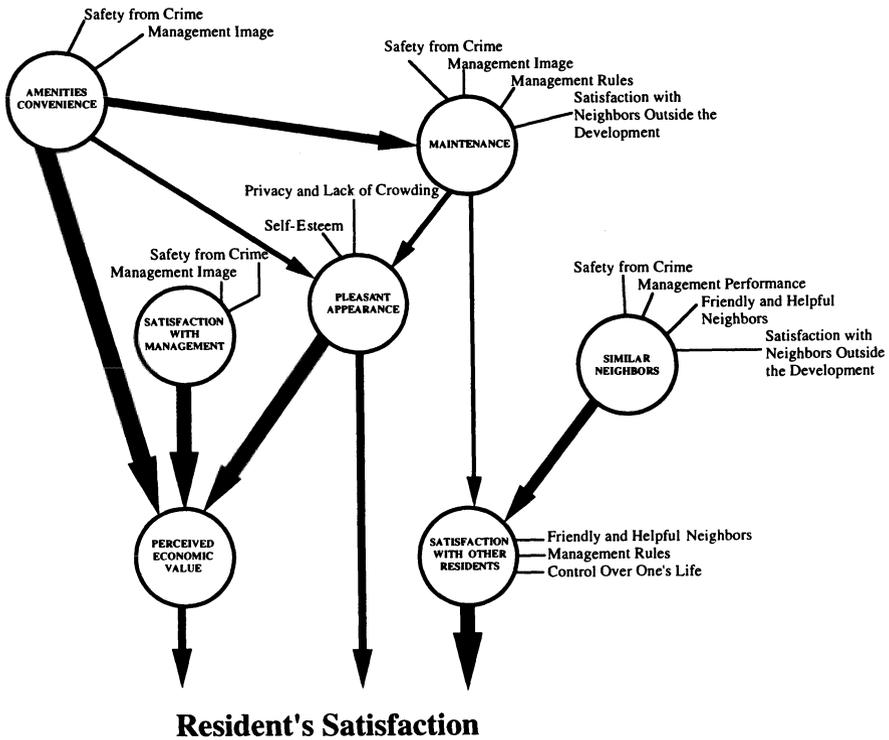


FIGURE 4. Model of the predictors of residents' satisfaction (Francescato et al., 1979).

Decatur, Illinois; it is typical of the other studies in this category (Weidemann et al., 1982). The process was generally one that began with open-ended interviews, meetings, or discussions.³ This helped to identify the salient issues for the specific site. Then a structured process of data collection began, based upon a core of items developed by Francescato et al. (1979), but adapted to include issues identified in the initial open-ended phase of the study.

Statistically, information was processed in a manner based on strategies of analysis developed in the initial study of the 37 sites. The process of analysis relied upon a two-step multivariate technique. First, a principle components analysis was used to reduce the number of individual self-report items into a smaller set of conceptual variables or factors. Each factor consisted of a set of self-report items, each of which had an empirically determined level of relationship to the factor as a whole (see Figure 6 for a

³These were usually conducted in the format of a focused interview as described by Merton, Fiske, and Kendall (1956) and others.

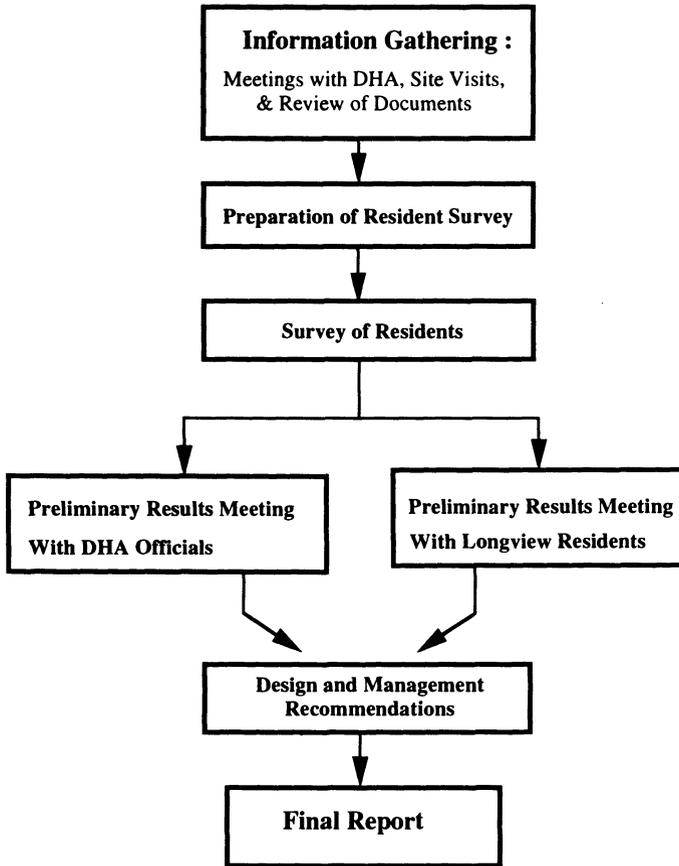


FIGURE 5. Typical research utilization process as carried out at Longview Place (Weidemann et al., 1982).

conceptual example). Indices representing operational definitions of each factor were created using the set of highest loaded items (generally those with factor loadings greater than 0.5). These indices, representing the conceptual variables, were unweighted sums or averages of the highest loaded items.

In the second step of this process, the indices representing the conceptual variables were used as the pool of potential predictors in regression analyses. The results of this analytic procedure indicate the relative importance of individual concepts in explaining or influencing an outcome variable such as residents' satisfaction (Figure 7 illustrates this conceptually). These indications of the relative importance of issues were used to develop the model of residents' satisfaction. Subsequently, the model of satisfaction became the basis for the selection and development of design and manage-

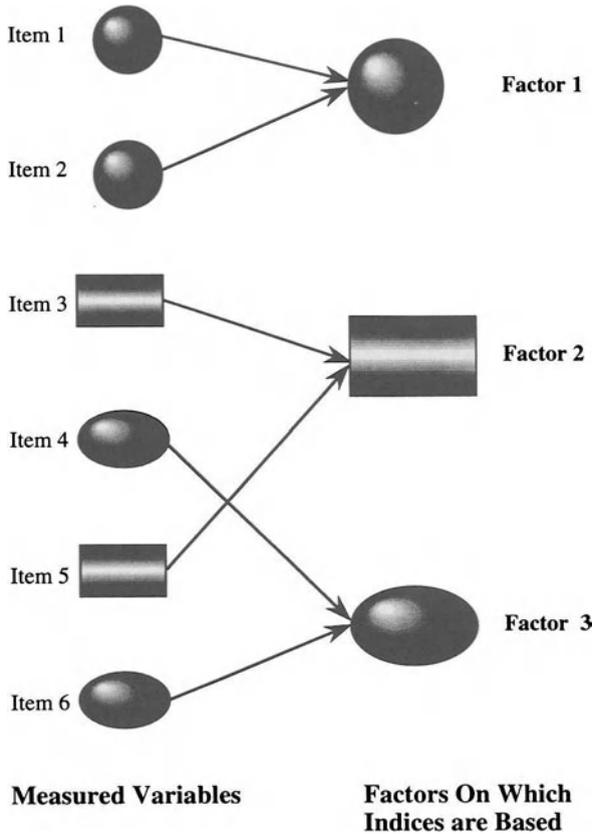


FIGURE 6. Factor model.

ment proposals. Those design and management proposals addressing concepts strongly related to satisfaction were given priority over proposals addressing other concepts.

The models of satisfaction derived from several applications of the process described in Figures 6 and 7 began to provide similar understandings of the dimensions involved in residents' satisfaction and to indicate that some issues were relatively consistent in predicting satisfaction. This convergence of models allowed one housing site to be addressed on the basis of the previous models of satisfaction. In the case of Springfield (Rose et al., 1990), recommendations for design and management change were based entirely on the understandings developed from prior studies. Theory became the basis for design and management change.

Theoretical Issues, Special Populations. It is reasonable to expect that different groups of people would have different reasons for being satisfied.

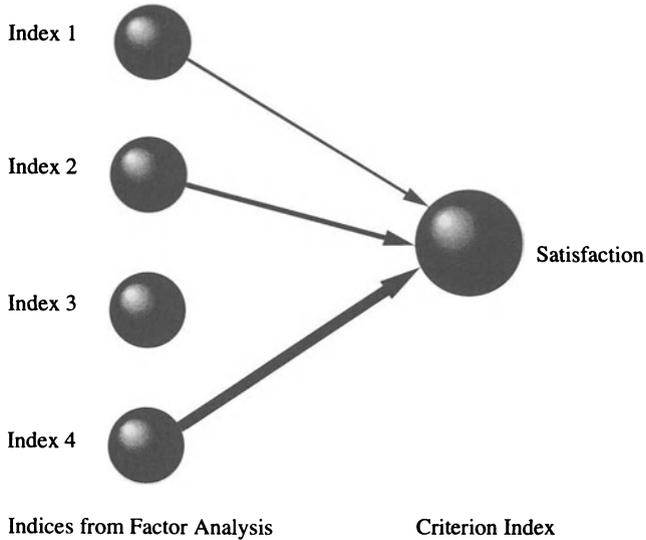


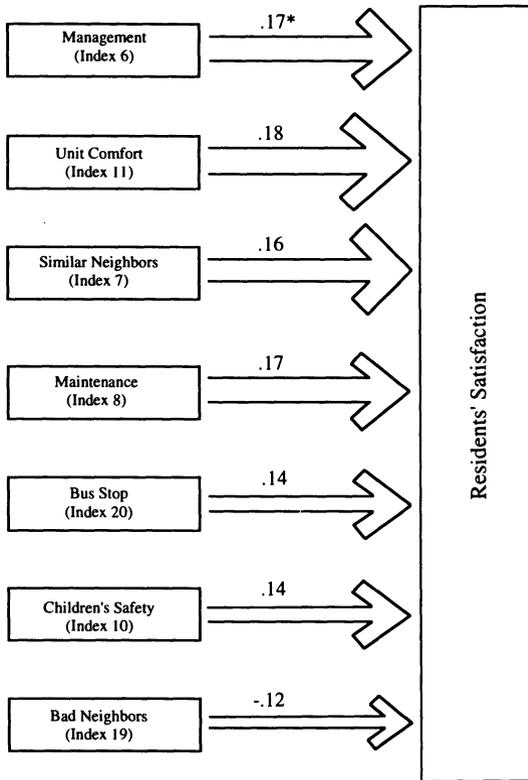
FIGURE 7. Regression model. Line width indicates the beta weight of each predictor, indicating the relative importance of each index in predicting satisfaction.

Certainly the views of planners and architects have been demonstrated as being different from those of residents (e.g., Lansing & Marans, 1969). Thus it is not surprising that as an overall model of residents' satisfaction emerged from the initial study of 37 sites, questions emerged as to whether special populations had their own unique sources of residential satisfaction.

Research done in the initial study of 1972–1979 involved multifamily housing for low- and moderate-income residents. Within many of these sites, there were also elderly residents. Comparisons of the responses of elderly residents to other residents had suggested that they viewed their housing in much the same way as younger residents, in terms of the way items were grouped by factor analysis (Weidemann, Anderson, Chin, Perkins, Kirk, & Bain, 1988). A joint study with colleagues in Australia and Canada examining samples of high-rise housing for the elderly in the three countries (Turnbull, Thorne, Anderson, Weidemann, & Butterfield, 1983) also found strong similarities in factor structure.

However, the more intriguing results, from this and other studies, had to do with the *relative importance* of the factors in predicting satisfaction. We have found that different population groups often have different predictors of satisfaction. This has been the case in looking at high-rise versus low-rise units (Francescato, Weidemann, Anderson, & Chenoweth, 1977) and public housing versus nonpublic housing sites (Weidemann & Anderson, 1980), as well as when looking only at demographic differences within the same site. For example, Figure 8 shows that elderly residents in low-rise units of public

Family Low-rise



Elderly Low-rise

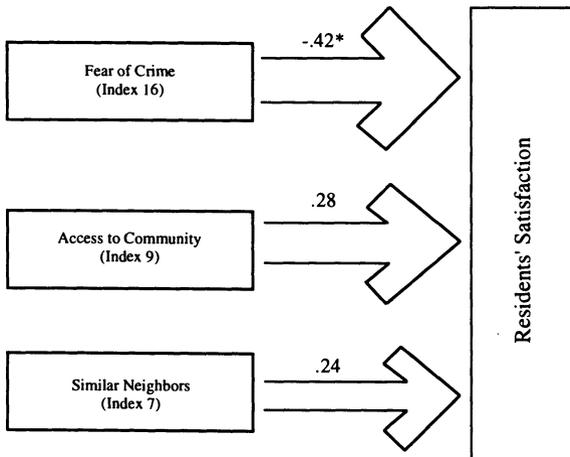


FIGURE 8. Comparison of predictors of satisfaction for different populations (Weidemann et al., 1988). Family low-rise: $N = 280$, $r = 0.61$, $r^2 = 0.37$. Elderly low-rise: $N = 70$, $r = 0.66$, $r^2 = 0.44$. *, Beta; standardized regression coefficient.

housing in St. Louis had some similar concerns as did family residents in low-rise housing. However, family residents showed a greater diversity and number of predictors of satisfaction. These issues ranged from social aspects to issues related to characteristics associated with the environment to management issues (Weidemann et al., 1988).

As our interest grew concerning the importance of population characteristics in explaining residents' satisfaction, other types of populations were also examined. These included severely disabled young adults in specially designed homes (Anderson, Anthony, Weidemann, Bain, & Allen, 1988), developmentally disabled adults in group homes (Butterfield, 1984), elderly (Lindström & Åhlund, 1986), and single parents (Anthony, Weidemann, & Chin, 1990). Methods of gathering information varied somewhat with the added use of structured interviews, time diaries, etc. Earlier research had relied primarily on structured questionnaires returned by mail. Additional issues specifically directed toward the particular setting and population were added. Yet there still remained a core of items and issues that were common to all. These included, for example, the index of satisfaction, questions about management, maintenance, appearance, privacy, safety, etc.

All of this research, although quite preliminary in nature, began to show that certain residential environment characteristics are important to many different populations (e.g., general aspects of appearance and maintenance), while other characteristics are particularly relevant to specific groups (e.g., the sample of severely disabled young adults were concerned with issues of environmental control, especially in terms of control over their own privacy).

Applied Issues, Multiple Sites. There have been three occasions when the research has focused upon the examination of a number of sites within the same housing authority (Selby, Westover, Anderson, & Weidemann, 1988; Weidemann et al., 1988; Weidemann & Tappe, 1986). For two of these studies (St. Louis and Champaign County), the types of buildings differed (high-rise versus low-rise) and the populations differed (primarily in terms of age distributions). In Chicago, there were 28 high-rise buildings, all basically identical, with a mix of elderly and family residents.

In all three situations, the primary need of the housing authority was to obtain information for *application*. They wanted (1) descriptive information about each of their sites, in terms of evaluations by the residents, and (2) differential recommendations, based upon the obtained analytic models, that would address specific site or population needs.

As an example, Figure 9 illustrates how well or poorly different sites in St. Louis were evaluated on each item with one of the indices found to be a major predictor of satisfaction. For those sites showing positive evaluations, the housing authority was urged to continue support of those aspects. Negative evaluations clearly showed which sites needed additional improvements (Weidemann et al., 1988).

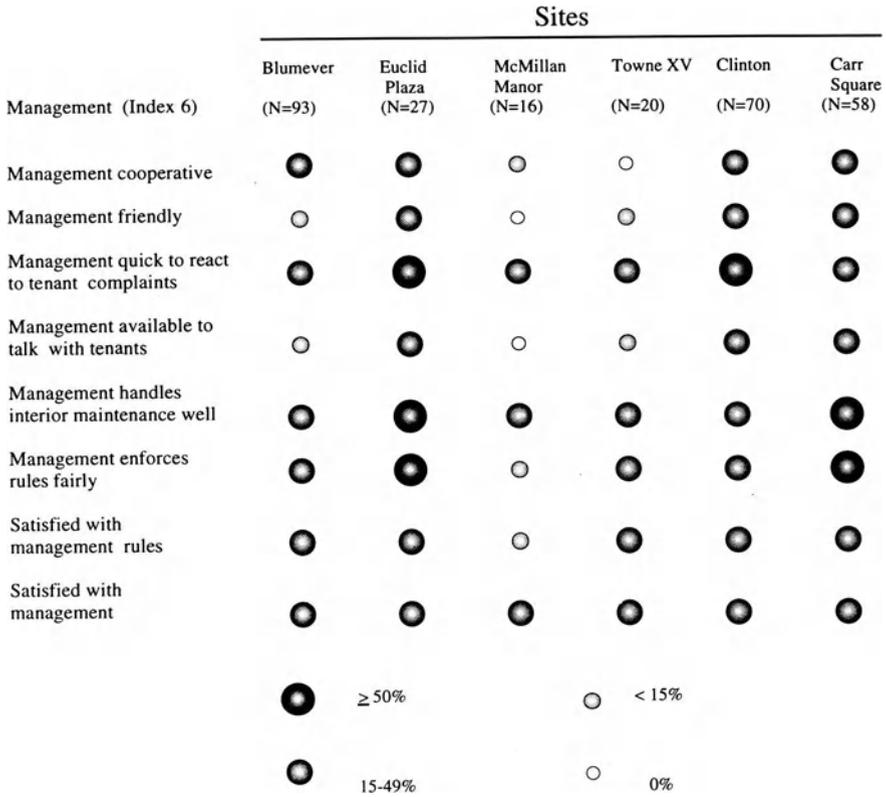


FIGURE 9. Site comparisons: performance on items within the Management-Index (Weidemann et al., 1988). Note: The figure represents the percentages of respondents responding *negatively* to issues highly related to residents' satisfaction with their living environment.

SUMMARY OF THE PROGRAM OF RESEARCH

This program of research has focused on housing environments, seeking resident perceptions about a wide variety of design, management, and social issues. Satisfaction with the residential environment has been the primary criterion. Interviews and questionnaires used at all sites had common items, as well as specific items to examine the unique issues of each site. The research used a common analysis process that relied on obtaining a set of factors that would describe the conceptual issues measured by the self-report method, thus reducing the number of specific items (through principle components analysis) and then determining which of those factors best predicted the index of satisfaction. The studies then used the obtained results (models) as the basis for recommending specific solutions for various design and management issues.

Whether the analyses deal with single sites or multiple sites, valuable information can be obtained for both theory and utilization. Within a single site, results can provide a baseline level of performance for that site, to which later monitoring of performance could be compared (Weidemann & Anderson, 1992).

From the researchers' point of view, the larger sample of residents obtained from the examination of multiple sites offers several opportunities. First is the opportunity to test the generalizability of the conceptual model of residents' satisfaction. Second, large samples can be partitioned to examine additional issues. For example, is the factor solution derived from elderly respondents similar to that obtained from responses of families? Such a "structural" comparison provides an assessment of whether or not the same constructs are applicable to different samples. Third, the nature and strength of potential predictors of satisfaction can be compared for different samples. That is, even if *levels* of satisfaction are the same, we have found that there are different predictors of satisfaction for different samples (e.g., elderly versus family respondents).

LESSONS FOR RESEARCH UTILIZATION

From this series of studies, we have reached a better understanding of the common issues that occur across settings and populations. Information from any single study, whether conducted by us or others, can be examined in the broader framework. There are important lessons we have learned; the remainder of the chapter addresses these issues.

THERE IS A PLACE FOR A CRITERION IN PROBLEM SOLUTION AS WELL AS IN THEORY DEVELOPMENT

Theory, in the social and natural sciences, is a conceptual description of the hypothesized, causal relations among real world phenomena. It seeks a general description, based upon specific observations. Theory development often requires an outcome, or criterion variable. In our research we see our primary criterion of evaluation (residents' satisfaction) as being the outcome or "dependent variable" influenced by other concepts.

In problem solution, the concept of a criterion variable is nearly always present, even if not explicitly stated. "Criterion" carries with it the idea of being a standard or a basis of evaluation. Certainly if we are to solve a problem we need some outcome by which the solution may be evaluated. There are any number of ways to evaluate housing and other built environments, each with its own criterion. Francescato et al. (1979) referred to financial, physical, and societal criteria. However, this program of research has not been based on these more traditional concerns. This research has taken as its criterion the satisfaction of the resident.

Obviously a criterion is important in evaluation, but it is equally as useful in developing design and management proposals. Certainly if we are to solve a problem, we need some outcome by which the solution may be evaluated. We have used the criterion variable in a way that is similar to the way an architect or landscape architect might use a "concept." For the designer, the concept is the idea that becomes the basis for judging all design decisions.

In the applied studies shown in Figure 3, e.g., North Chicago, Decatur, Illinois, and Aurora, Illinois, satisfaction (and security in the case of Decatur) became the "design concepts." Choices concerning the development of recommendations were made because of the expectation that they would affect an increase in the criterion variable. Thus, a research-based model, such as that in Figure 4, suggests that to improve satisfaction, design and management changes should address (1) resident relationships with one another, (2) the maintenance and appearance of the site, (3) cost of housing, (4) the availability of recreation facilities, and (5) the spaciousness of the site.

CHANGES GUIDED BY RESEARCH INFORMATION CAN ACHIEVE DESIRED RESULTS

One of the studies in Figure 3 provided a direct opportunity to test whether changes based on research-generated information achieved the desired results (Weidemann, Anderson, & Maattala, 1983). Marion Jones Homes was a site in north Chicago that had specific problems in terms of site drainage. The executive director of the Housing Authority wanted to correct those problems, but was interested in knowing if the residents perceived other problems that could be corrected at the same time. He saw no reason to disrupt the site with construction activities to solve the drainage problem one year, only to find out the next year that another issue had replaced the drainage problem.

We went through a process similar to that previously described in Figure 5. The result was a set of recommendations for site improvements that were selected because they addressed the predictors of satisfaction at Marion Jones Homes (Anderson & Weidemann, 1979). These recommendations were implemented in the year following the research. The architect hired one of the research staff to assist in developing the construction drawings; the final changes thus remained faithful to the original design recommendations (within existing resource constraints).

Following completion of the changes to Marion Jones Homes, a second study was conducted. This is an example of post research evaluation (PRE) as discussed by Sommer (Chapter 11, this volume). This PRE used a structured questionnaire based on the one used in the original study. Additional questions were included to address specific changes. Weidemann et al. (1983) discuss the changes in residents' perceptions that occurred following

the implementation of the recommendations. A consistent pattern of changes in perceptions was found. Residents expressed higher levels of overall satisfaction and generally were more positive toward aspects of the residential environment that had been changed, for example, backyard fencing, additional exterior storage, and children's play areas.

It is important to note that changes in perceptions were not just *generally* more positive, as might be expected in a Hawthorne Effect or if "history" or "subject mortality" were viable alternate explanations.⁴ First, residents' perceptions of aspects of the environment that were not addressed by the improvements were not significantly changed. Second, this was not a case of attrition where the dissatisfied had all moved out, leaving only the satisfied residents. At the time of the first study there were no significant differences between the perceptions of those who later moved out and those who stayed at Marion Jones Homes.⁵ Finally, at the time of the second study there were no significant differences between the perceptions of residents who had lived at Marion Jones Homes before the improvements occurred and those who moved in after the changes.

THERE ARE OPPORTUNITIES FOR COMPARATIVE RESEARCH, BUT CAREFUL PLANNING MUST OCCUR

While a number of these studies were directed toward specific settings, each with its own set of concerns, it was essential that this work be both additive and complementary to the previous research. Therefore, while data collection sources and procedures varied somewhat for each, a strong core of common items, obtained by self-report techniques, was maintained throughout the series of studies.

Obtaining a common set of information makes it possible, at a later time, to address comparative questions. It also allows change within one site to be monitored over time if repeated studies of the same site are conducted. Using a core of common items also allows the testing and refinement of a conceptual model. For example, it allows examination of questions that address the extent to which specific issues can be found to predict resident satisfaction across a number of sites. And, if such common predictors exist, are they equally important in different circumstances? Results from using a set of common questions across the studies shown in Figure 3 have indicated that there were certain issues that seem to be consistently important in predicting residents' satisfaction, for example, appearance and maintenance

⁴For a more thorough discussion of history, subject mortality, and other alternate explanations for research findings, see Campbell and Stanley (1963), Judd, Smith, and Kidder (1991), or Runkel and McGrath (1972).

⁵These, and the following comparisons, were not included in Weidemann, Anderson, and Maattala (1983) and remain unpublished.

of the site, having neighbors similar to oneself (in terms of beliefs about child-rearing, ideas of what is right and wrong, etc.), safety, management characteristics, etc. At the same time, other issues have been found to be important only at specific sites.

QUALITY OF INFORMATION MAY BE MORE CRITICAL FOR DESIGN AND PROBLEM SOLVING THAN FOR THEORY DEVELOPMENT

Quality of information has always been a major concern for research directed toward theory development and testing. However, we sense that others are sometimes willing to use "quick and dirty" information for problem-solving, while leaving more rigorously collected information for theory development. This is probably the opposite of what should be done. In our view, applied research, where costly implementation is going to occur, requires the use of information that is reliable, valid, and representative of the situation. Theory is developed over a series of studies; the process is thus somewhat self-correcting. If "quick and dirty" information misguides a statement of theory, subsequent research will reveal this and require revision of the theory. However, if "quick and dirty" information misguides the process of design or problem solution, the failure of the specific solution may be much more difficult to reverse, resulting in substantial societal and economic costs.

MULTIPLE-SITE EVALUATIONS PROVIDE DIFFERENT BENEFITS THAN SINGLE-SITE EVALUATIONS

The studies of the public housing sites in Champaign County and St. Louis were initiated in order to provide information to their respective housing authorities. For example, the executive director of the Champaign County Housing Authority explained in Anderson, Selby, and Weidemann (1991) that he needed the research because he was newly appointed and needed a quick way to begin to understand the problems and potentials across the Authority's sites. Thus, an evaluation of multiple housing sites can be an effective way to obtain an overview of the housing issues. Two years after completion of the Champaign County study, the executive director continued to refer to the report and to use the recommendations as priority agendas for the Authority.

However, when multiple sites are examined, it becomes more difficult to focus on a single site (unless resources are exceedingly plentiful). Implications for design and management tend to be more general. Further, there is a variation on one of the dimensions proposed by Min (1988); the level of resident involvement is typically lower in multiple-site evaluations since the researcher will typically have less contact with the residents. Therefore, one potential disadvantage of multiple-site applications of the research process

is that it becomes easier for residents to feel that they are not being adequately heard or that their site will not receive the attention that it deserves.

Yet it is important to realize that research utilizing multiple sites can generate comprehensive information, information that can be used to produce results with greater generalizability. A second important benefit of using multiple sites is that greater variation in the physical environment may be more evident. Greater variability in potential predictors of satisfaction increases the likelihood that relationships between the physical environment and people's perceptions and behaviors can be accurately identified. Further, the examination of a wide set of potential predictors has important implications for the development of theory.

CROSS-CULTURAL STUDIES INDICATE RESPONSE DIFFERENCES

We have found that in the United States there is very little difficulty in using self-report instruments (e.g., interviews and mailed questionnaires) to obtain information about residents' perceptions of their housing environment. Indeed, residents sometimes offer information in overwhelming detail. Residents are generally willing, and often eager, to discuss many aspects of their housing environment. High rates of participation can often be obtained with little missing data. We believe that this is because housing is critically important to these residents; whereas other research that might address issues of little direct relevance to the individual often result in more reluctance to respond.

In cross-cultural studies we have found differential responses to methods of gathering information and to specific issues. Our experience in replicating the use of our instruments and process in other countries indicates that this willingness to participate may not be universal. Chin, Weidemann, and Anderson (1991) report that mail questionnaires have not been as successful in Korea. Thus they chose a modified interview process where residents read a structured questionnaire and then the interviewer recorded their response on a separate answer sheet. In a self-report questionnaire used in Australia (Turnbull et al., 1983), the return rate was high, but missing data became an issue. For example, Australians in that study tended not to respond to a set of items concerned with the residential location of friends and relatives and the frequency of visiting with those individuals. These were items that had been used with no missing data problems at numerous housing sites in the United States.

THEORY NEED NOT BE NEGLECTED AT THE EXPENSE OF PROBLEM SOLUTION

Theory need not be neglected in studies where the initial focus is problem solution. The process for generating information for problem solution has one essential characteristic in common with the process for generating

information for the development and testing of theory: *There should be reason to have confidence in the information that the process generates.* It should not matter why information about environment and behavior issues is being collected; neither theory development nor problem solution should be based on information that is easily dismissed or refuted. Therefore, data collected for problem solution, obtained by a process that demonstrates a basis for confidence (e.g., reliable and valid data), can subsequently be examined for the development of theory.

The way one develops confidence in the information he or she generates is by paying attention to the process that is used to obtain the information. In short, this means that understanding the strengths and weaknesses of various research methods is as important to research utilized for problem solution as it is for theory development. Confidence may also be gained by obtaining a set of similar findings over different populations and settings, etc. (i.e., establishing external validity).

THERE IS NO PERFECT PROCESS

Unfortunately, there is no perfect process for generating information about the ways people perceive the built, designed, and managed environment. In some sense all information is "quick and dirty" because all of the tools and processes have a potential for introducing error. Thus, if you want to have confidence in your information it is important to know the relative strengths and weaknesses of the tools that you are using.

Still, It Is a Process. The generation of information is done by a process; it does not happen as the result of a single event. That process has been described very clearly, for example, by McGrath and colleagues (McGrath, 1981; Runkel & McGrath, 1972). It is not a single linear process; rather, it is a sequence of decision points, each of which impacts upon all others in the process. Feedback to various points can occur at various times within any single study. Decisions must be made at each point. What is crucial is that the strengths and weaknesses of each of the choices available at each stage must be understood. Choices within the process should be those most appropriate to obtain the desired information (what do you want to know?) in a particular situation, at a given time, within particular constraints.

IMPLICATIONS FOR FUTURE THEORY, METHODS, RESEARCH, AND UTILIZATION

There are several important issues we feel we (and perhaps others in the EB field) don't know enough about yet. They range from a relatively specific methodological / analytical issue to a much broader issue of generalizability

resulting from having a body of knowledge in which one aspect of the residential environment experience can be related to another conceptually and empirically.

WHAT IS THE NATURE OF THE RELATIONSHIP BETWEEN SATISFACTION AND RELATED VARIABLES?

All of our research (in the analysis phase, certainly, and generally in the conceptual phase) treats the operational measure of satisfaction as if it had a *linear* relationship with other variables. Analytically, it is a major assumption of most of the statistical techniques we use, for example, Pearson correlation analysis, which forms the basis for our multivariate factor and regression analyses. Conceptually, it is easier to think of relationships as being linear—for example, to think that as we increase the level of one variable, the level of another (e.g., satisfaction) will consistently increase or that it will consistently decrease if it is a negative relationship.

Empirically speaking, we would have to say that our results consistently “make sense” both at a practical and theoretical level. And they are also generally consistent over different populations in different settings.

However, we feel we have not adequately examined the issue of linearity (partly due to time and resource constraints). There are those (e.g., Galster, 1984) who feel that this is an important issue, as do we. It is an issue that needs to be further examined. If, as may well be likely in a complex world, there *is* a linear relationship between satisfaction and some variables and a *nonlinear* relationship with others, then we must all be more attentive to the need for (1) further research to examine the implications for utilization for theory development and (2) the implications for design and problem-solving. (For example, what if we found that one of our most consistent results, that dealing with the relationship between satisfaction and appearance/maintenance, really was nonlinear? If it were curvilinear, it might mean that people were dissatisfied if appearance/maintenance levels were too low [as we would intuitively expect] but also dissatisfied if they were too *high* [a condition that one of the coauthors must implicitly subscribe to, judging from the appearance of her office].)

Clearly, we feel that this issue has importance for research utilization and must be more carefully examined in the future.

IF SATISFACTION IS A CRITERION, HOW DOES IT RELATE TO OTHER OUTCOME VARIABLES?

Certainly, satisfaction is only one of a number of possible outcomes representing the quality of the residential environment. We do not yet have an adequate understanding of how satisfaction relates to other potential outcome variables, especially behavioral variables. Conceptually, there are

strongly hypothesized (and sometimes empirically tested) relationships between satisfaction and specific behaviors. For example, demographers and geographers look at relationships between satisfaction and moving or likelihood of moving (Speare, 1974). Housing managers would like to have a relationship between satisfaction and low levels of vandalism and vacancies. Planners talk of a relationship between satisfaction and community involvement.

What is needed is an integration of disciplinary and conceptual approaches to address perceptual, affective, and behavioral responses into a single study or set of studies. This is not meant to suggest that people have not done this to some extent. They have, and so have we, to a degree. But it is costly, in terms of resources and in terms of time, and is often quite limited in conceptual breadth. Yet, to effectively utilize research information about *any* outcome, we need a stronger knowledge base, and we need one that more adequately reflects the complexities of real life.

HOW FAR CAN WE GENERALIZE OUR RESULTS?

It is also important for research utilization that there be a body of knowledge that will allow at least some degree of generalization across populations, across settings, and across responses (e.g., "satisfaction" will be generally understood the same way by everyone). Without generalizability, we would have to start each new research study anew, without building conceptually or methodologically on past knowledge.

Our program of research has focused generally on certain types of housing and certain populations. What can we say about wealthy persons who have retired to the Bahamas? Not much, in terms of results of our research, especially if we are in the traditional role of "conservative researcher," not wishing to generalize too far. However, we do feel confident that a number of issues have been identified that are consistently related to resident satisfaction, although their relative importance may vary across settings and populations. We also feel that there are clear linkages (both directly and indirectly) between characteristics of the physical environment, people's perceptions, and satisfaction with the residential environment. What remains is to broaden the types of settings, the populations, and even the issues that have been examined in order to further test the generalizability of results. As an example, work initiated (Edwards, 1992) extends the research in terms of population (residents of Reston, Virginia), in terms of issues (the addition of more urban planning issues), and in terms of outcomes or criteria for the success of the residential setting. In this research, residents' satisfaction is examined as an intermediate outcome between the more specific characteristics of the residential environment and more general and encompassing quality of life measures.

Min (1988) has provided a useful description of six models of research

utilization in environment and behavior studies (see Figure 1 earlier in this chapter). However, the role of theory and theory development seems neglected at the expense of problem solution. Experience with a program of research that has included studies focused both on *problem solution* and on *theory development* suggests that a desirable model of research utilization is one that seeks to unite the interests in theory development and problem solution. As Rutledge (1985) has suggested, theory can be the arbiter of design decisions.

Also, absent from the dimensions defining Min's six models of research utilization is any consideration for the quality of research information. While this has traditionally been a concern in research directed at theory development, our experience suggests that it is an issue of equal importance to both problem solution and theory development.

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Environments for Older Persons with Cognitive Impairments

TOWARD AN INTEGRATION OF RESEARCH AND PRACTICE

GERALD D. WEISMAN

The relationship between older persons and the environments they occupy has constituted a continuing focus for both research and practice since the earliest days of environment-behavior (EB) studies. Environment-aging work has made major contributions in shaping the goals, theories, and methods of the larger field of EB studies of which it is a part. A number of the pioneering studies of both personal space and territoriality were carried out in geriatric settings (e.g., DeLong, 1970; Lipman, 1967; Sommer, 1959). Two major volumes on theory development in environment and aging (Lawton, Windley, & Byerts, 1982; Pastalan & Carson, 1970) have been widely utilized outside of an aging context, as has Lawton and Nahemow's Ecological Theory of Aging (Lawton & Nahemow, 1973; Nahemow, 1990). Proceedings of the annual conferences of the Environmental Design Research Association regularly include multiple entries related to the elderly (Wener & Szigeti, 1988).

Despite these past accomplishments, concerns have been raised regard-

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ing the current vitality of environment–aging studies. Parmalee and Lawton (1990) report a “lull in empirical research during the past decade . . . [with] more applications of person–environment knowledge to policy and practice than new theoretical concepts, interesting research methodologies, or major new research findings” (p. 464).

This chapter, however, takes a somewhat different position; it endeavors to demonstrate that at least one segment of environment–aging studies—that focused on older persons suffering from Alzheimer’s disease or other cognitive impairments—has not suffered the kind of “lull” that Parmalee and Lawton report for the field as a whole. The increase in awareness of, concern about, and research on Alzheimer’s disease and related dementias has been recent and rapid in the United States. Alzheimer’s disease is seen in 5% of the population over age 65 and in 20% of the population over age 80. Current estimates suggest between 40% and 70% of all residents of long-term care in the United States suffer from some form of dementia (Office of Technology Assessment, 1987). As a consequence, there is a rapidly growing research literature focused on environments for older persons with cognitive impairments.

Research on environments for older persons with cognitive impairments, this chapter suggests, has yielded meaningful advances in theory, methodology, and application. In addition—and reflective of the overall theme of this volume—it is suggested that this body of work illustrates a number of benefits inherent in the integration of the traditionally distinct realms of research and application.

Different facets of integration are considered in each of the four sections of the chapter. To set the context for subsequent discussion and analysis, the first section briefly reviews eight projects implemented over the past 25 years. Intended to serve as both model environments to demonstrate new concepts in dementia care and/or as settings for ongoing research, these projects collectively define a continuum of settings and services spanning from institution to community. Over this same period, environments for people with dementia have come to be dealt with in an increasingly holistic manner, requiring simultaneous consideration of multiple dimensions of the total care environment. Thus, the second section of the chapter analyzes these facilities as “environment/behavior systems” integrating individual, organizational, and architectural domains. The third section reviews significant empirical findings relative to therapeutic outcomes for the cognitively impaired elderly, families, and caregivers. The chapter concludes with consideration of implications for future theory, methods, research, and utilization. Are there strategies for dealing with theoretical and applied concerns in integrative rather than antithetical ways? How can recent work on environments for the cognitively impaired elderly be effectively integrated within the broader historical and disciplinary context of environment/aging studies, as well as environmental design research more generally?

THE INTEGRATION OF RESEARCH AND PRACTICE

Parmalee and Lawton (1990) proposed four possible explanations for the "lull in empirical research" in environment–aging research over the past decade. The first three of these factors are the lack of new federally assisted housing programs during these 10 years, a slowdown in new nursing home production, and a greater emphasis nationwide on the continued residence of older persons within their own homes in the community (cf. Lawton & Hoover, 1981). The fourth and likely more controversial explanation advanced by Parmalee and Lawton suggests that an emphasis on policy and practice applications over the past decade may have thwarted the emergence of "new concepts and methods . . . in a way that could pace new research" (p. 464):

Person–environment relations was founded on theory-driven attempts . . . to specify some of the links between people and their environments . . . a major portion of research since then has come from applied fields such as architectural and interior design, urban planning, public administration, and many of the service professions. Although much useful knowledge has been produced, such research neither utilized nor generated much theory; the low demand for theory-based research simply may have failed to reinforce development of theory. (Parmalee & Lawton, 1990, p. 464)

There is, of course, no reason to assume that "applied" research will necessarily generate new theoretical concepts or interesting methodologies. At the same time, recent work in other areas of EB studies (cf. Schneekloth, 1987; Weisman, 1983) suggests that research and practice *can* reinforce one another in mutually productive ways.

With respect to environments for older persons with cognitive impairments, the rapid increase in awareness and concern related to Alzheimer's disease and related dementias has spurred the creation of a variety of new facilities and facility types, some purposefully designed to serve as "model" or "demonstration" projects. The goals of these demonstration projects are multiple and integrative: to distill what is currently known regarding the planning and design of more therapeutic settings for people with dementia, to apply this knowledge in the creation of new and innovative facilities, and to systematically evaluate facility performance over time.

While the creation and systematic evaluation of such innovative environments for the cognitively impaired elderly has become more frequent and more visible in recent years, such efforts date to the earliest days of environment–aging studies (cf. Lawton, Liebowitz, & Charon, 1970). Viewed collectively, these model and demonstration projects begin to define a *continuum* of settings potentially appropriate for older persons with cognitive impairments—encompassing long-term care institutions, retirement homes, board and care facilities, and community residence (see Table 1; cf. Lawton, 1986). The earliest of these projects endeavored to ameliorate nega-

TABLE 1. A Continuum of Five Model/Demonstration Environments for Older Persons with Cognitive Impairments

Facility type	Long-term care	Retirement home	Board and care home	Community residence	Integrated
Project	Weiss Institute Philadelphia Geriatric Center Philadelphia, PA 1974	Wesley Hall Chelsea, MI 1983-1985	Corinne Dolan Alzheimer Center Chardon, OH 1989	Caring Home Project Los Angeles, CA 1988	Pathways Project Miami Jewish Home & Hospital Miami, FL Under development
Date	40 older persons with organic brain syndrome	11 older persons, 10 with Alzheimer's disease or multi- infarct dementia	2 groupings of 12 residents each	25 caregivers with dementia victims living in their homes	440 residents (Alzheimer's victims and caregivers)
Therapeutic goals	Mitigate disorientation and wandering Support social behavior Facilitate personal- ization	Involve residents in activities and self-care to extent possible Regulate sensory and social stimulation	Sensory and spatial orientation Involvement with familiar activities in familiar spaces Safety and security	Reduce caregiver burden Mitigate disorientation and wandering Safety and security Support functional abilities	Less expensive, less medically oriented care Safety and security Privacy Companionship
Environmental features	Resident rooms arrayed around large central space with dining and social areas	Intensive staff training Domestic finishes, furniture, and lighting Creation of traditional domestic rooms (e.g., private bedrooms, living room)	Open activity area with surrounding wandering loop Central and visible kitchen Secure 2-acre garden	ADL assistance (e.g., grab bars) Safety devices Provision of familiar materials to promote activities	Integrated village on 26 acre campus Range of housing types (free-standing and attached homes, apartments, rooms, hospice) as well as associated services

tive aspects of traditional nursing homes; more recent projects continue to move toward the community end of this continuum. Additionally, more recent projects have endeavored to deal with the environment—physical, social, and organizational—in a more integrated and holistic fashion. To provide a context for the balance of the chapter, eight selected projects are briefly described in the following sections, and five are summarized in Table 1; more detailed analysis of the organizational and physical environments of each, along with relevant research findings, will be reviewed in subsequent sections.

PHILADELPHIA GERIATRIC CENTER

The earliest of these demonstration projects, and clearly at the institutional end of the continuum, were undertaken at the Philadelphia Geriatric Center. The small-scale renovation of a ward for cognitively impaired older patients provided an opportunity to introduce and assess specific architectural ideas then being considered for the subsequent construction of the Weiss Institute, a new facility for older persons with “organic brain syndrome.” The initial ward remodeling (Lawton et al., 1970) involved the creation of six single bedrooms plus adjacent semipublic spaces to replace a single larger ward.

Subsequent to this first effort, several years were devoted to the planning of the Weiss Institute by an interdisciplinary team, with the explicit goal of “compensating wherever possible for the disorientation, memory loss, loss of social skills and sense of self typically demonstrated by organically brain damaged older persons” (Liebowitz, Lawton, & Waldman, 1979, p. 59). Contrary to typical nursing home design, the Weiss Institute arrayed resident rooms around the perimeter of a very large (40' × 100') central space (Figure 1). It was intended that this immediately visible area both serve as a “landmark” for spatial orientation and encourage resident involvement in activities that occurred there. An extended evaluation study was conducted by the Philadelphia Geriatric Center research staff subsequent to construction and occupancy (Lawton, 1986; Lawton, Fulcomer, & Kleban, 1984). These results, along with those of other model and demonstration projects described here, are reviewed in the concluding section of this chapter.

WESLEY HALL

Another significant effort directed toward the renovation of an existing institutional setting was the Wesley Hall research/demonstration project undertaken by the Institute of Gerontology at the University of Michigan (Coons, 1985). A special living unit for eleven residents with severe memory loss, Wesley Hall was created from one wing of an existing home for the aged. “The project . . . was experimental in that one of its purposes was to

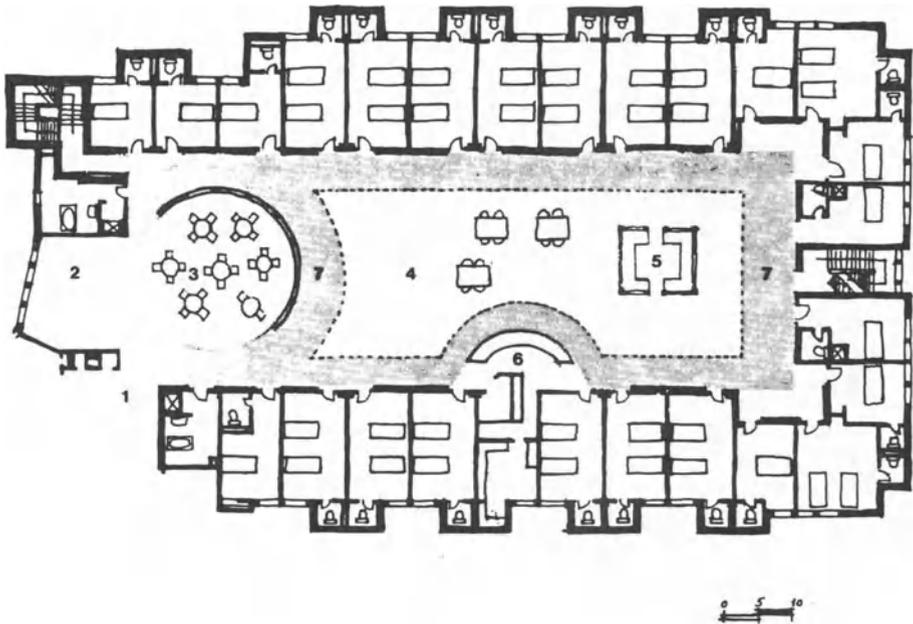


FIGURE 1. The Weiss Institute, Philadelphia Geriatric Center, Philadelphia, PA. Resident rooms are arrayed around the perimeter of a central open space that contains living, dining, and activity areas. Key: 1 = secure entry; 2 = living room; 3 = dining area; 4 = activity area; 5 = gazebo; 6 = nurses' station; 7 = wandering path. (Reprinted from Uriel Cohen and Kristen Day, *Contemporary Environments for People with Dementia*, Johns Hopkins University Press, 1993.)

learn through testing and experimentation the adaptations that would be essential in applying earlier criteria and methods to this special population" (Coons, 1991, p. 38).

Along with intensive staff training, a number of modifications were made in the existing physical setting; these included introduction of softer and more domestic finishes and lighting, provision of private resident rooms, and creation of traditional "domestic" spaces including a den, living room, dining room, and kitchen.

JOHN DOUGLAS FRENCH CENTER

More recently, a second generation of model and demonstration projects has emerged, explicitly designed and planned in response to the needs of people with dementia and their caregivers. The first of these facilities was the John Douglas French Center, a 148-bed long-term care facility in Los Alamitos, California. Each of its three floors is comprised of four "clusters" of 13 residents, meant to encourage small activity groups or "families" (Stevens, 1987). Small dining areas serve two clusters and were intended to minimize the potential confusion of large groups when residents eat.

GARDINER ALZHEIMER'S CARE CENTER

Planning for the Alzheimer's Care Center in Gardiner, Maine, was initiated in the mid-1980s and represents an important movement away from the institutional context of earlier environments for older persons with cognitive impairments. A "board and care" home rather than a nursing home, the Alzheimer's Care Center was intended to serve those people in the early stages of dementia who do not yet have medical complications. It was planned as part of an integrated project that also included a Geriatric Evaluation Unit, a Community Resource Center, and Alzheimer's day care and respite care located within the "board and care" facility. Designed on a "social" rather than a "medical" model, the center provides intensely supervised but nonmedical care. The design incorporated a variety of features intended to facilitate interaction among residents and staff; these include three groupings of patient rooms with activity areas, a kitchen large enough to accommodate residents assisting with the preparation of meals, and round tables in the dining room intended to support interaction (Faunce & Brunette, 1986; Fortinsky & Hathaway, 1988; Meyer, Jacques, O'Rourke, Dowling, Nicholas, & Dorbacker, 1990).

CORINNE DOLAN ALZHEIMER CENTER

One of the most highly developed specialized environments for older persons with cognitive impairments is the Corinne Dolan Alzheimer Center, a 24-resident home located on the grounds of a 210-bed health care facility in Chardon, Ohio (see Figure 2). Emerging from 2½ years of research related to the planning and design of Alzheimer's facilities, the Dolan Center was designed to be both a model facility and a setting for study of environment-aging relationships.

The physical setting of the Dolan Center has been shaped by a set of six goals: noninstitutional environment; opportunities for personalization; self-control and self-determination; opportunities for social interaction; security and freedom; and staff efficiency: "The Center is intended as a test of whether architectural cues—from high contrast door handles to built-in wandering paths that safely return to their starting points—can prompt the remaining memory skills of Alzheimer's patients" (*Built-In Memory*, 1990, p. 1).

An initial set of eight studies addressed issues of spatial disorientation, incontinence, distractibility, confinement, confusion, intake of food, and the reinstating of interest in familiar tasks (Namazi et al., 1991).

WOODSIDE PLACE

A somewhat larger facility for older persons with cognitive impairments, Woodside Place in Pittsburgh, Pennsylvania, shares a number of environmental and organizational innovations with the Dolan Center (Mal-

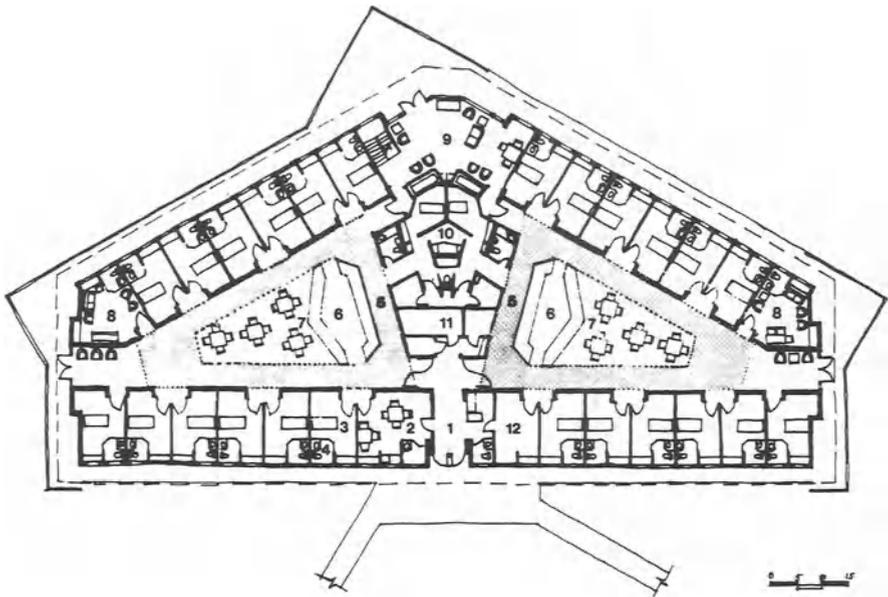


FIGURE 2. The Corinne Dolan Alzheimer Center, Chardon, OH. Taliesin Associates, Architects. In each of the two units, dining and social areas are surrounded by a wandering path and 12 private resident rooms. *Key:* 1 = entry and reception area; 2 = crafts studio and day care entry; 3 = typical resident room; 4 = typical toilet area; 5 = wandering path; 6 = nourishment center; 7 = central public area; 8 = activity room; 9 = tub and shower room; 11 = support areas; 12 = offices. (Reprinted from Uriel Cohen and Kristen Day, *Contemporary Environments for People with Dementia*, Johns Hopkins University Press, 1993.)

kin, 1992). Explicit goals for Woodside Place include more appropriate and less costly (75% of nursing home care) residential environment for people with dementia; a safe, nonrestrictive, and homelike environment that permits elimination of restraints or sedation; and creation and testing of new alternatives that are replicable by other agencies.

Woodside Place is not built to nursing home standards; rather, it is viewed by the state of Pennsylvania as a "personal care home." Like the Dolan Center, it is organized into "houses" of 12 residents each, although in this case three "houses" as compared with two at the Dolan Center (see Figure 3). Each of the three "houses" at Woodside Place is self-contained and includes 10 resident rooms (eight singles and two doubles) as well as dining and social areas. The three "houses" are joined by a meandering corridor with specialized spaces (music room, parlor with fireplace, library, country kitchen) along its length. The use of "care attendants" with no prior nursing home training represents one means by which Woodside Place hopes to minimize the regimentation typical of long-term care facilities. Other organizational innovations include the training of an interdisciplinary care man-

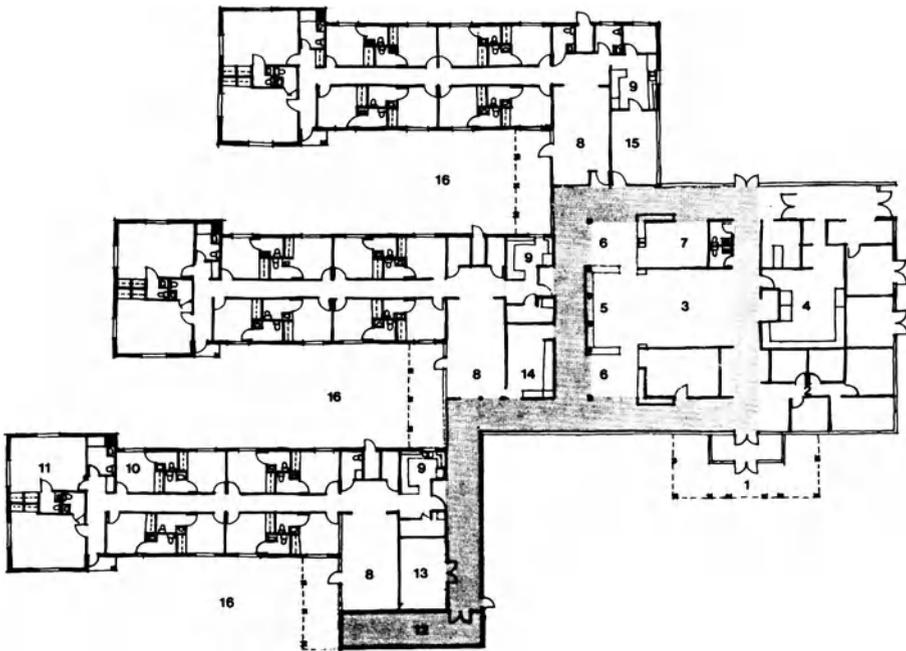


FIGURE 3. Woodside Place, Oakmont, PA. Perkins, Eastman, Geddes, Architects. Three self-contained clusters of 12 residents each are linked by a set of specialized music, crafts, and social spaces. Key: 1 = entry; 2 = administration; 3 = great room; 4 = main kitchen; 5 = lounge; 6 = sitting area; 7 = country kitchen; 8 = living/dining rooms; 9 = pantry; 10 = single bedroom; 11 = double bedroom; 12 = quiet room; 13 = music room; 14 = arts and crafts room; 15 = entertainment room; 16 = secure courtyards. (Reprinted from Uriel Cohen and Kristen Day, *Contemporary Environments for People with Dementia*, Johns Hopkins University Press, 1993.)

agement team to provide assessments of residents and to plan and monitor their care as well the provision of daytime, evening, or weekend respite care.

Woodside Place will be the focus of a 3-year controlled case evaluation comparing matched groups of patients at Woodside Place, a traditional nursing home setting, and a segregated Alzheimer's care unit in another long-term care facility. Evaluative criteria will include resident mental/functional status, overall health, health and burden of family caregivers, patterns of social interaction, safety/mobility, cost issues, and overall resident "quality of life."

UNIVERSITY OF SOUTHERN CALIFORNIA CARING HOME PROGRAM

The majority of the research literature on older persons with cognitive impairments (much like environment-aging studies more generally; cf.

Lawton & Hoover, 1981) has tended to focus on institutional rather than community settings. The next demonstration project to be considered began with recognition that three times as many people with dementia reside in the community as in long-term care settings and that the home thus represents the major setting in which care for people with dementia is provided.

Rather than being defined by a specific facility type, the Caring Home Program (Pynoos, Cohen, & Lucas, 1989; Pynoos & Ohta, 1988) studied 25 southern California caregivers tending to people with dementia in their homes. The objectives of the study were to determine whether (1) any environmental factors presented obstacles to effective caregiving, (2) there was a relationship between such environmental problems and caregiver stress or burden, and (3) if modifications to the home environment might ameliorate such caregiver stress and burden. To these ends a multidisciplinary research team interviewed caregivers, carried out detailed environmental assessments of the home environments, and—in a second phase of the study—carried out and assessed the impact of environmental modifications in the homes of the 13 treatment group families.

MIAMI PATHWAYS PROJECT

Finally, the Pathways Project of the Miami Jewish Home and Hospital is, in a variety of ways, a synthesis of the various demonstration facilities described earlier. To be developed on 26 acres in the greater Miami–Fort Lauderdale area, Pathways will be a 440-resident “village” consisting of a continuum of residential settings—free-standing or attached villas, apartments, and individual rooms—as well as associated services for cognitively impaired older persons and their caregivers (typically their spouses) (see Figure 4).

The belief underlying the Pathways concept is that many Alzheimer victims could remain with their spouses in residential settings or be served at a lower level of care if such care existed. Design of a less costly, less medically-oriented environment with fewer institutional design requirements . . . could result in significant savings. Further, delaying admission to an institution for a year or two by providing support and training to caregivers and . . . victims could also result in savings—emotional and financial. (Williams & Stern, 1992, pp. 32–33)

CONCEPTUALIZING THE ENVIRONMENT

The demonstration projects reviewed in the last section are noteworthy, not solely for their consideration of the therapeutic potential of the physical setting, but also for their efforts to deal with multiple dimensions of the total environment—organizational, social, and architectural. Grappling with such complexity constitutes a significant challenge for environment–aging studies (cf. Parmalee & Lawton, 1990; Proshansky, 1987). There has been a suc-

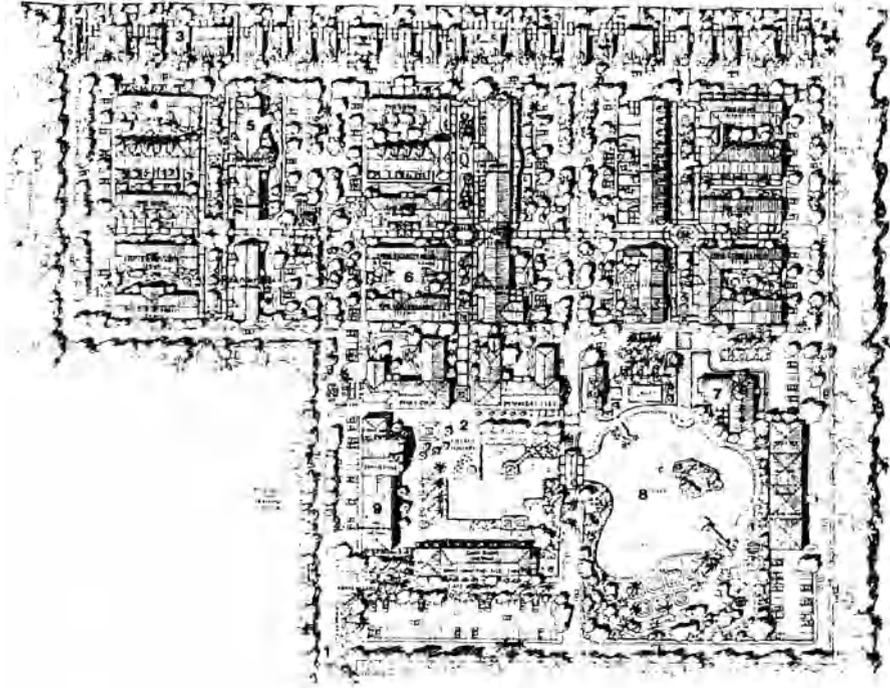


FIGURE 4. The Pathways Project, Miami Jewish Home & Hospital, Miami, FL. Korobkin Associates, Architects. A resident village for over 400 cognitively impaired older persons and their caregivers, Pathways will include free-standing villas, apartments, and individual rooms. Key: 1 = entry; 2 = village square; 3 = single-family houses or duplexes; 4 = row houses; 5 = assisted living units; 6 = comprehensive care; 7 = hospice; 8 = lake; 9 = administrative/research area. (Reprinted from Uriel Cohen and Kristen Day, *Contemporary Environments for People with Dementia*, Johns Hopkins University Press, 1993.)

cession of efforts over the past two decades to create better “conceptualizations of human environments (Moos, 1973) and to develop “better ways of describing and classifying . . . important environmental features [and] integrate more of the components of the complex . . . person–environment interaction” (Parr, 1980, p. 391).

The framework around which this chapter is organized endeavors to synthesize elements of earlier conceptualizations of the total environment. As depicted in Table 2, facilities for older persons with cognitive impairments are viewed as “environment–behavior systems” (Weisman, 1981; Weisman, Cohen, Ray, & Day, 1991). Table 2 also illustrates the parallels between this model and three earlier conceptualizations of person–environment relationships. Both Lawton’s (1973, 1986) fivefold “ecosystems” taxonomy and the conceptual framework of Moos’s (1984) Multiphasic Environmental Assessment Procedures have been particularly influential within

TABLE 2. A Comparison of the EB Systems Model with Earlier Conceptualizations of Person–Environment Relationships Drawn from Environment–Aging Studies and Environmental Design Research

	Lawton (1970, 1982)	Moos (1980)	Markus (1972)
People with dementia	Individual	N/A ^a	N/A
Social context	Personal and suprapersonal environments	Suprapersonal	N/A
Organizational context	Social environment (norms, values, and institutions)	Program and policy dimension	Objectives system, activities system
Physical setting	Physical environment (physical, consensual, and phenomenological)	Physical dimension	Building system, environmental system
Therapeutic dimensions of the environment as experienced	Person–environment interaction	Social climate	Environment/activity interface

^aN/A, not applicable.

environment–aging studies; Markus’s (1972) “doughnut model of the environment and its design” has also had substantial impact in the broader field of environmental design research.

In brief, the EB systems model is comprised of four interacting sub-systems: *people with dementia*, *social context*, *organizational context*, and *physical setting* (see Figure 5). The social and organizational context together with the physical setting constitute the “environment” external to the individual. The fifth element of the total environment, *therapeutic dimensions of the environment as experienced*, emerges from the interactions of the previous four sub-systems and mediates their impact on resultant therapeutic outcomes.

Utilizing this model as an integrative framework, this section reviews research relevant to understanding people with dementia, social and organizational context (considered jointly), physical settings, and therapeutic dimensions of the environment as experienced. It concludes with a brief comparison to non-dementia-specific facilities. The next section considers therapeutic outcomes with respect to cognitively impaired older persons, staff, and family caregivers.

PEOPLE WITH DEMENTIA

Of the dementing diseases affecting older persons, Alzheimer’s is the most common within the United States, representing 50–60% of all cases; it



FIGURE 5. An EB systems model of facilities for cognitively impaired older persons.

is seen in 5% of the population over age 65 and in 20% of the population over age 80. It is estimated that the number of individuals with severe Alzheimer's disease will more than double in the next 30 years (Office of Technology Assessment, 1987). A progressive and irreversible neurological disorder, Alzheimer's disease eventually renders its victims incapable of self-care and constitutes a major reason for institutionalization. Current estimates suggest between 40% and 70% of all residents of long-term care in the United States suffer from some form of dementia. At the same time it must be remembered that—at least in the early and middle stages of the disease—these people are *not* physically impaired.

There are a variety of models of the progression of the disease, with the three stages proposed by Reisberg (1983) likely the most common. Table 3 elaborates this model, emphasizing the major performance deficits associated with Alzheimer's disease in terms of four categories: behavioral/functional, cognitive, emotional, and social. While such models clearly are of value, they lack any explicit environmental context. Several recent studies, consequently, have endeavored to examine the progression of age-related cognitive and physical impairments and the impact of such impairments on both environmental experience and design.

TABLE 3. Behavioral, Cognitive, Emotional, and Social Deficits Associated with Alzheimer's Disease

	Behavioral/functional	Cognitive	Emotional	Social
Stage 1: Forgetfulness phase	Employment: no observable deficits	Difficulty remembering names of people, familiar places, and objects	Some anxiety and appropriate concerns about symptoms	No observable deficits
Mild symptoms Diagnosis: Retrospective recognition	Poor performance noted by coworkers	Word-finding deficit that becomes obvious to intimates Possible loss of objects of value	Moderate anxiety about symptoms Irritability	Decreased performance in demanding situations
Stage 2: Confusional phase	Difficulty with complex tasks and demanding employment situations	Poor concentration Impairment of reason and judgement Possible episodes of getting lost	Anxiety about symptoms	Inappropriate and embarrassing behavior in social situations
Moderate symptoms of anger/guilt denial, sadness Clear deficits	Inability to perform complex tasks Nocturnal restlessness	Difficulty recalling recent events and aspects of own history Difficulty traveling Financial incompetence Impairment of abstract thought	Denial of symptoms Flat affect Withdrawal from challenging situations	Social ineptitude Social alienation
Stage 3: Dementia phase	Inability to initiate or complete purposeful task Nocturnal confusion and wandering	Severe memory loss: inability to recall major aspects of life, names of close family	Denial and shame Catastrophic incidents: irritability, agitation, and violent episodes	Toleration of only simple, structured, familiar social situation Need for reality orientation
Severe symptoms	Incontinence Dependence for all care	Unawareness of time, space and events	Personality changes: paranoia, hallucinations, delusions	No social interaction
Separation from self	Loss of basic psychomotor skills (e.g., walking)	Abulia (loss of intentionality)	Obsessional behavior	
Terminal phase	Inability to recall own name			

As a part of their Caring Home Project, Pynoos and Ohta (1988) gathered data on the ability of their sample of community-dwelling older persons to carry out the activities of daily living (ADLs). These 25 older persons were relatively highly functioning with respect to some ADLs (e.g., mobility) but required considerable assistance with dressing, grooming, bathing, and toileting. Similarly, of the more than 100 people with dementia assessed for possible residence in the Alzheimer Care Center in Gardiner, Maine, almost 40% required no assistance with ADLs, while 40% required assistance with one or two activities. Paralleling Pynoos and Ohta's data, cooking, dressing, and bathing were most problematic, with more than one-third of the individuals assessed needing help with each of these activities (Fortinsky & Hathaway, 1988). By contrast, among Wisconsin nursing home residents with a diagnosis of Alzheimer's disease, fewer than 30% were able to deal with the demands of personal hygiene, toileting, mobility, or eating independently (Jesudason, 1991).

Pynoos and Ohta also queried the family members regarding problems they experienced in providing care to their sample of community-dwelling people with dementia. Of the ten most frequently occurring problems, five can be seen as having an environmental dimension; in rank order, these were staying at home alone, dressing self and preparing meals, and bathing self and cleaning the house. Similarly, of the ten problems that elicited the most negative reactions from caregivers, five were environmentally related; again in rank order, these were getting lost outside the home, staying at home alone, wandering outside the home, forgetting where one is, and losing/misplacing things.

SOCIAL AND ORGANIZATIONAL ENVIRONMENT

It has been suggested (Weisman, 1983) that EB studies have paid relatively less attention to social and organizational factors than to other domains of the environment and behavior system. Thus, the explicit inclusion of such variables in studies of specialized environments for older persons with cognitive impairments represents an "advance" that could profitably be integrated into other aspects of environment-aging studies.

A study by Sloane and associates (Sloane, Mathew, Desai, Weissert, & Scarborough, 1990) compared 31 specialized Alzheimer's units with an equal number of similar units within nursing homes. They found Alzheimer's units to be selective in their admissions criteria, discouraging potential residents who were abusive and nonambulatory. Alzheimer's units were also more intensively staffed than were comparison units; for all nursing staff (both licensed nurses and aides) the resident-to-staff ratio was 6:1 on the Alzheimer's units and 8.1:1 on the comparison units. The Sloane et al. study also illustrates how organizational structure can have a direct impact on physical structure. Alzheimer's units were found, on average, to have

fewer than two-thirds as many residents as comparison units (36 vs. 59). Again, reflective of the interplay of organizational and architectural structure, Alzheimer's units on average had more than half again as many private rooms as did the comparison units (21 vs. 13).

Data gathered by White and Oh-Jung (1988) from a national sample of 99 Alzheimer's/dementia units are indicative of the ways in which organizational policies may reflect the therapeutic potential of specialized facilities for older persons with cognitive impairments. More than 90% of the facilities they studied permitted residents to bring one or two large pieces of furniture from home, and nearly two-thirds identified other methods to personalize residents' rooms and make them more homelike.

PHYSICAL SETTINGS

There have been several significant efforts to study the physical settings occupied by older persons with cognitive impairments. As part of a broad-ranging study, Sloane et al. (1990) gathered data on environmental features of 32 special care units for people with dementia in five states, as well as for a matched comparison sample of nursing units. White and Oh-Jung (1988) mailed questionnaires to a nonrandom, purposive sample of 99 health care facilities in 34 states, yielding a highly detailed picture of physical settings of special care units for the cognitively impaired. Ohta and Ohta (1988) reviewed a variety of materials (published and unpublished reports, policy manuals, observation notes) from 19 special care units to define the multiple ways in which such units can and do differ from one another with respect to philosophy, therapeutic approach, and environmental design.

In sum, efforts have tended to focus almost exclusively on special care units (SCUs)—segregated settings for the cognitively impaired within long-term care facilities—rather than on more innovative environments. The following discussion deals primarily with such facilities, with exceptions noted as appropriate. After a brief review of basic descriptive information (e.g., history and size), attention is turned to features and qualities of these settings potentially supportive of the therapeutic goals outlined here; this section concludes with a discussion of whether, and how, dementia-specific facilities differ from other settings for older persons.

The vast majority of the units studied by White and Oh-Jung (1988) were created within existing facilities, while more than 50% involved some remodeling; 20% were converted to dementia use with no special design or structural changes, and less than 10% of the sample were purpose built for use as special care units. Most were relatively self-contained, having their own staff work area, dining room, dayroom, and/or lounge. Of the 32 SCUs studied by Sloane and Mathew (1990), only six were especially designed and constructed.

Sloane et al. (1990) found their sample of special care units to have, on average, fewer than two-thirds as many residents as comparison units (36

vs. 59). White and Oh-Jung (1988) report similar results with a mean of 32 beds per special care unit. Square footage allocations per resident, however, were quite similar for dementia and comparison units (302 and 328 square feet, respectively). Again, reflective of the interplay of organizational and architectural structure, the percentage of private rooms in Alzheimer's units was almost twice as high as in comparison units (21% vs. 13%).

THERAPEUTIC DIMENSIONS OF THE ENVIRONMENT AS EXPERIENCED

A number of researchers concerned with environments for older persons with cognitive impairments (e.g., Calkins, 1988; Cohen & Weisman, 1988; Lawton et al., 1984; Sloane & Mathew, 1990) have identified qualities of the environment deemed to be therapeutic with respect to dementia care. A synthesis of these efforts yields a set of eight *therapeutic dimensions of the environment as experienced* (Cohen & Weisman, 1991; Weisman et al., 1991) central in understanding the relationships between older persons with cognitive impairments and the environments they occupy.

As described on the pages that follow, these dimensions of environmental experience provide a basis for the aggregation of environmental features into higher-order constructs and for the positing of relationships to therapeutic outcomes. Specifically, the Therapeutic Environment Screening Scale (TESS) developed by Sloane and Matthew (1990) assesses the appropriateness of nursing home units for people with dementing disorders. The 12 items comprising the TESS scale were explicitly derived from a set of five "therapeutic principles" judged to be relevant to the care of people with dementia. White and Oh-Jung (1988), while not involved in scale construction, reported parallel descriptive data on five environmental characteristics with therapeutic implications.

Safety and Security. Given that people with dementia are vulnerable to environmental effects as a consequence of cognitive impairment and physical disability (Calkins, 1988), it is imperative that they experience their physical setting as one that is both physically safe and psychologically secure. Residents must be protected from potential hazards (e.g., unsupervised exits) and provided with those devices (e.g., grab bars) that may minimize accident and injury.

Sloane and Mathew's (1990) TESS includes two items judged to be relevant to safety and security: clean, nonslip floors and even lighting with freedom from glare. Scores for both these items were quite high. In the units studied by White and Oh-Jung (1988), environmental features found to be most common, and judged by respondents to be most successful, were exit alarm systems (found in more than 80% of units) and the provision of some form of outdoor space exclusively for use of Alzheimer's/dementia patients (50% of units). In similar terms, Ohta and Ohta (1988) focused on exit alarms

and protected outdoor spaces as reflective of concerns of safety and security.

Awareness and Orientation. Older persons with cognitive impairments often experience problems with respect to orientation to time and place. Coherent, legible, and congruent programs and settings may mitigate disorientation, wandering, and/or agitation (Gilleard, 1984; Namazi, Rosner, & Calkins, 1989; Weisman, 1987).

White and Oh-Jung (1988) included 12 items related to environmental cueing devices, ranging from personal markers or photos adjacent to doors of resident rooms and color coding of units or floors to usage of large murals or other supergraphics. While the first of these items was found in close to 70% of their study settings, the others were all substantially less frequent. Their instrument also included six items typically employed in reality orientation (e.g., large print calendars, clocks, schedules) that were found to be quite common in both SCUs and parent institutions with few statistical differences in their occurrence. Ohta and Ohta (1988) make reference to nameplates for resident rooms as well as personal items and furniture in resident rooms meant to support orientation to space and time. By contrast, Sloane and Mathew (1990), although they explicitly mention "orientation or wayfinding" as an important goal served by the physical setting in environments for people with dementia, indicate that they "were unable to identify standardized observable items to include in the rating scale" (p. 26).

Opportunities for Socialization. The goal in Lawton's (1990) terms is to increase the "social affordance" of a setting. Settings should create the potential for social interaction (e.g., places for passive viewing of activities) and support such interaction once initiated.

The accommodation and facilitation of social interaction, although an often articulated goal in the long-term care literature, has received only limited attention in assessment efforts. Two items included in the TESS—available space for family or small group meetings and television routinely turned off in public areas—clearly relate to such social contact; both were found in roughly two-thirds of Sloane and Mathew's (1990) study settings.

On a larger scale, Ohta and Ohta (1988) placed great emphasis on the impact of unit size on the social life of these therapeutic settings:

... the unit with 10 residents allows each patient to see and interact with a small and constant set of other patients throughout the day, each and every day. The size of this unit appears to promote friendships and socialization among patients and foster a sense of neighborhood. Such characteristics are not found in the unit with 49 patients. (p. 804)

The relationship between unit size and social interaction will be further considered in the following section on therapeutic outcomes.

Regulated Sensory Stimulation. It has been observed (Hall, Kirschling, & Todd, 1986; Johnson, 1989; Mace, 1987; Mace & Rabins, 1981) that cognitively impaired older persons are often assaulted with noxious and distracting stimuli. Thus sensory experience must be regulated; in Mace's (1987) terms this means "stimulation without stress." Pleasant views to the exterior or the presence of objects to manipulate can provide such stimulation without overwhelming residents.

This dimension reflects a goal that is far more dementia-specific than the preceding three, and several current environmental descriptions / assessments deal explicitly with mechanisms for the regulation of sensory stimulation. White and Oh-Jung (1988) included 12 items in their SCU questionnaire, ranging from application of sound-absorbent materials to the use of walkie-talkies in lieu of public address systems; on average, these 12 features were found in 33% of the facilities queried. The TESS (Sloane & Mathew, 1990) includes five environmental features related to regulation of stimulation: freedom from glare, absence of noise, absence of cleaning odors, absence of bodily odors, and television routinely turned off in public areas. Sloane and Mathew's sample of 31 SCUs received relatively high scores on these items (1.6, 1.4, 1.9, 1.8, and 1.3 respectively on a 0 to 2 scale). In a similar vein, Ohta and Ohta (1988) found a variety of features utilized to regulate stimulation, including sound-absorbent and nonreflective surface materials and soft pastel colors judged to be less "stimulating." They also suggest that residents of larger units are more likely to be "presented with a large and highly variable set of social stimuli" (p. 804).

Supportive of Functional Abilities. To the extent possible, the environment should facilitate maintenance of those abilities, such as ADLs, that are not totally impaired by dementia (Coons, 1987; Mace, 1987). Appropriate spaces and equipment (e.g., waist-level planters, safe kitchen appliances) can support these familiar skills.

Design interventions to support residents' abilities to carry out ADLs have received surprisingly little attention. Sloane and Mathew (1990) note "support of maximum self care" as an "important goal served by the physical environment in nursing homes" (p. 26). While they indicate that the TESS does not reflect this goal because they were unable to identify standardized items to include in their scale, their item "kitchen available for supervised resident use" appears to be consistent with this goal; this item was also the lowest scoring of the 12 TESS items.

Provisions for Privacy. Despite needs for staff surveillance and assistance, it is essential to respect residents' need for privacy (Nelson & Paluck, 1980) through both environmental and organizational means. To the extent possible, they should have control over their own personal space.

Issues of privacy appear to receive surprisingly little attention, either in terms of goal statements or operationalized as assessment items. Sloane &

Mathew (1990) do not include items in the TESS explicitly related to privacy; rather, privacy is viewed as one strategy for the accommodation of a range of social activities. The data reported by Sloane et al. (1990) in a larger study indicate that while Alzheimer's units on average have half again as many private rooms as comparison units (21% vs. 13%), private rooms remain surprisingly uncommon. In similar terms, Ohta and Ohta (1988) indicate that most of the units they studied have two or three residents per room. White and Oh-Jung (1988) report that residents in 61% of their study settings had private toilets and lavatories.

Ties to the Healthy and Familiar. It becomes increasingly difficult for people with dementia to adjust to new and unfamiliar environments. To the extent possible, they should be able to maintain normal social roles and familiar activities (Coons, 1987).

This dimension of environmental experience has received substantial attention in several environmental assessment efforts. The TESS (Sloane & Mathew, 1990) includes two such items related to personal items in resident rooms and homelike furnishings in public areas; however, the occurrence of both is relatively low (1.1 and 1.3 on a two-point scale). White and Oh-Jung (1988), by contrast, report that more than 90% of their study settings allowed residents to bring one or two large pieces of furniture (such as an easy chair or chest of drawers) and almost two-thirds of facilities permitted other personalization methods, but in only one-third of the facilities could residents bring their own bed. Ohta and Ohta (1988) likewise make reference to one unit where they found personal furniture and mementos both in patient rooms and corridors; they also suggest that presence of personal items in resident rooms is supportive of orientation with respect to time and space.

Autonomy and Control. The opportunity to exercise control over one's living environment—often through the introduction of familiar, personal artifacts—can contribute to a resident's sense of "home." Personal artifacts can also support orientation (Rosner, Namazi, Calkins, & Grotke, 1990), ties to one's past and meaningful roles and activities (Coons, 1987) and enhance resident and family satisfaction with a long-term care facility (Kruzich, 1989).

While there is potentially overlap with "ties to the healthy and familiar," this goal goes beyond the appearance of the physical setting to deal with one's role in shaping and manipulating the environment. As suggested by Koncelik (1976), a true sense of "residency" in long-term care settings must go beyond superficial furnishings and artifacts; it is created through opportunities to personalize one's environment and have some measure of control over its use.

Nevertheless, relatively little attention was paid to this goal in assessment efforts, and the occurrence of such control was quite low as well.

Sloane and Mathew (1990) found relatively limited evidence of "personal items in resident rooms" (1.1 of 2.0). As noted earlier, Ohta and Ohta (1988) observed "personal furniture and effects" in at least one facility; 92% of the settings studied by White and Oh-Jung (1988) allowed one or two pieces of residents' furniture, and 66% permitted personalization.

COMPARISON WITH NON-DEMENTIA-SPECIFIC FACILITIES

It should be recognized that these environmental assessment efforts are derived primarily from work on SCUs within long-term care facilities and assume a therapeutic, resident-centered perspective. It may be that goals for other kinds of facilities for people with dementia (e.g., board and care homes) will differ from those within an institutional context. Furthermore, as suggested by Hyde (1989) and Ohta and Ohta (1988), not all organizations set such high aspirations.

Comparative data presented by Sloane and Mathew (1990) for both SCUs and comparison settings indicated that overall TESS scores were significantly higher in the 30 dementia units studied than in the 29 comparison nursing homes. While TESS scores were higher in the six purpose-built dementia units than in the other 23, the difference was not statistically significant. Four of the 12 TESS items (absence of loud, distracting noise; personal items in resident rooms; direct access to outdoor areas; and television off in main public areas) most strongly differentiated SCUs from comparison units; differences for all four of these items were in the predicted direction, with two reaching statistical significance.

In similar fashion, White and Oh-Jung (1988) reported that differences between resident rooms in SCUs and in the parent institutions were typically in the expected direction but quite modest. Statistically significant difference included the lower occurrence of bathrooms shared by two resident rooms within SCUs, the presence of environmental cueing devices, and communication/noise control methods. Cueing devices included use of personal markers or photos near doors to resident rooms, signs, labels, pictograms, large murals, and other "landmarks"; however, only the personal markers for resident rooms were found in more than half of the sample settings. With respect to methods for control of noise and facilitation of communication, expected and statistically significant differences were found for 6 of 12 items, including use of sound-absorbing material on ceilings and walls, efforts to curtail or eliminate use of public address systems, and absence of televisions in dayrooms and lounges. Again, as with cueing devices, only one means of noise control—use of sound-absorbing ceiling material—was found in more than half of the sample settings. Finally, reality orientation aids (e.g., large print calendars, clocks, schedules) were found to be quite common in both SCUs and parent institutions with few statistical differences in their occurrence.

THERAPEUTIC OUTCOMES

As noted at the outset of the chapter, a number of the environments for older persons with cognitive impairments created over the past 25 years have been model and demonstration projects, designed to both implement and evaluate innovative approaches to organizational, social, and architectural aspects of the dementia care environment. The following review stresses findings from these model and demonstration projects with results of other studies included where appropriate. As with the preceding discussion of the various subsystems of these specialized environments, the available literature is heavily weighted toward segregated SCUs within long-term care facilities. Attention will first be directed toward outcomes relevant to people with dementia themselves; following sections will deal with the much more limited data available regarding family and staff responses.

OUTCOMES FOR OLDER PERSONS WITH COGNITIVE IMPAIRMENTS

As introduced earlier in this chapter, the earliest investigations of the behavioral consequences of specialized environments for older persons with cognitive impairments were associated with the Weiss Institute demonstration project at the Philadelphia Geriatric Center. The first of these studies (Lawton et al., 1970) explored the impacts of single bedrooms versus wards. A large existing ward was renovated into six single bedrooms plus adjacent semipublic spaces. Unfortunately, due to death and illness, only one of the original residents was able to move back to the renovated ward. While data gathered were very limited (nine residents prior to remodeling and six after), results indicated that residents utilized the private spaces provided and greatly increased the amount and range of their ambulation. While interaction between residents as well as resident-staff interaction decreased, this was judged to be a consequence of the greatly enhanced opportunities for privacy.

This exploratory study and an intensive, interdisciplinary planning, programming, and design process (Liebowitz et al., 1979) resulted in the construction of the Weiss Institute, a new 40-resident facility explicitly designed in response to the environmental needs of this user group. A longitudinal study (Lawton, 1986; Lawton et al., 1984) compared the behavior of severely cognitively impaired residents of the Philadelphia Geriatric Center before and after their transfer to the Weiss Institute. Data on patterns of resident behavior were gathered on four occasions in the year prior to the move and then 1 and 7 months after relocation; as a consequence of attrition, complete data were available for 53 of the original 135 study participants. Results indicated that, despite expected decline over time in measures of basic competence of residents, there was not a corresponding decline in more pliable behavioral variables. "Even more remarkably, in five instances

improvement occurred, and in only one instance was there a significant decline. This pattern of findings . . . confirms the presence of a clear prosthetic effect, to the point where the direction of a decline was reversed in some instances to become improvement" (Lawton et al., 1984, p. 751).

As part of the 2-year Wesley Hall research/demonstration project undertaken by the University of Michigan, 11 institutionalized older persons with severe memory loss were relocated to a remodeled special living unit created from one wing of an existing long-term care facility (Coons, 1987). Along with intensive staff training, a number of modifications were made to the physical setting; these included introduction of softer and more domestic finishes and lighting, provision of private resident rooms, and creation of a den, living room, dining room, and kitchen. While the holistic nature of the intervention precluded any specific linkages between independent and dependent variables, staff observations indicated positive resident response to this range of therapeutic interventions and a reduction in problem behaviors such as night wandering, incontinence, and combativeness.

Although not conducted in the context of long-term demonstration projects of the sort just described, two more recent studies (Benson, Cameron, Humbach, Servino, & Gambert, 1987; Chafetz & West, 1987) provided useful longitudinal data on SCUs. Benson et al. assessed 32 elderly, demented patients prior to their admission to an SCU, then 4 months and 1 year later. Although the researchers' focus was not explicitly on the physical setting, some environmental modifications (e.g., orientation boards, color coding of doors, permanent signs and photos adjacent to residents' rooms, double doorknobs to discourage unauthorized exiting of unit, and alarms) were implemented and described. Since improvements in mental and emotional status as well as basic ADLs were observed at the 4-month assessment and continued to the 1-year assessment, the authors concluded that specially designed and programmed SCUs can benefit select patients.

Chafetz and West (1987) undertook a longitudinal control group evaluation of a 30-bed SCU and a "traditional" long-term care facility with no specialized programming for dementia patients. The SCU was viewed to be "special" with respect to staffing and training, high levels of activity programming, regular meetings with families, and the physical environment (self-contained with an adjacent outdoor patio). It had been hypothesized (cf. Lawton et al., 1984) that cognitive status would continue to decline for both groups while behavioral status, more affected by environment and learning, would show less deterioration. Initial data, however, demonstrated significant declines in behavior of SCU residents and apparent, but statistically insignificant declines in their cognitive status.

More recently, the Corinne Dolan Alzheimer Center has undertaken a significant series of eight empirical studies to assess the impacts of specific environmental modifications on the realization of therapeutic goals of the sort presented in this chapter (Namazi et al., 1991). The first of these studies

(Namazi, Rosner, & Rechlin, 1991) assessed whether the display of personal items adjacent to doorways to resident rooms would enhance orientation and awareness, as reflected in the ability of residents to lead a trained observer to their room. Results indicated that personal items were most beneficial as orientation aids to people in the middle stages of dementia and that items that called upon long-term memory were more effective than items that had no connection with personal history.

Two further studies at the Dolan Center examined the impact of environmental modifications on the incidence of incontinence (Namazi & Johnson, 1991a,b). Over a 6-week period, toilets in the rooms of control group residents were concealed behind a curtain, while the study group had visual access to the toilets in their rooms. Results indicated that patients in intermediate and advanced stages of Alzheimer's disease were more likely to locate and utilize toilets when they were visible. A second study of environmental factors influencing incontinence tested various forms of bathroom identification; results indicated that arrows and the word "toilet" placed directly on the floor leading toward the bathroom, using colors with high contrast, were more effective than any of three forms of wall mounted signage.

The fourth of these studies (Namazi, Calkins, & Grotke, 1990) tested the extent to which control of potentially distracting visual stimuli—through use of movable room partitions of varying heights—influenced residents' task performance. Full-height partitions (72-inch) were found to be more effective than either low barriers (45-inch) or no barrier conditions. Results from the fifth study suggest that a glass-sided refrigerator, which permits visibility of the food inside, prompted more independent consumption of snacks by Dolan Center residents than did a traditional dormitory-style refrigerator. The next study explored whether familiar household tasks, such as washing dishes and folding laundry, would keep female residents active and occupied for longer periods of time than would tasks that bore no relationship to residents' past lives. Preliminary analysis suggests that residents were more likely to participate in familiar than nonfamiliar tasks. Two final studies focused on the facilitation of resident dressing through specially arranged closets and the impact on resident behavior of free movement of residents to an outdoor courtyard.

An earlier study conducted by the same research group in a more traditional dementia facility (Namazi et al., 1989) explored a variety of environmental modifications to curb the tendency of residents to exit through an emergency door. Concealment of door hardware behind a cloth panel was found to be more effective than other strategies such as the visual grid evaluated by Hussian and Brown (1987).

Among cross-sectional studies of dementia facilities, likely the most comprehensive analysis is that undertaken by Sloane et al. (1990). Data were gathered on organization and staffing, financial considerations, environmen-

tal features, residents and resident characteristics, and care and behavior for 32 SCUs in five states, as well as for a matched comparison sample. SCUs were found to differ from comparison settings along several dimensions—including staffing ratios, levels of social interaction, reduced levels of restraint, and nature of the physical setting—all of which the authors believe can reasonably be viewed as having therapeutic benefits:

Differences were noted in all areas we studied—structure, administration, resident population, and provision of care. Dementia units have a smaller size and census, which may be helpful in managing the behavioral manifestations of the disease. Specific design features are frequently incorporated into these units. While research on these environmental features is scarce, we believe that certain design elements can engage, orient, and comfort the cognitively impaired. (p. 36)

As described previously, Ohta and Ohta's (1988) review of materials on 19 SCUs for people with dementia revealed substantial differences in the number of residents accommodated, varying from 10 to 49. They argue that unit size can have a significant impact on residents:

For example, the unit with 10 patients allows each patient to see and interact with a small and constant set of other patients throughout the day, each and every day. The size of this unit appears to promote friendship and socialization among patients and foster a sense of neighborhood. Such characteristics are not found in the unit with 49 patients, in which its patients are presented with a large and highly variable set of social stimuli, making the feeling of intimacy extremely difficult to achieve. (p. 804)

Finally, reports from the staff of the Alzheimer's Care Center in Gardiner, Maine, suggest that there were improvements in residents who had come from more traditional nursing home environments and that there were also benefits for some residents from the more moderate levels of stimulation that the center provided (Meyer et al., 1990).

STAFF RESPONSES

Given the demands of Alzheimer's care and frequent difficulties in recruitment, it would seem to be essential for research studies to consider staff perceptions and evaluations. However, available data are quite limited; some consideration has been given to response to the physical setting and some to broader organizational/architectural issues of unit size.

As a part of the postoccupancy evaluation of the Weiss Institute at the Philadelphia Geriatric Center (Lawton et al., 1984), a "consumer survey"—designed to elicit responses to the Weiss Institute and the traditional nursing home it replaced—was distributed to a diverse group of approximately 100 staff 12 months before and 7 months after relocation. Favorable response to a variety of environmental features including lighting levels, bedroom space, activity areas, and availability of a space for work breaks increased substantially in the new facility. Closets, wheelchair access in bedrooms and dining room, and efficiency of the nurses' station were problematic in both old and

new buildings. The only features judged less favorably in the Weiss Institute than in the traditional nursing home were bathroom temperature and the extent to which noise in the central space seemed to bother residents.

Ohta and Ohta (1988), in their analysis of material on 19 SCUs, focused on the impact of unit size on staff attitudes and behavior:

In addition to the obvious implications of the staff-to-patient ratio for the details of patient care, it is also important to note its apparent implications for staff stress. Those units with a high staff-to-patient ratio tend to report virtually no staff stress or turnover, whereas those units with a low staff-to-patient ratio tend to suffer considerably from these problems. (p. 805)

Furthermore, staffing ratios may impact the ways in which a unit deals with staff stress, which in some SCUs can be quite high (cf. Wilson & Patterson, 1988). Ohta and Ohta (1988) suggested that in units with high staff-to-patient ratios, problems of stress can be more readily handled without rotating staff to other units, thus maintaining desirable consistency of staffing.

Meyer et al. (1990), in reviewing the first 18 months of the innovative Alzheimer's Care Center in Gardiner, Maine, reported high staff morale and low turnover. Possible reasons advanced for their more positive experience include periodic in-service training, tuition assistance, and the absence of prior negative nursing home experiences among most of the staff.

FAMILY CAREGIVERS

Although family caregivers are often characterized as the "second victims" of Alzheimer's disease, very little attention has been directed toward their responses to therapeutic settings for persons with dementia. Here again, the postoccupancy evaluation of the Weiss Institute is a notable exception. Mail questionnaires were sent to relatives of residents of both the Weiss Institute and the traditional long-term care facility from which residents were relocated. Respondents favorably evaluated 9 of 12 issues (e.g., adequacy of lighting, closets, and bedroom space and desirability of the central social space). Negative responses were elicited by accessibility of social workers' office and problems of noise.

The Alzheimer Care Center in Gardiner, Maine, also endeavored to involve families. Meyer et al. (1990) reported results, but not data, from a survey of families indicating a very high level of satisfaction with the center. The authors hypothesized that because family members are often involved in initial assessment, they are more informed and are better able to cope with a relative's placement in this Alzheimer's facility. Finally, they noted that the relationship between a person with dementia and family caregivers often changes over time:

Our experience has been that despite efforts to organize activities to involve families, many family members gradually reduce contact with residents after they become comfortable with and confident in the care provided at the home. (p. 22)

IMPLICATIONS FOR FUTURE THEORY, METHODS, RESEARCH,
AND UTILIZATION

The projects and studies reviewed in this chapter are clearly encouraging with respect to the therapeutic potential of specialized environments for older persons with cognitive impairments. At the same time it must be borne in mind that they are few in number and potentially subject to several interrelated methodological and theoretical limitations.

As described earlier, there appears to be little or no unanimity in the definition, or the reality, of specialized facilities for older persons with cognitive impairments. This high degree of heterogeneity with respect to philosophy, environmental design, and therapeutic approach presents a variety of complex problems to researchers. Thus, among their set of desiderata for more rigorous and informative research on SCUs, Ohta and Ohta (1988) include "a clear taxonomy of unit characteristics" (p. 807). Their call for such a taxonomy clearly echoes those of previous researchers (e.g., Baumeister & Tice, 1985; Frederikson, 1972; Sells, 1963). While the benefits of such taxonomies are clear, this goal has yet to be realized:

The environment has yet to be subjected to a successful classificatory effort. If we knew the most meaningful dimensions of the environment and how they were related to one another, this taxonomy would be enormously useful in the further development of the science of person-environment relations, much as the periodic table served this function in chemistry. (Lawton, 1986, p. 17)

While Sloane and Mathew's (1990) TESS breaks important ground, it includes only 12 items and does not reflect two additional and important SCU goals—support of maximum self-care and orientation/wayfinding. Although not explicitly focused on facilities for people with dementia, Moos and Lemke's (1984) Multiphasic Environmental Assessment Procedure (MEAP) covers those environmental variables—organizational policy and program, resident and staff characteristics, social climate, and physical and architectural features—considered in this chapter and permits analysis of relationships between these domains (Moos & Igra, 1980).

Without the ability to reliably describe and classify such environment along multiple dimensions, the meaning of much current research remains unclear. Particularly in studies limited to one or two settings (e.g., Benson et al., 1987; Chafetz & West, 1987; Lawton et al., 1984), it is not possible to ascertain the extent to which a given facility is or is not representative of the larger "population" of settings with respect to organizational, architectural, or resident/staff characteristics.

The ability to make inferences about causation is of course critical in any effort to understand the social and behavioral impact of specialized dementia facilities on residents, families, and caregivers. However, this need must be tempered with the requirements and constraints of field research. As reviewed in this chapter, relatively little is yet known about the total popula-

tion of these settings, particularly with respect to their physical settings. As noted by Schaie (1988), one of the dilemmas imposed by the gathering of data in naturalistic settings has been "the discrepancies in the care with which settings are described" (p. 5). In terms of Cook and Campbell's (1970) treatment of external validity, it is presently not possible to determine "the extent to which an observed effect holds for other populations [and] settings" (Nesselrode, 1988, p. 18). Furthermore, dementia facilities may vary from one another in terms of macro as well as micro aspects of their physical settings. Small-scale features such as signage or the presence of movable partitions may be added to or removed from a setting at will. More fundamental physical characteristics, such as the number of resident rooms per unit, may be equally important but with rare exception—as in a number of the demonstration projects reviewed here—such variables are simply not amenable to modification. Thus a central challenge in the study of specialized environments such as those for older persons with cognitive impairments is the balance of causal inference and ecological validity (Winkel, 1987).

Finally, this chapter has emphasized that specialized facilities for older persons with cognitive impairments are complex organizational, social, behavioral and environmental systems. This very complexity presents challenges for both the design and interpretation of research. Ohta and Ohta (1988) raised such concerns in their critique of the Benson et al. (1987) study. Lawton et al. (1984) took note of similar difficulties in the context of their Weiss Institute study: "The independent variable itself was distressingly gross, in that the change in treatment locale subsumed an immense variety of components whose effects are unquestionably related to one another in very complex ways" (p. 755).

They suggested that the "so-called independent variable problem" is intrinsic to such environmental evaluations. More recently, however, Parmalee and Lawton (1990) proposed the *transactional* perspective as a possible answer to the question: "How can empirical research accommodate the complexity of person–environment relations?" (p. 476). This perspective views personal and environmental processes as fundamentally inseparable, with the appropriate unit of study the reciprocal person–environment transaction. Indeed, they suggest that the research program of Moos, Lemke, and associates directed toward the development of the MEAP "comes closest to the transactional ideal in emphasizing the covariation of a variety of aspects of the environment" (p. 480).

This emerging work on environments for people with dementia may also temper, at least to some extent, the pessimistic assessment presented by Parmalee and Lawton (1990) and illustrate new approaches to research and practice. The question of theoretical development becomes even more critical when one builds multilevel conceptual frameworks that endeavor to integrate individual, group, and organization. Parmalee and Lawton have also raised this issue in a clear and direct manner:

If we conceive of person–environment relationships as being arranged in hierarchical order of complexity the specificity of a relationship confirmed on one level may not be preserved on the next. Thus the units of causal relationships at lower levels are frequently transformed into more complex units that include the lower level units but require new concepts or methods. (pp. 476–477)

This is one of the key challenges confronting environment / aging studies as it endeavors to deal with older persons and the settings they occupy in a more holistic and integrative fashion.

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Utilization Issues in Environment–Behavior Research

ROBERT SOMMER

THE IMPLEMENTATION GAP

The implementation gap is one of the most persistent and vexing issues in environmental design research (Merrill, 1976; Reizenstein, 1975; Seidel, 1979). An editorial in the first issue of *Architectural Research and Teaching* (Editorial Board, 1970) declared with remarkable prescience that the implementation gap “will turn out to be surprisingly resilient and will defeat our best intentions unless its causes are analyzed and strategies planned accordingly” (p. 3). Seidel (1982) pointed out that the applications gap is not unique to environment–behavior (EB) research and has been reported in many fields. Program evaluation is subject to the same underimplementation. One study after another has found that evaluations are sporadically used to improve policy outcomes and, in some cases, are never even read (Mitchell, 1990). Exhortation, public lamentation, and scapegoating interfere with clear definition of the problem and the development of effective solutions. Instead of using defense mechanisms, we need to look at implementation as a design issue and develop solutions through systematic and focused research. As Zimbardo (1973) put it, to be seriously concerned about the effects of re-

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search requires substantial evaluation research. Follow-up can play the same role in evaluating the work of researchers that postoccupancy evaluation (POE) has in evaluating the completed designs of practitioners. The evaluation need not wait for publication, since research impact can precede publication (Archea & Margulis, 1979; Marsh & Glassick, 1988).

Havelock (1973) noted perhaps three or four people in the entire world in 1963 who were committed to the study of research utilization as a full-time endeavor, and 10 years later could find perhaps 20 individuals in this category and a modest amount of research. By 1987, Huberman found a burgeoning research literature on the utilization of social science knowledge and noted that the field was overripe for meta-analytic review, complete with estimations of effect sizes for each of the main mediator variables.

The most comprehensive framework for analyzing the applications gap in EB research has been presented by Seidel (1982), who classified methods for increasing research utilization into three categories: *communications theories*, *linkage theories*, and *collaboration theories*. Communications theories place the emphasis on making relevant information readable and available to designers. Linkage theories imply more active means for conveying information to practitioners, such as the use of advisory committees or information transfer specialists. Collaboration theories emphasize the need for researchers to work together with potential users of the information.

THREE RESEARCH MODELS

In developing strategies for overcoming the implementation gap, it will be helpful to begin with models for scientific research that assign different priorities to implementation. Following the method of ideal types, *academic* or *basic research* assigns an incidental role to utilization, *applied research* places it in the primary position, and in *action research*, utilization becomes one important objective among several. As a field of study with associated institutions including curricula, training programs, journals, and meetings, environment and behavior is faced with the problem of integrating and optimizing the contributions of individuals following each of these models, plus various hybrids.

ACADEMIC MODEL

Academic research is done by highly trained specialists who follow theories or their own curiosity to test hypotheses through rigorous studies and publish their findings in peer-reviewed journals read by other researchers, with a gradual partial trickle-down to practitioners and the public through textbooks, teaching, and consultation. Schneekloth (1987) describes

this as an information transfer model, in which research and practice are institutionally separated. Each has its specific role, with research intended to generate knowledge that is then tested in practice, while practitioners generate "problems" that are studied by researchers. The academic model is slow in delivering research results to practitioners, since completed studies must pass through an extensive review system in addition to a publication lag.

Seidel (1982) acknowledges that researchers who operate within the academic model have little incentive or desire to develop the type of materials understandable and usable by designers and that no one is willing to pay for such translation. Furthermore, researchers are not encouraged by their academic colleagues to "popularize" their findings by putting them in a more readable format. Scher (1974) suggests that the desire of those who follow the academic model to keep the good regard of colleagues may encourage a *devaluation* of the useful aspects of their work.

APPLIED MODEL

In the applied model, researchers use scientific methods to answer questions posed by clients. Often the research is done in-house by someone employed by the client, and the findings remain proprietary. Caplan, Morrison, and Stambaugh (1975) found that 53% of the reported use of social science data by Washington, DC, policy-makers came from in-house research. The major emphasis is upon communication between applied researchers and their clients through technical reports and joint development activities within organizations. In some fields, applied researchers have their own journals and communicate among themselves.

Marsh and Glassick (1988) maintain that utilization depends on the commitment of the researcher to the user-centeredness of the information, which includes understanding the user's needs and context, framing the research questions in use-related terms, involvement of users in the research, and disseminating the results so that they will be accessible to practitioners. Certainly it is possible for a basic researcher to accidentally come across something of practical value, yet without a set for application, the practical aspects may not be recognized or reported.

When Loo and Ong (1985) mailed copies of their report on crowding and neighborhood satisfaction in San Francisco's Chinatown to the city agencies, they received no response. This has been my experience, starting with our early research on study environments. My students conducted POEs in libraries and other study facilities at 19 colleges and universities. Within weeks following each survey, summaries of the preliminary results and personal cover letters were mailed to the librarians who subsequently received copies of the final report. There was not a single response to any of the materials. This has also been our experience in other settings, including

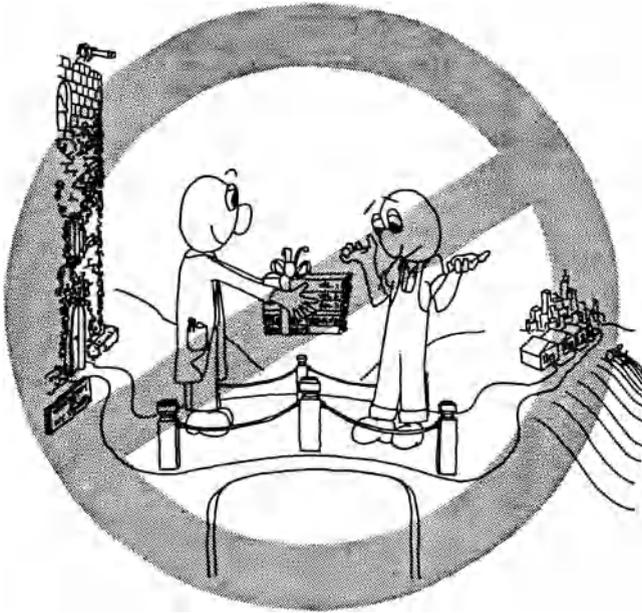


FIGURE 1. A white-coated researcher delivering a bulky report to practitioners is a prescription for nonutilization. (Drawing by Terry Amick.)

childcare centers, farmers' markets, and co-op stores. Occasionally I met a recipient of the report who said, "Yes, it was interesting" or perhaps, "I haven't had a chance to read it yet, but I will." (See Figure 1.)

ACTION RESEARCH MODEL

To promote use of EB research by practitioners, Weisman (1983) advocated the adoption of an action research paradigm. Sanford (1970) defined action research as problem-centered research that bridges the gulf between theory and practice. It has three interrelated objectives: to advance knowledge, to improve the situation of the participants, and, through critical evaluation of outcomes, to refine the practice of action research. Schneekloth (1987) sees similarities between Lewin's (1948) action research and Schon's (1983) reflective practice. In both cases, a person engages in research and practice simultaneously, using theory as a framework while fully respecting the discrete nature of each case. Action research emphasizes the practical use and dissemination of research products and builds utilization strategies into the overall research design (Ketterer, Price, & Politser, 1980). The drawings in Figure 2 show the dissemination process in action research. The figure in the striped shirt is ART, an acronym for action research trainer.



FIGURE 2. Research consultation by ART, whose name is an acronym for action research trainer. (A) Internal feedback: ART is present when the research committee presents its findings to the organization. (B) Dissemination: ART writes papers for academic journals and also attempts to reach practitioners through articles in trade magazines, media interviews, etc. (C) Technical assistance: ART assists the group in applying the results. (D) PRE: A year later, ART contacts the organization to find out if the research findings were used. (Drawings by Terry Amick.)

In action research, the potential users of the information are involved in all stages of the research. Rather than practitioners being the targets of dissemination activities, they become the disseminators of information they have helped to collect. According to Parlee (1983), "Psychological knowledge would be dramatically changed if it were consistently developed through interactions with its 'subjects' and its intended audiences instead of being developed with professional colleagues in mind and 'given away'" (p. 1).

In EB research, action research has been honored more in word than in deed. There are probably more articles describing its potential value than its utilization. The chief problems with the method are more practical than epistemological, for example, obtaining outside funding for a fluid, dynamic activity that cannot be neatly described in advance; obtaining the right combination of researchers and clients/users willing to work collaboratively; and finding a publication outlet for a study that has necessarily traded off some degree of rigor in order to increase client participation and is more of a case study than a replicable experiment. Traditionalists are likely to view the action researcher's blurring of the boundaries between research and application as a threat to existing categories and standards, making it difficult to evaluate the worth of action research studies (Schneekloth, 1987).

OTHER DISSEMINATION MECHANISMS

In addition to written reports and conference presentations, EB researchers have found other means to reach practitioners, including *consultation*, not as part of the research process, but as an independent activity; *nontechnical papers* for trade periodicals; testimony as *expert witnesses*; and service on *task forces* developing standards and regulations. In such optional activities, researchers "walk the extra mile" to bring their findings to the attention of practitioners.

DIRECT CONSULTATION

Interviewing practitioners in the social welfare and planning fields, Slater (1990) found that many of them doubted the value of printed information sources. There was an attitude that "nothing ever happened because somebody read something" (p. 11). She describes practitioners "who run around to meetings and committees, continually exchanging essential snippets of information en route . . . who manage to be well informed, without apparently ever reading anything, if they can possibly help it" (p. 10). Such attitudes suggest the value of personal contact as a means of conveying research information to practitioners. One institutionalized mechanism for personal contact between researchers and practitioners is consultation.

Within EB research this can take place with architects, developers, public agencies, occupants, and community organizations. Lawton (1990) describes three roles for the researcher who serves as a consultant on design projects—the sensitizor, the advisor, and the facilitator. The sensitizor raises awareness of the connection between environment and behavior. The advisor provides behavioral information on the tangible effects of design elements, for example, the most suitable color for a social lounge, needs of older people for increased illumination, and so on. The facilitator combines the technical expertise of the advisor with human relations skills in the context of practicing design teams.

Consultation provides a direct line to practitioners, but it is largely unsatisfactory in yielding feedback on research utilization. A consultant provides information and advice to be adapted and used by clients without any legitimate claims of authorship or expectation for acknowledgment of contribution other than a paycheck. Much of the consultant's work is based on "winging it," in terms of going beyond existing data. Weiss (1972) argues that the "gap between data and action . . . will have to be filled in with intuition, experience, gleanings from the research literature, assumptions based on theory, ideology, and a certain amount of plain guessing" (p. 125).

TRADE PERIODICALS

EB researchers have been successful in using existing technical journals and creating several new ones and in publishing articles in journals sponsored by professional organizations. We have not been as effective in packaging articles for trade periodicals directed to particular settings. There are trade magazines for offices, schools, banks, hotels, supermarkets, and almost every imaginable setting, some of which will be receptive to articles on design issues. As examples, I published articles on airport design in *Air Travel World*, on retail display windows in *Visual Merchandising*, on salad bar layout in *Restaurants USA*, and on automatic teller machines in *The Independent Banker*.

EXPERT WITNESS TESTIMONY

Archea and Margulis (1979) found this to be an excellent way of bringing their research findings to the attention of the courts and legislative bodies and offered the possibility of seeing the research cited in published decisions. Becoming an expert witness can provide access to settings and informants otherwise unavailable to outsiders. Edelstein (1988) was able to enter communities exposed to toxic contamination and interview the residents. The recognition of EB relationships by the courts is not only confined to harmful or deleterious effects. Numerous court decisions have accepted behavioral research on positive qualities of the environment, such as wilderness value and scenic attractiveness (Ventre, 1989).

There are severe constraints upon the researcher operating in an adversarial system in which truth often becomes the first victim. Rothman and Rothman (1984), who documented the various legal battles surrounding the Willowbrook School for the developmentally disabled, commented, "When social science entered the courtroom, the litigant might win but the discipline did not. Testifying and carrying out research . . . are activities more antithetical than anyone who does both would like to admit" (p. 112). EB researchers have testified on both sides of lawsuits on prison conditions, some maintaining that crowding has demonstrable negative effects, and others denying that the case has been proven (Sommer, 1979).

BOARDS, TASK FORCES, AND SELECTION COMMITTEES

Such service provides the researcher with opportunities to directly influence practice through awards, standards, and regulations. Relative to consultation, service requires a much larger commitment of time and effort on the researcher's part. A consultant devotes a few days to a project and is paid for the time spent. The task force member makes an open-ended unremunerated commitment. Examples of this approach in the EB field include service on design juries and selection committees for architectural projects. Several years ago, I was one of three panel members selecting the architect for a \$67-million-dollar prison. This gave me the opportunity to play the sensitizor role as described by Lawton (1990) in asking architects how they would deal with behavioral issues such as crowding, the sensory impoverishment of institutional life, and so on.

NEW UTILIZATION MECHANISMS

COOPERATIVE EXTENSION SPECIALISTS

Merrill (1976) proposes the use of the agricultural extension specialist as a model for disseminating EB research to practitioners. Agricultural extension has been described as "the most widely recognized system in the world for the diffusion of technological innovations" (Rogers, 1988, p. 493). Eveland (1986) maintained that "it is impossible for anyone to speak ten words about diffusion without two of them being 'agricultural extension' . . . in many ways, it constitutes the defining metaphor for all technology transfer efforts" (p. 308).

At the University of California, Davis, there is a sophisticated extension model involving several levels of specialists. Community-based county advisors close to information consumers are in a good position to define local problems. Other extension specialists, most of whom have Ph.D.s and considerable research experience, are housed in university departments, with proximity to knowledge producers. These specialists serve as liaisons be-



FIGURE 3. Agricultural extension agent speaking to farmers, Yolo County, California, 1913. (Photo courtesy of UCD Agricultural Communications.)

tween the county agents and university researchers. Cooperative extension specialists at the federal and state levels have professional staff who specialize in program and staff development, whose role is to foster communication among all levels of the system through meetings, workshops, and publications, with a professional periodical, the *Journal of Extension*, dedicated to linking research and practice and a Division of Agricultural Communications that assists researchers with visual documentation (see Figures 3 and 4).

Figure 5 shows two major routes for communication between researchers and practitioners. The left arrows show a problem originating in the community, which proceeds to the locally based farm advisor, who contacts the university-based extension specialist for assistance, who in turn contacts university researchers working in the research area as well as electronically accessing information sources in the state and national departments of agriculture. The right-hand arrows depict the reverse flow of information, as in the case when a university researcher develops an innovation considered to be of some practical value. The researcher and extension specialist work together to develop a dissemination strategy, which may include visual aids prepared by the extension service. These are shown to the local farm and home advisors, who make them available to farmers,



FIGURE 4. The 1928 "California Agricultural Special" brings researchers into the countryside, making stops in 24 communities to meet farmers. (Photo courtesy of UCD Agricultural Communications.)

ranchers, and rural communities. In each case, there is continuous feedback in both directions on perceived benefits and costs.

In the United States, federally funded extension activities constitute about one-half of the federal investment in agricultural research and development. State and county government make additional contributions, bringing the total extension budget to an amount roughly equivalent to the total agricultural research budget. In other words, for every dollar invested in agriculture research and development (R&D), another dollar is invested in extension (Rogers, 1988).

Among factors contributing to the success of this model, Rogers (1988) includes a critical mass of new technology with potential usefulness to the clients, a research subsystem oriented toward utilization, a high degree of user control over the technology transfer process, structural linkages among all components of the technology transfer system, considerable client contact by the extension subsystem, and evolution as a complete system rather than having the extension service grafted on to an existing research system.

Recently the extension services have been developing environmentally benign technologies that do not necessarily increase yield or reduce costs

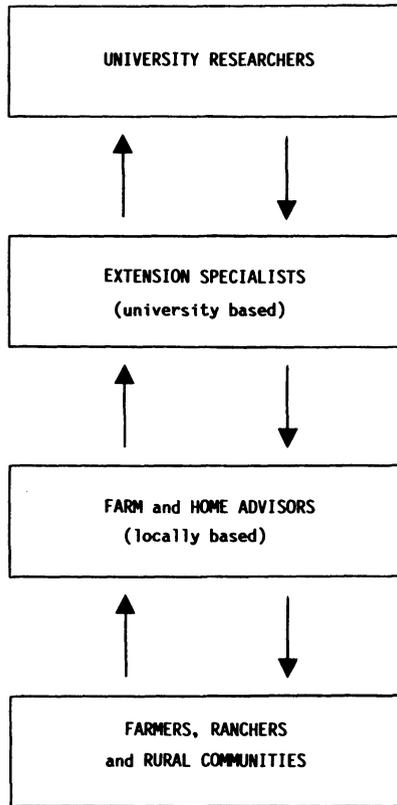


FIGURE 5. Bidirectional information flow in the cooperative extension model.

(Zilberman, 1991). This is a good model for those EB studies that improve environmental quality or increase occupant satisfaction without being able to demonstrate reduced costs or productivity gains. Some EB researchers at land grant universities in the United States already benefit from a relationship with cooperative extension. At the University of Missouri–Columbia the Department of Housing and Interior Design is the academic home for 12 housing and interior design extension field specialists located throughout the state. The extension linkage provides a structure for distributing knowledge and translating it into a form useful to local communities (Brent & Phillips, 1987).

The lessons from agricultural extension for information transfer specialists in EB research are:

1. A transfer specialist requires training or experience in both research and design in order to conduct liaison activities between the two fields. This involves familiarity with the key terms, concepts, and

- standards in the two fields, plus knowledge of time coordinates, codes of ethics, and economic constraints.
2. The specialist should be skilled in oral, written, and graphic communication. Communication must proceed in both directions—from knowledge producer to knowledge user and vice versa. EB research has journals and conferences for communication among knowledge producers and for researchers to convey information to those practitioners willing to read the journals or attend the conferences, but no continuing mechanism for bringing the concerns of practitioners to researchers exists.
 3. Information transfer specialists would be available to answer questions currently being asked of researchers during paid and unpaid consultation. They could also write pamphlets and articles on EB issues of concern to practitioners and the public.
 4. Information transfer should not be an appendage to existing research and practice institutions, which are primarily interested in their own activities. Specific individuals need to be designated as information transfer specialists and provided with the autonomy and resources for accessing information sources and traveling to relevant field locations to carry out their activities.
 5. Funding should not be diverted from existing projects but provided for as supplemental funds allocated specifically for information transfer. Agencies that currently support EB research should set aside funds specifically to promote research dissemination and utilization. Evaluating the degree to which these efforts have been successful comes afterward.

POST-RESEARCH EVALUATION

In the EB field, the best-developed and most formalized follow-up procedure is postoccupancy evaluation (POE) (Moore, 1982; Wener, 1989). Much less common and less formalized is follow-up of *research studies* or post-research evaluation (PRE). This occurs to a degree in literature reviews and meta-analyses. A literature review brings together existing theoretical and empirical work on a topic to identify the most promising approaches and findings. Meta-analysis involves the compilation of the relevant quantitative studies on a topic with the goal of computing overall effect size. Both meta-analysis and literature reviews assess the influence of an independent upon a dependent variable, but not the effects of the research upon practice. Since practitioners do not routinely or spontaneously record sources of influence, there will be no available records of the effects of research upon practice.

If evaluation is an attempt to pause and reflect on the impact of an intervention (Wener, 1989), then PRE is an attempt to objectively document the effects of the evaluation. PRE must be appropriate to the model underlying the research evaluated. For research following an academic model, a

citation search of the technical literature will be sufficient. Citations can be counted by author or aggregated to schools of thought and whole institutions. However, citations do not represent a valid index of the degree to which the findings have been used in practice. Zube (1990), who has used citation searches to examine the dissemination of landscape perception research, acknowledges, "An important lesson learned from these experiences is that I often did not and probably still do not know how my work was and is being used and applied" (p. 302).

To supplement citation searches in EB research, one could do a hand search of citations in proceedings of relevant organizations. Saarinen (unpublished) has used a major directory, handbook, and journal in EB research to estimate the number of authors affiliated with applied settings as compared to universities.

Applied studies can best be followed up through interviews in the client organization and with the researcher. Benefits to the researcher need to be included in the evaluation of applied projects. Just as an architect may take some projects in order to pay the bills, the head of an applied research team may take on projects to support staff and graduate students.

Action research requires a tripartite follow-up, including a citation search of the technical literature to determine the contribution to knowledge, interviews with the research participants and other users of the research, and interviews with other applied researchers. The Science Policy Research Unit of the University of Sussex (United Kingdom) uses a triangulation approach to evaluate research impact that includes citations, grant awards, and external predictions of future performance. When these indicators all point in the same direction, then the team regards the results of the evaluation as being relatively reliable (Martin & Irvin, 1983).

Archea and Margulis (1979) made a comprehensive PRE of the Bourestom and Tars (1974) studies of the consequences of involuntary relocation for institutionalized elderly. The original research had shown increases in mortality to be directly related to the extent of the environmental change and to the degree of the elderly person's cognitive and physical decline. As an outgrowth of their research, Bourestom and Tars developed a program to prepare nursing home residents for involuntary relocation that would reduce the fatal consequences of the move. The PRE showed that most of the impact upon legislative action and court cases occurred *before* publication in the technical literature, through various progress reports, oral presentations, informal exchanges, citation of the research in court testimony, and use of the research by advocacy groups for the elderly.

Kantrowitz and Nordhaus (1980) followed up the dissemination and utilization of a comprehensive POE of subsidized housing in Albuquerque, New Mexico. They presented their findings in the form of a case study documenting that the POE provided useful information for planning and design decisions and lent credibility to the housing authority in its dealings with tenants, public officials, and federal agencies.

PRE can be guided by theories of communication and behavior change. One can test the effect of different modes of communication (written reports vs. videotapes vs. consultation) and different styles (personal vs. impersonal or descriptive vs. prescriptive) and compare the value of general versus specific recommendations. The potential for applying theories of group dynamics and persuasion to the implementation gap has barely been scratched. One could compare written communication of EB research results with group discussion by itself or in combination with group commitment. Reactance theory (Brehm & Brehm, 1981), in which people will resist and react against attempts to constrain their free behaviors, may explain why so many practitioners resist the application of EB approaches that seem to limit their creative expression.

FOLLOW-UP INTERVIEWS

Over the past 10 years, my research unit has routinely undertaken PREs. After several projects when it was abundantly clear that our research had not been helpful to the client, the best course of action was to convert nonutilization into a research problem. The secondary gains from this transformation are not difficult to discern. Nonutilization is no longer a personal affront, but a phenomenon located in the outside world to be investigated. We could cease fretting and become active in our familiar research roles to learn what had gone wrong. We also felt that the follow-ups would provide information that would be useful to us on future projects and to colleagues. Because we are a university-supported research unit, we could absorb the cost of follow-up interviews in our regular budget. For a private firm to do this would be uneconomical. The ideal solution is for PRE to be budgeted in the original submission.

Follow-up interviews are conducted by individuals with no connection to the earlier study. Typically this means asking research assistants to follow up surveys completed before they were hired. The interval is important to allow implementation activities to occur. We do not attempt an impact analysis at the time that the results are delivered to the client, which would probably result in polite expressions of appreciation without information as to practical applications.

We have successfully undertaken PREs of projects completed 1, 2, and 5 years earlier. To minimize social desirability effects, the interviewers are told that in order to improve our service to clients, we want to find out those aspects of the research that are *not* being used. The reliability of the follow-up information is gauged through the use of multiple informants. Finally, we look for specific examples of utilization and not simply general statements of appreciation or gratitude. If an agency head declares, "Oh yes, we found the survey very helpful" but is unable to describe specific changes in policy or practice, the outcome is classified as nonutilization.

Recipients of our research reports typically did not see the results as

providing new information so much as confirming what they already knew. This theme has recurred so many times that it has become a litany. Initially we interpreted it to be a criticism, but further reflection has removed any stigma. Essentially the clients were saying that there was nothing counterintuitive in the findings. A good manager knows how the occupants feel about the building, at least in general terms. What we have done through research is confirm and sharpen these beliefs, putting numbers to suppositions and presumptions to give clients the confidence to follow and extend approaches they had already considered feasible.

In conducting a PRE, it is necessary to make a distinction between results and recommendations. Those aspects of a study most useful to the client may be items the researcher considers trivial and irrelevant. As an example, we have found many clients interested in the respondents' demographic characteristics. It is surprising how many agencies and institutions lack information about the people they serve. This was the case in a survey we did of environmental design aspects of Goodwill Industries stores, a nonprofit organization dedicated to rehabilitating the handicapped. The follow-up interviews showed that the most significant aspect of the study, from the client's standpoint, was the demographic information on customers. Prior to the study, management believed that most of the customers who came to buy second-hand clothing had large families. Our survey showed that this was not the case. Large families had hand-me-downs available, and thus small families made most use of second-hand clothing outlets. We would never have known that this information was helpful to the client without the follow-up interview.

Discovering a lack of utilization can be very damaging to a fragile ego. On the other hand, it is satisfying to find out that people have read and used your findings. Researchers cannot wait for spontaneous feedback. A decade after my first article on airport design was published (Sommer, 1969), I received a letter from an architect saying he had used the recommendations in the renovation of the Portland International Airport. When I visited the airport, I was very pleased with the outcome. I suspect that some of the other changes I have seen in airports over the past decade resulted from environmental research documenting negative response of passengers to cold, sterile, and institutional waiting areas. However, researchers cannot know the extent of their influence until they apply systematic follow-up procedures.

IMPLICATIONS FOR ACTION

Based on our follow-up interviews, we have found the following factors to be associated with a high degree of utilization:

1. There is continued contact between researcher and client beyond a single survey, leading to trust, a common language, and shared value system.

2. At least some of the recommendations are capable of prompt and easy implementation.
3. Results are consistent with the client's belief system and goals. The two most likely responses to unwelcome information are "failure to hear" and "blame the messenger."
4. "Magic numbers." Related to Archea and Margulis's (1979) criterion of explicitness, this refers to numbers with clear and dramatic appeal. *The Recycler's Handbook* (Javna, 1991) uses this device successfully. Readers are informed that Americans throw away 600 times their body weight in garbage during their lifetimes, a legacy of 90,000 pounds of trash for the average 150-pound adult. Even when other information recedes from consciousness, the vivid numerical images of 90,000 pounds of garbage remains intact.
5. Visual appeal. A photograph or drawing can show the tangible implications of a new design or technology. This is especially true for visual-minded clients such as architects.
6. Verbatim comments. The personal statements of survey respondents help humanize a report. Sometimes a single graphic comment in a respondent's own words is more persuasive than a mass of tables and charts. During one PRE, a city official commented, "I really enjoyed the personal comments at the end of the report. They gave me a real feel for what people were thinking." Note how this statement personalizes the abstract phrase "verbatim comments."

Factors associated with an *absence* of utilization include the following:

1. Minimal client involvement in the project, as in the belief that the study was undertaken by university researchers for their own purposes.
2. Changes in the client organization during the course of the research, rendering the study obsolete or irrelevant in terms of the goals of the new administration.
3. Client perceptions that the research team is uninterested in the survey. Occasionally we had interviewers or observers who were not enthusiastic about a project, and this was apparent to the respondents.
4. Client perceptions of bias on the part of the researchers. When the client believes that the researchers are using the survey to support a position with which the client disagrees, this will be seen as bias and likely to result in criticism of method, sampling, or recommendations.
5. The research has revealed the need for changes that the client is unwilling or unable to make.

NEED FOR TECHNICAL ASSISTANCE

The PREs revealed the resistance of many clients to lengthy reports containing detailed numerical information. Tables can be intimidating to

people with no background in statistics. In terms of presenting statistical information to clients, we follow the architectural maxim that less is more. A limited amount of information about the key findings clearly presented and well highlighted will be more effective than a bulky report with every obscure finding carefully noted and qualified. In data analysis and presentation we use different strokes for different folks, that is, descriptive statistics, mostly means and percentages, for practitioners or lay audiences and inferential statistics for academic audiences.

No matter how extensive the research and the report, there will always be limitations and constraints on sample size, questions asked, and areas covered. These omissions can be used to criticize and dismiss the report and recommendations. The researcher needs to be physically present to explain, interpret, and, if need be, defend the method against unwarranted criticism. Archea and Margulis (1979) described the key to application as "*active investigator commitment, participation, and follow-up throughout the research communication process*" (p. 226). However, Glaser and Taylor (1973) found a reluctance on the part of many principal investigators to take the initiative in promoting the utilization of their findings; some felt that such activity was "unprofessional" (p. 144).

As an alternative to the current system of devoting thousands of person hours preparing, undertaking, and analyzing data in a POE and then 1 or 2 hours presenting them to the client, I recommend 30 to 40 hours in technical assistance and follow-up. Although this seems like a lot of time, it represents an increase in less than 5% in person hours for a year-long study. If this were a significant issue, the scope of the study or sample size could be reduced. The precise adjustments in time allocations are less important than the general recommendation for increased time devoted to technical assistance following delivery of research results.

IMPLICATIONS FOR FUTURE THEORY, METHODS, RESEARCH, AND UTILIZATION

We should increase the amount of time spent on implementation. If we devote 12 months to a POE and another 6 months to the data analysis and write-up, we must be prepared to devote 1 or 2 solid months to activities designed to promote implementation. There will be bugs in any new plan, and it will be useful for the researcher to be present during the needed fine-tuning.

There is a saying in architecture that it takes a great client to make a great building. This may also be true in successful EB research. Ideally, there should be a client interested in the research who is willing to provide access, locate available records, and give ongoing feedback as to what is or is not useful.

PRE should be institutionalized and formalized. Following the model of

teaching evaluations, a standardized interview format should be developed containing core questions with room for additional items suited to a particular setting or project. This will permit meta-analysis of completed projects and both quantitative and qualitative estimates of effect size. The possibility of publication may provide an additional incentive for researchers to undertake PRE. Follow-up studies can be published in their own right, not merely as appendages to substantive papers.

Formalization of PRE will increase the legitimacy of applied research. It will be easier for professional organizations to bestow awards for research impact if a formal mechanism for PRE is in place. There may be a niche within EB research for a contractual follow-up service, perhaps within a firm that already engages in consultation, programming, and POE. Professional organizations such as EDRA can facilitate the development of ethical guidelines for obtaining and disseminating PRE. Attention must be paid to issues of confidentiality and anonymity for respondents.

Some general issues about research impact will not be answered until more PREs are undertaken. How much impact should a single research study be expected to have? Are there differences between evaluating single projects and integrated programs? To what degree is it possible to quantify and monetize research impact? What types of projections can be used for assessing long-range impact?

One conclusion from the follow-up interviews is so unusual that I refrained from mentioning it for many years. In our PREs there seems to be no relationship between the rigor of the research and its utilization. The small-scale study with minimal resources whose results are delivered to the client in a timely manner is often more useful than the extensive investigation with a sophisticated statistical analysis spanning several years. I refrained from mentioning this conclusion because I did not want it to be seen as an apology for sloppy methods. However, as I have attended more closely to the EB literature, I have found others expressing a similar view.

Schon (1983) asks rhetorically whether researchers should stay on the hard, high ground of rigorous research or descend to the swamp to deal with the most important and challenging problems that require trade-offs in technical rigor. Following Schon's metaphor, Farbstein and Kantrowitz (1990) call for a new paradigm of "design-decision research" that accepts ambiguity and uncertainty associated with the swamp where roles and identities are in flux, issues swim by with amazing rapidity and complexity, and the air is thick with implications. De Young and Kaplan (1988) advocate "adaptive muddling" in the form of modest, incremental steps and a tendency to compromise. Wicker's (1986) substantive theorizing also calls for compromises with traditional conceptions of experimental design. It may not be possible or desirable to lay out in advance a linear research program. As promising leads develop, these should be pursued using whatever seems at the time to be the most appropriate and feasible method. Lawton (1990)



FIGURE 6. The tower or the swamp? (Drawing by John Urban.)

suggests that data can be obtained without mobilizing the total armamentarium of traditional behavioral scientists.

In a search for alternatives to the academic research model, some EB researchers have made occasional forays into the metaphorical swamp described by Schon (1983). Farbstein and Kantrowitz (1990) point out that swamps are uncomfortable places, sticky, and full of unknown and unrecognized creatures (see Figure 6). Fortunately the choice between swamp or hard high ground is not irrevocable. Botany and zoology provide ample precedent for university researchers to make scheduled forays into swamps, jungles, and polar regions and for universities to maintain field stations to

conduct ongoing studies and facilitate investigations by visiting researchers. The crucial point is that researchers should adopt the research model appropriate to their circumstances. There are times for the twentieth permutation of a complex laboratory simulation using college students. There are times for contract research with individual clients and times for action research suited to the flux and ambiguity of design practice. Each research model has its value under certain circumstances, and we need to acquaint our students with all of them.

The overriding lesson from these experiences has been the necessity of systematic PRE by someone unconnected to the original studies. We cannot rely on our own intuitions or on spontaneous feedback. Only specific questions asked by a neutral interviewer can elicit reports of utilization or lack of it. Often the items that we feel are relatively unimportant will be most valued by clients, and those things we feel are significant will be ignored. Working with multiple clients allows formal comparisons of different means of consultation and dissemination. We must learn from our failures as well as our successes. Standardized methods will encourage meta-analysis.

Reflecting upon dissemination mechanisms in EB research, I am reminded of Winston Churchill's description of democracy as the worst of all possible political systems until one considers the alternatives. In EB research, we have every mixture imaginable of basic, applied, and action researcher. Channels must remain open so that those who feel that their viewpoints are not being heeded can tell their colleagues, "You are neglecting _____, and something must be done about it!" Fill in the blank with theory development, consultation, community participation, social action, or needs of special populations. I cannot say that the present dissemination system works as well as I would like. If I had my way, there would be more emphasis on _____.

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