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Soft City Culture and Technology

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Preface

> …Yes I know I can use the Mirror World, too, whenever I want, sure, great. But let's be honest, Okay? These things don't work by magic. They don't operate themselves. You've got to know something in order to squeeze all this knowledge out of a Mirror World. High school hackers are going to be a lot better at it than the chairman of the Political Science department…
>
> -David Gelernter, *Mirror Worlds*: *or*, *the Day Software Puts the World in a Shoebox… How It Will Happen*, *and What It Will Mean* 1993:25

It's late in 2011. I am working from home in Manhattan at a laptop that belongs to an academic conglomerate (Most folks still call them "Universities") whose products include a dizzying array of programs offering to address some narrow segment of either the cultural or technological dimensions of "media," from computer hardware engineers to multimedia artists. Inevitably, some of us are trying to integrate media meta-domains, while maintaining our legitimacy and competence as creative and/or research specialists. For some of us, it's a simple matter of finding tasty new problems to solve within our respective subfields; for others, it's a matter of due diligence about the human purpose and potential effects and side effects of our work,

I've been working for a little over 3 years on the Betaville project, to develop a new kind of editable online mirror world platform in which professional planners and designers can collaborate to develop new concepts for specific urban environments, and effectively engage the intended beneficiaries of their work: the people who actually live in work, or might live and work, in the places they propose to alter, create, erase, or remake. At one level, it's a software engineering and interaction design problem; at another, it's a prototype platform to substantially alter the media of imagination and communication about alterations to the physical conditions of daily life. What combination of expertise, engagement, and due diligence should be brought into play?

What/where is a "Soft City?" For our purposes, it is a "blended reality" of the physical (hard) and seemingly stable environment of roads, buildings, and service infrastructure with the nonphysical and constantly mutating (soft) networks of affiliation and communication: soft in the sense of software and intangible information

exchange, but also soft as in mutable: the constant flux of the human populations in neighborhoods, personnel in firms… and "soft infrastructure," the network of intangible institutions, relationships, and habits whose interaction regulates urban ways of life.

One important thing to remember about this hard vs. soft concept pair, in the context of social software designed to alter some very complex socio-technical systems at an urban scale: the analogy to a hardware-software dichotomy is misleading, in that the "hard" elements are often not the ones that most resist transformation, or are otherwise inflexible. It is much easier to demolish or remake a highway interchange or public square than it is to substantially alter an obsolete company culture or an ineffective public administration. Meanwhile, the complex of communications tools, networks, and practices generally lumped together under the imprecise term "media" has fundamentally transformed important sectors of society and culture, from academic publishing to the performing arts and public governance. I will use the term *New Soft City* to describe an emergent city type, in which the data/media technologies now being deployed are fully implemented, and naturalized, internalized by citizens as *media* of daily life.

Flashback: It was early in 2004. I have proposed a new Master of Science program in Integrated Digital Media for the Polytechnic Institute of New York, known to most as Brooklyn Polytechnic. The "Integrated" denotes a productive synthesis of the technological, creative, and critical dimensions of multimedia, and do so at the experimental cutting edge: for artists, breaking new creative ground; for designers, developing new media products and services.

As an artist working in the public realm, a teacher, a multimedia designer, and a community organizer in my native Toronto, I had felt too many times that we were wasting the power of new technologies on old habits of imagination and communication, while risking more than we were prepared to acknowledge. Might it not make sense to build a fully capable synthesis of the cultural and engineering aspects of "experimental media" in a global powerhouse like New York City? What new media forms might be built to enable new levels and qualities of collaborative invention, extending the traditional role of intentional avant-gardes more broadly, while providing for due diligence of commensurate scope? Revolutions, after all, are only as legitimate as their consequences.

I had a thousand reasons for proposing the Digital Media programs. Among them, one was as simple as access to the plasticity of software itself. As an artist working with multimedia, I knew the frustration of having to accept the constraints of tools which had been designed, built, and marketed for specific commercial applications. I also knew from bitter experience the special Hell of graduating from a specialized academic program having developed my skills attached to very particular and capital-intensive equipment. The ability to make strategic choices between tools, and to modify those tools as necessary, would have to rely on a non-traditional combination of multimedia programming in the service of new creative forms. Of course, that would mean that I would have to become competent to lead software development projects, as well as academic programs, for a new set of categories of application.

Indeed, this would call for full integration of art, design, and hardware/software development at every level, from foundation to creative/research work. It turns out that even in the art world, multimedia is a team sport, in which people with radically different skills and professional cultures have to work effectively together.

The most extreme form of such an integration would involve people with very different kinds and levels of competence being able to work together on a project of common interest, in which the software might develop by an agile process in full coordination with the evolution of the work, at a scale beyond the confines of classroom or laboratory…

Every academic and administrative department, from engineering to art education, is in the "experimental media" business in one way or another. The present work tells only one of these stories, of a software design project in the service of full and effective participatory collaboration between a very rich mix of stakeholders in a specific spectrum of use cases from public art and urban design to local development and redevelopment planning: Betaville.

The Betaville project was conceived to some extent through a series of fruitful misunderstandings: I was in the midst of a somewhat dysfunctional partnership in Brooklyn in 2008, wondering how to get out of it, when one of my students shared an optimistic version of the effort to a friend in Bremen, himself the director of a creative program at an engineering school: Martin Koplin, of the M2C (Media2Culture) Institute for Applied Media Research at the University of Applied Sciences there. By the time I knew what was happening, Martin had convened an "International Urban Media" symposium. There was only one viable solution: give two presentations, one about the current project, another about all the other things I wanted to do with a variant of it… At the end of the session, Martin (a social scientist by training, with a lot of experience in tech ventures and the rave scene) and his collaborator Helmut Eirund (a software engineer and mobile application designer with a crazy sense of humor) offered to collaborate with me and my team on the second set of ideas. I said, as I recall: "Okay. Can we call it Betaville?" They looked at each other. I can't remember which one said: "OK, that's a good name." We have been working together ever since.

To date, Betaville has been interpreted as a work of art, data visualization software, an e-governance tool, science fiction, and a Science-Technology-Engineering-Mathematics (STEM) education experiment. I have been introduced at conferences as everything from a techno-artist to an architect to a software engineer. I do my best to set the record straight. I have formal credentials as an artist, considerable experience as an organizer and tech development project leader, and a full "suite" of research collaborators to work with… each of whom is a member of a community of practice with its own particular range of understanding and agenda in relation to the mutant technological-social-cultural forms of new soft cities.

Along the way, Betaville has developed into a suite of robust working prototypes and migrated with me beyond the academic realm into a new mash-up: the Gotham Innovation Greenhouse (GiG), a synthesis of the research-to-advocacy functions of a think tank, and the specific concrete creative work of a studio, a "think studio." Meanwhile, the M2C group in Bremen has assembled a European "ThinkBETA"

consortium; between the two groups, we have the right combination of critical mass and flexibility: a deep pool of motivated people with complementary expertise and knowledge, working together by choice. It's not just that some artists and engineers can and like to undertake sustained and disciplined collaborations using novel applications of software, hardware, and networks—to properly address certain kinds of questions, like the iterative development of built environments, we have to.

New York, NY, USA Carl Skelton

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Along the way, Microsoft Research supported the work on Betaville by funding some terrific graduate assistants through the Games for Learning Institute at NYU, and the German Bundesministerium für Bildung und Forschung helped keep the collaboration between Brooklyn and Bremen productive and close through its funding for the ThinkBETA consortium organized by Martin Koplin at the Media2Culture Institute for Applied Media Technology in Bremen.

If you're serious about work as promiscuously interdisciplinary as the Betaville project has been, the need to find and rely on top specialists in cognizant fields outside your own area of expertise is constant and acute. Looking back, I am still shocked and awed by the generosity of Joel Wein, whose software engineering (and software project management) experience helped guide the work and guarantee the quality of the code itself; architects David Lieberman and David Turnbull, who have offered by turns sound counsel, feedback, and some great ideas; Peter Morales, the CTO of my dreams (and NYU's Law School); Skye Book, developer and cat-herder exraordinaire; Levis Reyes, whose attentive skill in 3D modeling and imagination in speculative architectural design has amazed me every time.

Any community, and especially a New Soft City, thrives by providing opportunities for close friendships and working partnerships to form and flourish. I am in some sense particularly grateful to Betaville as such a community, for bringing me together with some of my most valued partners and friends: Vin Cipolla at the Municipal Art Society of New York City, Norm Jacknis of the Public Sector Unit of the Integrated Business Solutions Group at Cisco Systems, Martin Koplin at the M2C in Bremen, and Jee Won Kim. I couldn't have done this work without you, and

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Thanks Viv, for not even blinking when I said I was going to quit a full-time job at NYU to do this.

Thanks Pearl, for being a good enough reason for just about anything.

Contents

Chapter 1
Introduction

The Betaville platform was initially developed as a specifically *informatic* response to the need and potential for broadly distributed and sustained design collaborations that could effectively include the full range of expertise and stakeholders in situations calling for changes to the physical built environment: massively collaborative design software. As the research/development fields of "serious games," e-governance, open data, and distributed collaboration evolve in parallel, Betaville has become more broadly relevant to the performance requirements/expectations/future development path of open massively multiplayer online (MMO) engines, raising in particular questions about the possibility (and necessary development in informatics) for interactive representations of physical spaces across a very wide domain: scaling from interdisciplinary teams to entire communities in practical problem-solving and creative future-making.

In an international context, the term "informatics" needs some disambiguation. In Europe, it is a synonym for Computer Science; in North America, Informatics is an interdisciplinary field combining computer and information science. The terms Social Informatics and Socio-informatics are roughly congruent worldwide, in two or more of computer science, information science, information systems, human–computer interaction, and various social sciences. A representative sample definition:

> …the body of research and study that examines social aspects of computerization—including the roles of information technology in social and organizational change and the ways that the social organization of information technologies are influenced by social forces and social practices. (Website of the Rob Kling Center for Social Informatics, Indiana University Bloomington)

What follows is intended less as a theoretical argument than a thorough account of the purpose, planning, design, and first deployments of Betaville as a new hybrid work of creative social software, in the context of ongoing fundamental change in how the new soft cities—which so many of us now live and work in—function and evolve.

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Betaville's shift of online game and virtual world genres from massively *multiplayer* to massively *participatory* addresses the convergence of research, development, and adoption of smart city IT infrastructure, publication of large public data sets as "open data," and the increasing availability and power of mathematical simulation and graphical visualization tools for collaborative planning and design applications.

Just as a physical city combines public and private domains, and must address the mix of technical (infrastructure) requirements while providing a robust social and symbolic environment (art and design) for its human population, the emerging complex of public digital "spaces" must depend on and serve a mix that has always been complex, but is becoming more and more dynamic: a digitally augmented body politic made up of diverse skills, roles, rights, and responsibilities.

Even just within the domain of engineering, the range of implicated research specialties is bewildering. Database design, parametric architecture and software engineering, distributed server architectures for real-time collaboration, real-time distributed 3D graphics, data visualization, geodata, augmented reality, human–computer interaction, role and access management for extremely large groups, etc. Multiplying that complexity by the need to address qualitative (social and cultural) as well as quantitative dimensions of the platform itself, as well as its contents, and deal with the fray of competing interests in high-stakes situations, makes formulating a performance specification for Betaville *n*-dimensionally intimidating. On the other hand, the potential for some new constructive creative collaborations to supersede some old power struggles is just as real. The necessary cultural and technical resources seemed to be available in the summer of 2008, so we got to work, first by breaking down the separate domains of creation and research.

Art applications of computing, particularly for collaborative work: three very distinct threads of development bringing informatics and experimental art practices together are in turn synthesized, or at least convergent, in the Betaville project: one, software art, particularly process-oriented software art developed by allowing a set of initial conditions and operations to unfold without direct "in-process" control by the artist; two, another body of "social sculpture" or "relational" work built on the direct engagement of social/political processes by artist; three, the developing ubiquity of digital graphic models and simulations as part of the process of conception, development, and advocacy for new works of art and urbanism.

Massively multiplayer games: in particular, games oriented to city-building and social interaction—SimCity may be the best-known city planning "God game," but the genre ranges from Roman and Egyptian settings to Utopia itself (Utopia, in this case, being the strategy game published by Mattel in 1981). Claims have been made for the stimulative educational/civic engagement potential of these games (Lenhart et al. 2008). The Betaville project offers three basic developments from the "God game" genre: first, to build it on an open-source platform, whose process and software more directly reflect peer relations, rather than divine authority; second, by shifting the emphasis from game play within a fixed "environment" and "rules" to a more dynamic social-collaborative process of world *editing*, with emphasis on collaborative creation supplemented by discussion forums, and an orientation to the world being mirrored as the current one of any number of possible iterations; third, by developing site-specific

mirror worlds as the subject of each instance of the game, based on the actual physical environment in which a particular group will develop new ideas for each other and third parties to fly through, and eventually propose alterations or alternatives of their own.

Open-source software development practices: Eric Raymond, in his influential *The Cathedral And The Bazaar* (Raymond 1997–2001), identifies open-source software development as a form of creative group play which is at the same time a process of developing informatic tools and resources for general use and one of the approaches available to IT professionals seeking to provide cost-effective and robust services. As open-source software practices have matured, and been formalized at various levels and in different contexts of use and hardware/network capability, a new range of norms and use patterns has emerged within informatics, extending and adapting academic practices to the formation of more radically *ad hoc* development "communities." Betaville tests the limits of the transferability of those practices to the cultural and civic spheres, both in terms of the state of general usability of software originally developed within a very small group of technical experts with common expectations of competence, access, and authority over the project, and in terms of the effective advantages and consequences of treating public art and urbanism as suitable objects of "open-source" development.

As we move from a technical situation in which cultural applications of informatics are constrained by the performance limits of available computers, networks, and software, to one (or a web of many) in which those tools constitute a new order of effectively ubiquitous infrastructure common to work, play, government, and art, it becomes very important to provide experimental frameworks for constructive development, and to rigorously assess opportunities and risks.

This is not a matter of the current capabilities of the most powerful specialized teams and systems, but rather of the complex of software, hardware, infrastructure, skills, and practices now embedded in the mainstream. Fifty years ago (1960–1964), the most powerful computer in the world was the IBM 7030 Stretch, at 1.2 MIPS (million instructions per second). The early 2011 laptop with which the manuscript for this book was prepared runs at about *100,000 times that speed*. That per-machine improvement, however, is much less significant than the multiplication of the sheer population of computers, the number and variety of people using them, and the fact that millions of them can talk to each other in real time, worldwide, 24/7.

With this in mind, the present work describes a software development project built with a "prescription-strength avant-garde" workflow design: An aggressively innovative—some might say radical—outlook on the big-picture possibilities (art) was followed up with a systematic assessment of practical feasibility and core technology option assessment (due diligence). Once a usable prototype was in hand, controlled small-scale deployments with robust partners were undertaken and assessed for both technical performance and social/cultural impacts before general release, of which this book is one channel.

The project's general conjecture was that ad hoc groups of citizens, proponents, and experts could effectively address public art, urban design, and planning issues over time through a shared virtual environment as a kind of public design space, whose low running cost and broad accessibility might essentially emulate the dynamics and effectiveness of open-source software development. Within that

context, we conjectured that the combination of infrastructure, skills, and appetites in the general population for computers, social engagement online, and interactive 3D graphics for creative/professional/recreational uses had spread and matured to the point where an editable mirror world might be viable as a new form of public space. The specific hypothesis addressed by the present work is that a small group of us could actually build such a public software environment, in which new ideas could develop over time into robust plans, *in a fully public medium*.

1.1 The Case: Betaville

Betaville is an open-source multiplayer environment for visualization of participants' own built environment, designed to promote the development of general 3D visualization and design skills, and a new approach and open resource for participatory urban planning, design, and public art in context and for the long term. The present work considers the Betaville project from three principal perspectives: technological, cultural, and social. We consider the possibilities, risks, work to date, outcomes, and plans for the future.

Technological: under current conditions of performance and accessibility of hardware, software, networks, and skills, we posited that the capacities developed for and within the disparate spheres of computer games (particularly online games) and open-source software development could be adapted to a broadly participatory cultural application: online mirror worlds as engines or media of collaborative design beyond the scale of professional teams to that of local communities.

Cultural: the formal cultural sector includes the arts and design disciplines. Betaville proposes a new cultural form, virtual cities as media of collaborative-to-collective experimentation with possible variants of existing built environments, in which professional experts can exchange concepts, solutions, and ideas for improvement with the full range of stakeholders over time, to iteratively invent new urban forms within the public realm rather than on it.

Social: insofar as the built environment expresses, defines, and constrains the human lives that unfold within it, the process of engaging that environment constructively as something that can always be changed for the better, the prospect of public art and urban design as social media offers a new range of forms of public participation specifically as shared endeavor, whether in a spirit of open creative play or purposive problem-solving. Just as the Linux operating system is built, maintained, and improved by a developer community composed of individuals with an infinite variety of skill levels and points of view, so a street corner or waterfront park might be not only used, but transformed organically over time by and for the people who know it best, and need it most. Just as many programmers have learned and honed their skills through ideation, debate, and experiment with prototypes that could mature before they were deployed, so can the built environment. In essence, a digital *design environment* can be a *public creative space*.

The Betaville project addresses the potential of online open-source tools for collaborative public art project development and participatory urban design and

planning at the local level, through a joint development initiative between the BxmC and M2C. Betaville is an open-source online massively multiplayer visualization environment, in which anyone with a computer and internet access will be able to "fly through" their city, and model new structures and forms within it with accurate scale and location. Many such imaginary structures can coexist in the same space, and evolve continuously over a period of time chosen by their creator, or others who may elect to "fork" the concept in a new direction. The platform provides for collaborative development of projects, and for real-time discussion.

This approach is not so much holistic for the sake of holism as it is intended to fully undertake the entire development pipeline, from imagination to preliminary design, prototype, controlled test, small-scale deployment, ongoing design iterations through to large-scale availability. There are situations, particularly those aimed directly at altering the mechanics and dynamics of social and cultural processes in schools, neighborhoods, and entire cities, where the duty to fully investigate effects and side-effects of simple technological innovations in new uses is paramount. In these "deep social media" situations, neither the marketplace nor formal specialized research norms can be relied on to guarantee that the ultimate impacts will be positive. The "Invisible Hand" of the marketplace imagined by Smith (1759) in the eighteenth century, invisibly steering self-interested parties to inadvertently—but consistently—serve the general good, simply can't wave fast enough anymore fortunately, there are lots and lots of hand-hours available now, online.

Along the way, Betaville is set up to promote awareness and experience of open-source software development for collaborative design, participatory planning, and new practices in public art. The skills kids are developing in online games during leisure time as entertainment can be leveraged as skills for creative expression and social empowerment of the students and their own communities, embedded in and serving local issues and desires. If those skills can at the same time provide a pathway from consumption through creative use to understanding the underlying technology in greater depth, or at least understanding the intimacy of the connection between their game-playing skills and computing per se, we might actually motivate greater and more effective participation in STEM fields *and* community life.

The appeal of computer games to young—and other—people, and games' effectiveness in driving consumer interest in personal computing at all levels of society, is well recognized. The Betaville project represents a major initiative in the use of networked computers as a vehicle for creative and civic uses of that infrastructure, and the creative and civic dimensions of computing, in an unbroken pipeline from middle school through to social and cultural development in (and of) the community.

With that in mind, the Betaville Research and Development Group was brought together to combine expertise in integrated media development. The two principal partner organizations were the Brooklyn Experimental Media Center (and its academic programs in integrated Digital Media) under my direction at the Polytechnic Institute of New York University, and at the Media2Culture Institute for Applied Media Research of the Bremen University of Applied Sciences led by Martin Koplin, in collaboration with Helmut Eirund and Thorsten Teschke in the Media Informatics and Digital Media programs.

Thanks to decades of prior open-source development work by third parties oriented to specific aspects of the necessary software, and to our own initial work on proofs-of-concept and prototypes, the research group was able to launch its first robust "public beta" demonstration project in the fall of 2010 at the Municipal Art Society's Summit for the Future of New York City.

Betaville can ultimately seed a transformation in the working relationships between artists, planners, and designers, and the communities they serve; better integration of tools and social and cultural initiatives in the minds of students, and better integration of the skills they acquire in formal and informal settings; through the regular use to open-source tools, access to underlying technology, providing opportunity and incentive to develop skills and interest in computing; integration of computing, creative disciplines, civic engagement, and entertainment interests of students, leading to broader and more effective participation in and of computing AS a creative discipline whose capabilities and effects will soon be in the hands of people whose skills, interests, and expectations are now in development.

1.2 Structure of the Present Work

Following an account of the initial deployment, this work will undertake a thorough critical analysis of Betaville: its viability as an environment for play, its effectiveness as a medium of collaborative creative work, its relevance to social and civic needs, unintended problems or side-effects it may generate, and whether those can be mitigated or offset to provide an ultimately beneficial expansion of the field of action of informatics, and its emerging norms.

The text will detail the rationale, strategy, praxis, and outcomes, and infer possibilities for future work in this area. By "area" I mean the participatory modeling of alternative versions of existing urban environments. Some of those possibilities will be at the level of technology, such as P2P 3D streaming, while others will be at the level of new approaches to art-making based on the "elective dictatorship" protocol for open-source code, whereby an original author moderates volunteer comments and contributions, and dissatisfaction is resolved by forking. Others may yet involve more early-stage involvement of communities in design and planning proposals, or the normalization of permanent informal design collaboration and debate in local communities. Formative: I will undertake a general overview of the elements Betaville is designed to develop from historical precedents in art, software, games, and participatory design, and in particular from precedents in combining aspects of each. On the basis of this historical overview, I will lay out a rationale and strategy for the Betaville project, working within the limits of creative and technical resources available to the development team, and with a view to deployment in districts for which we have greatest access to necessary information, and the greatest commitment to success, our own cities.

The Betaville platform's development was undertaken through an unusual integration of pedagogy and research, within which faculty and students in very different fields collaborated directly in Brooklyn and Bremen for specific components, and

through a distributed network for the undertaking of the full suite. The first round of deployments were undertaken within formal education frameworks from the secondary to doctoral levels, and in collaboration with museums (both art and science) and civil/civic sector partners, in various combinations. Representative cases will be discussed in depth, with considerable detail on key events and decision points.

Just as participatory architectural and urban design may be approaching new levels of viability through Betaville, it offers an opportunity to model and develop new practices in public art, which is after all a specialized type of public construction. Betaville explores and tests the potential for an effective infrastructure of participation in the elaboration of public works by public means.

1.3 The Betaville Hypothesis

Like this book, and Betaville itself, the hypothesis operates in three dimensions: technological, cultural, and social.

The technological dimension of the hypothesis is simply that a Betaville can be built and run using current open-source frameworks, consumer-level computers, and the internet, and that a critical mass of potential users have both access to those resources and the skills to use them to invent and develop new ideas for urban environments. Essentially, this is the hypothesis that all the necessary technological hard and soft infrastructures for Betavilles are already broadly distributed.

The cultural dimension is that our Betaville in particular can be used collaboratively by a mix of creative professionals and citizen stakeholders, to provide for a productive engagement of the combination of formal expertise and informal knowledge, whose tools, skills, habits, and networks have co-evolved for a new level of participation in public cultural and functional alterations to urban environments.

The social dimension is, of necessity, limited within the scope of the first generation of development and test deployments: even a conventional public art program or urban design project workflow unfolds over numbers of years, and the large-scale projects can take decades to scope and build. For our purposes, the social level of the work has boiled down to two key questions. First, to demonstrate that a Betaville project undertaken from within the education/research sector can engage students in software and media development as a local social medium, and thereby in local urban design and development issues, or conversely in the development of new digital public spaces to support such activity; second, that the products of that engagement can augment the work of existing stakeholder groups, or combinations of them in the field.

1.4 Caveat Prime

The Betaville project was originally defined in the summer and fall of 2008, in Brooklyn and Bremen. At the time of publication of this text, the possibilities and constraints bearing on public-interest software development have already changed

considerably, both in terms of available frameworks and data and in terms of the requirements for developing tools for the broadest possible range of hardware, and thereby accessibility. Every deployment must be undertaken with specific local conditions in mind, from terms of use for a particular city's policies and resources, and every user group's special mix of capabilities and goals.

1.5 Strategy

This section of the text describes in detail the process and products of a careful review of the state of the related arts, to develop a schema and performance specification for the Betaville platform to test the feasibility of such a software environment, with a view to its eventual release as a first-generation public work.

David Gelernter's importance to the development of parallel computing is better recognized than his contribution to the design of new infrastructures for public discourse at the municipal level. His concept of "mirror worlds" (Gelernter 1993), however, helped provide a crucial level of conceivability, and legitimacy, as we worked to build the Betaville team in the fall of 2008. Gelernter had envisioned a kind of urban-scale graphical *Memex* system (Bush 1945), whose interface would be a virtual replica of a city (eventually a whole world), in which real-time data would not only be embedded but also be processed and made readily available to citizens as a live information resource and a social medium for the exchange of ideas between citizens.

In some sense, Betaville started out as a very specific "hack" of the mirror worlds Gelernter had outlined 20 years ago: we moved up a level, to the understanding and engagement of the physical space being represented online as itself a *plastic* medium, i.e., malleable, always available to change, never actually arriving at a definitive or static form, in a permanent or perpetual "Beta release" (Techterms 2013). Betaville was developed from that premise as an experimental design environment, whose risks of adverse effects on the existing network of interests and mandates could be limited by its separation from the physical world, by its ludic status within the "magic circle" of the play world (Huizinga 1950:77), by its marginal "ivory tower" status as an academic project on one hand, and its *framing* as a work of contemporary art on the other, and by the practical fact that a Betaville could be shut down if it overheated (degenerated into a sterile power struggle) or started to create more problems than it solved. At the very least, the Betaville project could help make sense of the relations between two orders of common ground: built urban environments, and the evolving infrastructure of creation and development for those environments.

1.6 Deployments

The deployments described in Chap. 5 were undertaken in a carefully staged sequence. Insofar as Betaville was potentially disruptive, it would not have been sound (or even ethical) to dive right into the field without an interim phase of

semi-controlled applications. Working in educational and public domains in ways that aren't well-covered by the terms of reference of academic codes of practice (especially in the service of the underserved), we had a clear duty to be sure we didn't actually make things worse (more expensive, cumbersome, or disruptive of already-marginal levels of effectiveness in the status quo).

As the tool proved its robustness, and developed beyond a research prototype to a properly deployable "beta," we set out to work first on theoretical use cases, then in partnership with established schools and local organizations with established norms of their own, on an explicitly experimental basis.

At the point at which we could honestly make claims about the functionality, requirements, and appropriate expectations in the field, we released the platform for general use, and set about our own deployment and development "in the wild."

1.7 Outcomes

Pursuant to the basic questions of functionality, we considered Betaville's effectiveness in terms of its impact on the breadth and depth of the participation it effectively provided for in its initial deployments in New York and Bremen. Had people been actively engaged? Had outcomes actually been affected, in terms of built work in the physical realm or enrichment of the planning and design processes at the local level? Had there actually been negative side-effects to the Betaville project, either because it provided opportunities to subvert or manipulate participation, or because of other unforeseeable consequences?

What specific benefits and problems emerged from initial deployments of Betaville in Brooklyn and Bremen, and what might this imply for broader implementations or new directions in research and cultural applications of informatics?

1.8 The Roadmap (Before and Beyond the Horizon)

If an open-source game engine can be applied successfully to civic and cultural uses within current conditions of access to computer hardware, software, and skills, bearing in mind that some of those skills will have been acquired formally (Computer Science at the secondary and post-secondary levels) and some informally (navigation and manipulation within virtual environments as computer game play), a whole new domain of citizenship is possible. In that digital public domain, practices and norms developed for open-source software may be successfully "ported" to collaborative and participatory development in public art, urban design, and planning as integral components or modes of participatory e-governance.

The Betaville platform's development and deployment are ongoing, within and beyond its initial purpose. This section of the text will give a brief account of the current state of the Betaville art: what's in the works, and what ambitions might seem newly reasonable in the light of work and results to date.

Betaville itself was undertaken concurrently as a research project, development of an experimental medium, and a new form of public creative space. For me, and for many of the dozens of people who contributed directly to the work, it was also an effort to augment the process and products of distributed creative collaboration. The research and development work called from the outset for an interdisciplinary mix perhaps atypical in academia, but characteristic of the field under study/engagement: artists, architects, designers, advocates, teachers, students, citizens, and engineers.

Whether you read what follows as the study of a generic case of promiscuously interdisciplinary action research and development, or as the account of a proof-of-concept for a new class of deeply social media, may amount to a simple difference of scale.

Either way, the Betaville project offers a new level of possibility for the development of new collaborative software environments, characterized by FULL engagement of technology expertise in the development of system performance requirements and full exploitation of available frameworks and information resources, in exchange for full engagement of end-users in the practical realities of the technological infrastructures on which they rely, extending the principle of "open source" beyond developer communities to user–designer–developer working groups.

The initial success of Betaville's radical integration of cultural, social, and technological programs at the levels of teaching and research suggests that new levels of interdisciplinary collaboration are practicable, and can be fruitful in the field.

How these domains may further contribute to each other, in the linked emergent areas of participatory e-governance and distributed creative collaboration in general over the coming decades, is now in play. The book will conclude with a brief outline of ongoing Betaville-related work in New York and around the world.

Game on.

Chapter 2
Background: Waking Up in a New Soft City

> …Where Information Is Infrastructure, Reality Is Always Blended, and the Studio Re-Designs Itself Overnight.
>
> The classical unities of architectural space and experience have shattered—as the dramatic unities long ago fragmented on the stage—and architects now need to design for this new condition. (William Mitchell, *City of Bits* 1995:44)

Mitchell's "City of Bits" was *soft* in two ways: in adding soft*ware* to the lexicon of urban infrastructures and in highlighting the ways in which IT-augmented urban systems and the use of the Internet as a new form of public space where social and public communication are not only accelerated but offer new affordances for new social formations subject in turn to constant reconfiguration driven by the ad hoc evolution of the digital ones. There may still be a town square in front of a building that is still called City Hall, but half of what they were built for has migrated online, and the Internet is subject to change without notice.

Affordances, in this context, should be taken in both senses of the term: as originally coined by J. J. Gibson (Gibson 1979:127), the opportunities for action *afforded* by the environment, i.e., what you can actually do there; and, as somewhat redefined by Don Norman in his *Psychology of Everyday Things* (Norman 1988:9), the cues offered by an object or interface that suggest functions and interaction, i.e., what it *looks like* you can do, as well as what you actually can or can't. Of course, in a situation where the functionalities (Gibson's affordances) are changing fast, then the perceivable functionalities (Norman's affordances) represent a special design challenge: how to provide recognizable cues for interaction in a novel environment, with new functional capabilities? You can hardly recognize something you've never seen before.

Architects (among others) can and must now work *from within* this condition: the architectures of software, teams, markets, and communities may not look or work anything like the architectures of the buildings and cities and networks through which they circulate. My environment is built of two architectures, more or less alien to each other—an information architecture and a physical one. Every generation of software or hardware reengineers this New Soft World. Just in terms of the software itself, I use enough different programs for this to happen more or less daily.

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If West 30th street outside my Manhattan window were changing at the same rate, it would be unrecognizable most mornings.

Taken separately, data networks and applications are actually nothing like this. They are planned, designed, built, and deployed through the public, civic, and commercial sectors on purpose, over long product development and marketing cycles, as if the whole system were as fixed and "hard" as the Manhattan Bridge: a massive and iconic monument provided with clear indications of which parts do what. The trolley lanes now carry cars and trucks, and the approaches have been crudely adapted to a bastard child of nineteenth-century city street and twentieth-century expressway, but the thing itself seems to hold its shape and stands the same distance from my front door as when it was inaugurated in 1909.

My studio and office, on the other hand, weigh less than 7 lb, and I carry them with me when I travel. Most of my personal storage "space" is in Germany, I think (I use Hetzner). How would I make sense of my physical work space needs to an architect or configure a collaborative design environment for a multi-person studio or even (yikes) a public space?

Fortunately, software techniques and technologies can be taken apart and rebuilt on short notice. Big design problems may be soft, but the tools to address them are hyperplastic, amenable to instant and infinite transformation as the need arises.

A city is "soft" to the extent that it can be characterized as a meta-network of data flows and personal communication, operating to some extent independently of the "hard" infrastructure of buildings, districts, and roads and geography. Arup's Dan Hill talks about the *New Soft City* (Hill 2010) as one whose buildings and roadways are telematic in some way: a city whose buildings are augmented in their functions through the use of cameras and other sensors feeding data to everything from the ventilation equipment to command-and-control centers for surveillance, emergency response, and day-to-day operation of services like traffic control and public transit. Piggybacking on this infrastructure, he offers another layer of softness, under the rubric of experience: buildings and streets acting as interactive "urban informatic" systems, displaying real-time data as public information outdoors, and things like smart meters in the private domain. In this New Soft City, people are offered real-time information as "awareness," governments get "intelligence," and planners/architects/engineers get lots of new "data mines."

Where Hill's concept of a New Soft City augments the design of buildings and public infrastructure to include sensors, controls, and displays, the New Soft World is radically a symbolic, social, and political environment, of which the physical components constitute a subset of architectural/urban media, and the very bedrock is blurred and fluid. Every time you wake up there, the shape of your job, your neighborhood, and your social network has already changed a little bit.

The term "soft city" was actually coined almost 40 years ago. It had nothing to do with computer software, hardware, or digital infrastructure….

> Cities, unlike villages and small towns, are plastic by nature. We mould them in our own images: they, in turn, shape us by the resistance they offer when we try to impose our own personal form on them. In this sense, it seems to me that living in cities is an art, and we need the vocabulary of art, of style, to describe the peculiar relationship between man and material that exists in the continual creative play of urban living. (Jonathan Raban, *Soft City/The Art of Cosmopolitan Living* 1974:2)

Raban was writing about the art of inhabiting this soft city, where social groups or districts might disappear or become unrecognizable in a few years. At any given moment, a street corner might seem to have the solidity of a place that was there before you were born. It may still be there next time you happen by, but may have lost what you remember as its essential place-ness—apparently stable in day to day, but effectively temporary over longer periods, fluid and contingent. The buildings and streets persist as fossils of a long-dead neighborhood, as another *seems* to settle in its place.

Ironically, "soft" communities maintained through online media may yet be more stable than conventionally understood hard "neighborhoods": I can move out of my loft when the rents go through the roof, without losing contact with the other creative eccentrics I knew there, as we all migrate to other urban frontiers or "age up" to residential districts with better schools and less toxic topsoil. Some tele-topias are more site-specific than others, but many call into question the technical capabilities and terms of use of our shared space. The blended virtual/tangible reality of everyday life is running into the potential for entirely new forms of citizenship.

This is true in a thousand ways, down to the scale of a single room. A class full of students with laptops and Wi-Fi needs a different physical configuration to be as effective as one without, for lectures or seminars. Just ask any instructor who has had to look out at a room full of students with their laptops open. On any given screen, there can be porn, poker, social chatter with half the Internet, class notes, or all of the above. The physical isolation of the students and the instructor in that physical space no longer isolates their attention spans from the soft world. "Outside" has lost its meaning and its purpose. Now, imagine designing a whole university. How much of the campus is just there out of habit? What new hybrid architectures make more sense now or offer better preparation for what's coming?

A lot of telecommuters and cubicle captives NEED Facebook to stay any kind of sane through the day, with or without pink noise, deer in the backyard, or Nespresso; the real-time data I mentioned above are now as fundamentally "infrastructure" as the underground conduits that house the electrical and communication cables; and I am a member of several formal and informal communities, some of which are poorly (or maybe just primitively) supported by the legacy environments and habits we intermittently struggle to outgrow in "hard" (physical) environments. The shapes of those hard rooms and buildings and urban fabrics have changed mostly by having more mechanisms grafted on Ethernet cables, servers, security cameras, ID scanners, etc. While office buildings in lower Manhattan may be converting to residential uses in whole or in part to compensate for the flight of commercial tenants whose employees can now work at greater physical distances from the empty trading floor of the stock exchange, more profound changes in how we understand, imagine, and build natively Soft Cities are still ahead of us.

In this world, a building is not so much an artifact with communication and control systems added onto it as it is a configuration of physical and virtual elements in a constant state of co-transformation. This is inevitable, in a situation where the building's uses and capabilities change constantly. The term "in beta" is a bit of jargon used by software developers to describe the provisional version of a new piece of software that is released at no charge to users who have enough proficiency and

interest to work with something that hasn't been definitively vetted (Techterms 2013). For many applications, this is the only effective way to fully finish the project. For a city, the project is never finished anyway: as local demographics, macroeconomic factors, or transportation and communication technologies change, the optimal form of every form and function of a building, a neighborhood, and a city change too.

That city, in software developer's terms, is effectively in "perpetual beta": always *almost* complete, subject to just a bit more refinement and debugging in the field with just a bit more feedback from its most engaged end users, which never is never quite done before enough has changed "out there" for the whole cycle of development to reiterate.

All of these softnesses are, in fact, over and above the plasticity of the physical city itself, whether organic (building-by-building replacement of auto body shops and meat wholesalers by luxury apartments, fashion boutiques, and art museums on the west side of Manhattan) or by design (redevelopment of former industrial waterfront districts in Boston, Montreal, Toronto, Bremen, Istanbul, Busan…).

A New Soft City is soft in all these ways at once: subject to physical evolution and reconfiguration; inclined to gradual change in its human communities and organizations; engaged to rapid evolution of its public spaces, taken as the aggregate or synthesis of physical and digital media of social and political processes bearing on urban life; and currently, we propose, capable of transformative positive change in the breadth, sophistication, and power of public participation in the processes of ideation and design development that form a crucial domain of public discourse about the form and purpose of future urban settlements, in large measure as future forms of present ones.

Concurrently, computer-aided design (CAD) tools like Gehry Technologies' Digital Project and GTeam are being built and used to conceive, design, build, and manage physical buildings and urban systems. Some of these tools are evolving into scalable collaborative software environments. At the point at which we can recognize design and planning of the next iteration of a city as forms or modes of its governance, the question of software environments for citizen participation in them arises, as a form of interactive informatic public *space*.

The Betaville project proposes and presents such a space: open enough, straightforward enough in its usability, and with the necessary functionalities to be able to support a new scale of collaborative public participation, particularly in the early phases of specification and conceptual design for public projects.

Betaville draws on specific prior art and critiques within the disparate domains of art, software engineering, digital design, and urban planning politics and is motivated by an ambitious, rather than Utopian, idea of what new purpose-built tools may offer at the technical intersection of massively multiplayer online games, geodata, and distributed 3D authoring (i.e., 3D model creation, not to be confused with *authoring* as creation of text documents) tools; the cultural intersection of public art, social sculpture, and experimental digital media; and the social intersection of distributed collaboration and participatory urban planning and design practices.

Within each of these domains, controversies about what's right and what's realistic are ongoing. The Betaville project was developed not so much to prove a specific

ideological point, as to demonstrate the general possibility of an upgrade: broader, more innovative, and more effective participation in the early-stage or conceptual design phases of proposed changes to urban environments. What follows is a synopsis of the elements we drew on from the discourses of the various relevant domains.

2.1 Motivating Factors in the State of the Art(s)

> We contend that dialogue, free ranging and exploratory, is at the heart of collaborative rationality, and that communities of inquiry are essential to the development of robust, informed and nuanced policy adapted to the unique conditions in particular times and places. This dialogue explores, challenges and changes frames; it makes creative use of metaphors; it proceeds to a considerable degree by role playing and storytelling; and it creates ways out of stalemate by a process of collective bricolage as participants draw on ideas from many sources to put together a new approach. (Judith Innes & David Booher, *Planning With Complexity* 2010:2)

At first reading, Innes and Booher's term "communities of inquiry" refers generically to local working coalitions or networks of professional experts, advocates, and stakeholders with deep informal knowledge, engaging urban-to-regional planning issues. However, the concept of a community of inquiry goes back to its initial formulation by the American pragmatist philosopher (and mathematician and engineer) C. S. Peirce in 1900:

> The course of life has developed certain compulsions of thought which we speak of collectively as Experience. Moreover, the inquirer more or less vaguely identifies himself in sentiment with a Community of which he is a member, and which includes, for example, besides his momentary self, his self of ten years hence; and he speaks of the resultant cognitive compulsions of the course of life of that community as Our Experience. (Charles Sanders Peirce, *Review of Josiah Royce's 'The World and the Individual'* CP 8:101)

Peirce's inquirer evolves at an individual level over time, within a likewise dynamic, sentient, and conscious *scientific* community:

> Thought is what it is only by virtue of its addressing a future thought which is in its value as thought identical with it, though more developed. In this way, the existence of thought now depends on what is to be hereafter; so that it has only a potential existence, dependent on the future thought of the community. (Charles Sanders Peirce, *Writings 2*:241)

John Dewey extended the scope of this concept of community of inquiry in the domain of "social inquiry" (the social sciences) on three axes: by explicitly including students in the community of inquiry, by acknowledging the potential impact of research on the social relations under study, and therefore requiring that the potential for such impacts be taken into account as a fundamental aspect of what he calls "indispensable logical conditions of conceptual subject matter in scientific method":

> 1) the status of theoretical conceptions as hypotheses which 2) have a directive function in control of observation and ultimate practical transformation of antecedent phenomena, and which 3) are tested and continually revised on the ground of the consequences they produce in existential application. (John Dewey, *The Logic of Scientific Method* 1938:506)

This concept has been applied since to public administration (Shields 2003) and online education (e.g., Garrison et al. 2000). Communities of practice, a variant, addresses the informal social learning processes by which individuals build proficiency and identity in the world of work (Constant 1987; Wenger and Lave 1991; Wenger 1998). Knowledge-building communities (Scardamalia and Bereiter 1994), like Peirce's original community of inquiry, have learning as their principal purpose and product.

As education, government, business, and citizens' groups of all kinds have migrated to one extent or another from physical environments like offices, schools, and parks to laptops, smartphones, email, distance learning platforms, and social media, the underlying logic of the human relationships they run on has come into question. In the absence of traditions or habits adapted to a radically new digital (or at least partly digital) environment, how informally can learning, proficiency, and identity develop? Is the cultural capital accrued by senior faculty and managers actually devalued in these media or perhaps brought into a new dynamic as they address students and subject novices who are substantially more fluent navigators and communicators in the new blended reality by virtue of being native to it?

Hoadley and Kilner (2005:38) directly address software infrastructure for what they call "Distributed Cognition" as a design challenge:

> While not all learning takes place in communities, communities do appear to be an important mechanism for generation and dissemination of knowledge. In the fields of CSCW [Computer-Supported Collaborative Work] and CSCL [Computer-supported Collaborative Learning], the core challenge is linking design challenges at the individual level to outcomes (especially learning) at the collective level. (Hoadley, C. & P. Kilner *Using Technology to Transform Communities of Practice into Knowledge-building Communities* 2005:38)

Taking Innes and Booher's *community of inquiry* at face value in this context, I might well imagine a community specialized in its time, place, and purpose (the development of a new urban policy/plan/design for a particular location), but radically unspecialized in its constitution: planners, designers, and stakeholders with different stakes and very different levels of fluency with the requisite digital tools for research, discussion, file sharing, mapping, data visualization, and CAD. Those differences of fluency aren't necessarily between communities of practice, either, but often within them—I've met high school students from lousy neighborhoods who were much more proficient with 3D design software than some of my architect friends.

A New Soft City is a double world: a virtual–physical social *medium*, in the sense that any city has always been a medium for community living, subject to transformation over time. In New York City, where I write, that's been going on as an iterative urbanization process since 1608. I live on a street that was laid out in 1811, in a row house built in 1848. The newly emerging virtual layer, however, is an ad hoc artifact of technological advances and market-driven saturation that seems to have mutated faster than it has been designed. If the accumulation of Internet-connected personal computers is construed as the virtual layer's infrastructure, the very idea of its planning or design as urban space is meaningless. If urban planning and design have become impossible and absurd in the virtual layer of the New Soft City, what of governance and what of design as a crucial mode of that governance?

Might a new and purposeful mash-up of social media (from online bulletin boards and multiuser dungeons to blogs, wikis, Facebook, and Twitter) with massively multiplayer games (including virtual worlds like SimCity, Second Life, and Minecraft) and collaborative design platforms (such as Building Information Models and GTeam) now be possible, providing a medium within which a new level of experimentation with built urban environments can serve an appropriately rapid prototyping environment for both the virtual and physical cities and their effective synthesis over time?

Etienne Wenger, in his *Communities of Practice* (Wenger 1998:73), identified "three dimensions of the relation by which practice is the source of coherence of a community: (1) mutual engagement, (2) a joint enterprise, and (3) a shared repertoire." Does this not describe an optimal working relationship between professional designers, planners, political representatives, and citizens in driving the ongoing evolution of their shared environment and duty of care?

From a somewhat different perspective, Yochai Benkler describes a general pattern of democratization of production, as well as access to *information* through online media:

> We are seeing the emergence of the user as a new category of relationship to information production and exchange. Users are individuals who are sometimes consumers and sometimes producers. They are substantially more engaged participants, both in defining the terms of their productive activity and in defining what they consume and how they consume it. In these two great domains of life—production and consumption, work and play—the networked information economy promises to enrich individual autonomy substantively by creating an environment built less around control and more around facilitating action. (Yochai Benkler, *The Wealth of Networks* 2006:138–9)

At one level, this seems to amount to a simple "port" (in programming terms, the rewriting of a piece of software in another language for a different system without changing its function) of the language of participatory democracy to the digital domain, albeit a crude one: conflating writing with discourse with production of information and production with work against consumption equated with play. Are the people of New Soft City citizens or users?

At another level, my experience of reading manifestoes about participatory democracy or massively collaborative urbanism has been subtly altered by lived experience of open-source software development. Try reading a few of the quotes above or below as if they were about GNU/Linux, rather than learning or design or politics. Are open-source developer communities not only living Utopias but also a proof of concept for methods and practices that would work in other domains? Is "developer" already a better translation of "citizen" into *New Soft City* than "user"?

In 1995, when William Mitchell first published *City of Bits*, I was working as an artist, a teacher, and president of the Niagara Neighborhood Association in my native Toronto. The district was a classic specimen of an urban redevelopment area: a mix of working class and immigrant households, vacated industrial land sprinkled with a few hold outs (a slaughterhouse, a bread factory, a brewery, some warehouses), live work and creative tech loft conversions, social housing, and occasional historic landmarks, traversed by a wild variety of elevated highways, train tracks,

public transit, and picturesque streets where the mix of small commercial–industrial buildings and townhouses had jostled itself gently together over the century and a half since the city's incorporation. Right in the middle of the Niagara Neighborhood, 300 acres of what had been the Massey Ferguson tractor factories and showroom when I was a student, now vacant, had been acquired and then lost by Olympia and York when they were driven under by the failure of their Canary Wharf development in London….

What might the next iteration of that area become? Where Raban had described a city that was "soft" insofar as it lent itself to gradual ebbs and flows of occupation, the area was now entirely fluid. It could be anything in 5 years, from parkland to malls or high-rises.

The Niagara Neighborhood Association was exceptionally competent and in an unusually good position to make the most of that competence: congenial political representation at the municipal, provincial, and federal levels; a rich and well-connected mix of urban activists and creative professionals; and the advantage of a deep economic recession, providing some valuable breathing room to develop alternative visions and plans… sort of.

We could do things like traffic calming and public art projects and participate more or less effectively in the conventional approval processes for small commercial developments, but we didn't seem to be particularly good at imagining a coherent future for the district, against which any proposal from outside could be evaluated as more or less positive. As an artist interested in the public realm, accustomed to cooking up and promoting small-scale idiosyncratic changes to very specific urban sites, I was struck by how much energy we spent defending the community from people with big ideas and how little we knew how to spend on our own. Over time, it seemed to me that this essentially defensive culture was bound to lose enough battles for the integrity of what we were defending to erode, for having failed to imagine and articulate an image of something better, other than our own little status quo.

Could a community actually imagine itself forward? Would the very process of taking on the possibility already be a valuable development of civic culture? What would it take?

This was about the time I started to work with electronics and video in my art practice directly. My computer was more and more indispensable for the day-to-day business of communication, clerical chores, proposal preparation, and documentation, but people who used them to actually make art still looked cute to me, and the city itself still seemed to be a network of places and things: immersive material culture, simultaneously the physical medium (infrastructure) and symbolic environment… as such, definitely "soft" in the sense of plasticity, something subject to change—not so much by happenstance, as with Raban—but by design.

The vague impulse or wish for a new form of shared creative space, the very space that might make it practical for entire communities to practice participatory-to-collaborative forms of self-construction through ongoing speculative urban reimagining, had yet to resolve itself in my mind as a software engineering project, simply because I was still finding my way around the strange ecosystem of digital authoring tools and networks in the same way that Raban or the situationists might

have: a kind of urban semi-nomadism, taking the city day to day as a landscape in which the "art of living" must be continuously reinvented… as yet unprepared to make the most of the even more radical plasticity of my computer, in an emerging (or at least possible) digital *polis*.

How might it be possible for a community to constitute itself as an artist, capable of making an image of its own future from, through the ongoing re-imagination of its material culture, the city itself? The messy term "participatory-to-collaborative" above refers to a potential learning curve that would culminate with the kind of specifically collaborative participation envisioned by Innes and Booher.

Henry Jenkins offers a working definition of the kind of culture that would support, or even be built on, participation in general:

For the moment, let's define participatory culture as one:

1. With relatively low barriers to artistic expression and civic engagement
2. With strong support for creating and sharing one's creations with others
3. With some type of informal mentorship whereby what is known by the most experienced is passed along to novices
4. Where members believe that their contributions matter
5. Where members feel some degree of social connection with one another (at the least they care what other people think about what they have created)

> Not every member must contribute, but all must believe they are free to contribute when ready and that what they contribute will be appropriately valued. (Henry Jenkins et al., *Confronting the Challenges of Participatory Culture*: *Media Education for the 21st Century* 2006:7)

Where Peirce and Dewey described learning as the product of a social process of exchange of ideas and critical engagement, Innes and Booher advocate (and practice) direct collaboration with groups of stakeholders and experts to arrive at specific urban policy recommendations. Might this approach be extensible from policy to the development of specific design solutions? At what scale?

This idea had been explicitly tackled before networked communication and creation software were even on the horizon. While the Situationist International (l'Internationale Situationniste) may be better remembered as a group of writers and agitators that had provided some of the theoretical infrastructure of radical student movements in Europe in the 1950s and 1960s (Guy Debord's Society of the Spectacle, Raoul Vaneigem's Revolution of Everyday Life), its program addressed architecture and urbanism as crucial (and necessarily collaborative) creative media:

> L'entrée de la notion de relativité dans l'esprit moderne permet de soupçonner le côté EXPÉRIMENTAL de la prochaine civilisation, encore que le mot ne me satisfasse pas. Disons plus souple, plus « amusé ». Sur les bases de cette civilisation mobile, l'architecture sera—au moins à ses débuts—un moyen d'expérimenter les mille façons de modifier la vie, en vue d'une synthèse qui ne peut être que légendaire.
>
> *The appearance of the idea of relativity in modern thinking suggests the EXPERIMENTAL side of the next civilization, although the word doesn't quite satisfy me. Let's say more flexible, more 'playful'. On the basis of this mobile civilization, architecture will be—at least early on—a means to try out the thousand ways to change life, working towards a synthesis that must necessarily be legendary* [*author's translation*]. (Gilles Ivain, *Formulaire pour un urbanisme nouveau* Internationale Situationniste n. 1, 1958)

This project was taken up most systematically by Constant, who had abandoned his work as a painter in favor of "unitary urbanism," a synthesis of art and technology as playful experimentation he called for in a short manifesto with a prescient title, *Le Grand Jeu à Venir* (The Great Game to Come):

> Les inventions techniques qui sont actuellement au service de l'humanité joueront un grand róle dans la construction des cités-ambiances à venir. Il est notable et significatif que ces inventions, jusqu'à présent, n'aient rien ajouté aux activités culturelles existantes, et que les artistes-créateurs n 'aient rien su en faire. Les possibilités du cinéma, de la télévision, de la radio, des déplacements et communications rapides, n'ont pas été utilisées et leur effet sur la vie culturelle a été des plus misérables. L'exploration de la technique et son utilisation à des fins ludiques supérieures sont une des taches les plus urgentes pour favoriser la création d'un urbanisme unitaire, à l'échelle qu'exige la société future.
>
> *The technical inventions that humanity has at its disposal today will play a major role in the construction of the ambiance-cities of the future. It is worth noting that significantly, to date, these inventions have in no way contributed to existing cultural activities and that creative artists have not known what to do with them. The potential offered by cinema, television, radio and high-speed travel and communication has not been exploited, and their effect on cultural life has been deplorable. The investigation of technology and its exploitation for recreational ends on a higher plane is one of the most pressing tasks required to facilitate creation of a unitary urbanism on the scale demanded by the society of the future.* [*trans. notbored.org*] (Constant, *Le grand jeu à venir* Potlatch nouv. série, n° 1:3–5, 1959)

Within the art canon, the living legacies may yet belong to the most promiscuous polymaths, Nam June Paik, Michael Snow, Robert Wilson, Iannis Xenakis, and Frieder Nake, and a cluster of actual engineers, Steve Rutt and Bill Etra, Douglas Engelbart, Max Mathews, and Alan Kay, may yet have contributed more, and more directly, to Constant's program than could be understood through consideration of the development any one of the relevant fields in isolation.

A history of the work leading up to Constant's demand for that *Grand Jeu*, and answering it since, would have to hopscotch between the separate domains of art, technology, architecture, and entertainment. Betaville could be his Great Game's first working prototype.

2.2 Mix–Mash Culture: Art–Design–Technology

By the time I left Toronto for New York City in 1998, more and more of my personal creative practice was virtual and digital: still designing and making objects to be experienced in material form in particular places, but more and more with a computer as my primary tool of sketching, planning, drawing, and explaining what I wanted to do next… still very much, though, as an end user, gradually substituting 3D, graphical, web, and video authoring tools to make art well outside the use cases intended by the firms that sold them, but well inside the techniques described in their user's manuals on any given day.

I vaguely felt that my art school history of avant-gardes was somehow out of sync with this new environment. I lived in a world where the Bauhaus, Joseph

Beuys, and Jane Jacobs now belonged in the same canon, but Jackson Pollock and Andy Warhol might not…. Was New York still an engine of renewal?

I hadn't really intended to spend more than a few weeks there, but I got a new kind of lucky: of the very few people I knew in the city, most had gravitated into a strange amalgam of contemporary art and digital design—Greg van Alstyne, a studio mate from Toronto, was running the Museum of Modern Art's website; Ron Wakkary ran StadiumWeb, an online art atelier and virtual Kunsthalle project; and Luke Murphy, a conceptual/process artist trained (like Ron) at the Nova Scotia College of Art and Design, was working in web development for Sony, then CBS, and eventually MTV… while gradually evolving his own art practice into a level of digital authoring that included real programming. Ron and I had discussed my doing a project for StadiumWeb. When we sat down for coffee, the first thing he said to me was "I'm moving to Vancouver to start a new digital media program." I said to him, "What are you doing with your apartment?" He said to me: "You'll do fine here. Come to my going-away party."

In every art school, there's a department or division that attracts the most ambitious and interesting students; likewise, in every city's art scene (or ecosystem of scenes), there are a few pockets that are dynamic at any particular moment. In New York, at the turn of the century, it seemed to me very much to be this odd semi-network of artists working who were engaged enough with digital media that they had gotten to the point not just of making unintended uses of their tools but of dis- and reassembling them into entirely new media: mostly art school grads, self-teaching and bootstrapping their way to form more oriented to a kind of playful electronic *détournement* than either the earnest techno-modernism of the Bauhaus or academic (as in university culture) art-world "deconstruction"—Grahame Weinbren, Mark Napier, John Klima, Jodi.org, Wolfgang Staehle, the Eight-Bit All-Stars, Atau Tanaka, Keiko Uenishi, and the SHARE collective.

For such a set of practices to mature, this would require a new kind of institutional research and development component: a natively digital creative program at the right university. Ideally, such a program would be, it seemed to me at the time, within the liberal arts wing of an engineering school in New York.

In due course, a friendly chat in a cab at an Internet art conference in Lisbon led to teaching a night class at Brooklyn Polytechnic, officially the Polytechnic University of New York (PUNY!) since its acquisition of NYU's engineering faculty in 1973.

We had a bit of a misunderstanding about the course…. I had understood that I was to teach a graduate seminar about the cultural geography of the Internet, but the students were expecting a technical night class in web design. It turned out that the department of Humanities and Social Sciences was trying to stand up a "media studies" program combining creative and critical components. They had secured a mandate and space to do it, but lacked the underlying skills to really make it go as something more than an undergraduate "retention" program. While teaching there as an adjunct, I had a chance to think through in detail what a more ambitious form of the program might look like and how it might better combine not only the engineering capabilities of the school and its students but also the very deep talent pool in the city.

By 2003, when the founder of the original media studies program left, I had a pretty fair idea of what I wanted to do and what it would take: a full integration of the creative, critical, and especially technological dimensions of digital media, supported by a ground-up redesign of the curriculum, as radical as the Bauhaus curriculum had been in its day, indeed borrowing liberally from the precedent. Programming fundamentals and physics would be taught not only concurrently but with full cross-referencing of syllabi, for web, video, graphics, game design, and multimedia performance project studio courses.

All of this would be supported by software, hardware, and facilities designed to provide for the best possible range of project and career outcomes, from solo/artisanal to corporate… to be set up with whatever equipment I could scrounge or pay for without any direct investment up front from the school! If this seemed like an unreasonable requirement, it was actually healthy at the time and doable.

2.3 Tools, Toys, and Treadmills: Hard Engineering Lessons About Art and Vice Versa

As an undergraduate art student, I had transferred from the Université des Sciences Humaines de Strasbourg, whose art program had not much more than tables and chairs, to Queen's University in Kingston… where I had learned to be unable to make my work without access to a Hunter-Penrose flatbed offset handpress, a singularly heavy, expensive, delicate, very specialized, and very rare piece of obsolete printing equipment. Setting up my own studio was out of the question, and the choice of graduate programs boiled down to… one. Since then, I have seen any number of teaching facilities (the old glass studio at the Ontario College of Art, the AtLAS Center in Boulder, the Dolan recording studio at NYU) that seemed to provide for either narrow or unlikely career outcomes for graduates.

For an interdisciplinary digital media program to make any sense, the matching of tools and overhead to goals and resources would actually have to be a clear and iterative component of the research and teaching programs. Students with ambitions to start up their own creative practice independently would need not only the experience of a set of tools they could realistically expect to get their hands on while dealing with student loans and New York City rents; they would need the critical–technical skills to make the most of new gear and capabilities indefinitely, or find themselves confined to job opportunities that might not even exist in 5 years. Any serious technical foundation would be, of necessity, provisional.

I had taught my first class in a computer lab provided with twenty iMacs net booting from an Apple G3 tower under a desk at the back, hardwired over a never-quite-completed LAN installed at the behest of the department the same year the school put in Wi-Fi, while students were required to lease a more powerful school-issued laptop with a different operating system and the wrong software for $4,000. If you're thinking this was some kind of Humanities Department stupidity, the

Computer Science department's server room then ran all its racks from the wall outlets provided for janitorial use, in a room with a 200-amp panel (most of which had not been connected at all).

While the physical plant and the business operation were a mess, "Poly" at that time had a rare and precious set of assets that every academic I know would envy: a grand total of ten department heads and one provost to deal with, who were generally on speaking terms with one another and universally committed to the integrity of their service to their respective fields and the students. While the mystique of engineers as dour but rigorous in practical matters had subsided somewhat by the time I got to his office to semiofficially pitch the idea that Poly should have an art and design program, I was very much in awe of ret. Colonel Fletcher "Bud" Griffis, a civil engineer with a long and distinguished record of which I vaguely knew tiny snippets: "West Point," "Poisson Variables," and "four-dimensional modeling for construction management applications."

As I remember it, I was about a paragraph into my pitch when he stopped me with the following, delivered in exactly what I imagine to be a very West Point tone: "God-DAMN IT, son, I've been waiting TWENTY-FIVE YEARS for someone to GET UP THE NERVE to take RESPONSIBILITY for MAKING THIS HAPPEN [pause]. When can you start?"

So much for my particular stereotype of engineering culture! In fact, Bud Griffis' interest in the proposed digital media program was mature before I got to him, in the sense that he had already thought through reasons for supporting the idea: as a researcher and practitioner working with Building Information Models (BIM), he was already working with the same kind of data-driven design and interactive 3D technologies we intended to build new programs of teaching and research around. As provost, he was professionally interested in enriching the curriculum with nonengineering-yet-allied fields and in augmenting the institutional culture with some explicit engagement of creative ones in particular. He was also an amateur painter.

I mention this last detail as relevant to the history of the Betaville project's progress because it turned out not to be atypical. When word got around that there was to be an *art* program at the Polytechnic and that I was to lead it, a pattern emerged of faculty and staff "coming out" to me as hitherto "closeted creatives"—taking me aside to show me their photos or paintings or offering whatever help I might need for components of the program for which their specialty or authority could be of help.

The relatively awkward status of art and engineering fields within academic culture is consistent with a more fundamental compatibility at the level of praxis. Engineering as "Applied Science" makes the same kind of sense as multimedia installation art as "Fine Art." The grand equations of physics are expressed as a particular and real building or bridge; an algorithm is expressed, but also finds its value, in the subjective quality of the forms to which it gives rise. The necessary skills are similar.

This affinity is urgently convenient, insofar as interactive digital media networks now add up to a shared "world," both between the cognizant disciplines and in the broader culture, including the public sphere.

2.4 A Sample of Congruence: Art, Architecture, Planning, and Software

2.4.1 Art

The transition described by Nake (Nake 2012) from analytical to generative modes of the first generation of "Information Aesthetics" in the 1960s and 1970s eventually settled into a very broad range praxis of algorithmic composition practices: the artist would set parameters with initial inputs and degrees of variability, essentially automating a process of form generation; while this process may have altered the status of individual compositions from things created directly by the artist to the lesser status of performances or products of a more or less complex and variable *procedure*, the value or "aura" of the work was not so much lost as transferred to its underlying/driving logic, shifting the role of the artist from *creator* to *designer* of the work of art. Thus, the process of perception of the work presupposes it to be in some sense a passive outcome of a process whose agency had moved up the concept chain from execution (handled by precisely obedient mechanisms) to rule setting or rather rule building (the work is received as one of any number of possible outcomes of a set of procedures whose generative power and structure are to be inferred through thoughtful viewing). While the individual work may suffer the loss of its traditional status as a unique artifact within this situation, it does so in favor of the status of the *medium*. Rather than creating a work of art, the artist defines logic and parameters according to which a work can now compose and perform itself, automatically, within a likewise artist-defined range of variability in overall structure and fine detail.

The art object, in this situation, is actually invented by defining its logic and parameters, in a strange scrambling of the traditional relationship between artist, critic, and audience: the composer composes by an analytical process of definition of the work *as* its synthesis, leaving to the critic and spectator a *second* analytical role inferring and evaluating the underlying logic as expressed by the means of automated generation of at least the score, but just as readily the "work" itself, as *output*. Every end product of the composition is now more like an artist's proof, in the sense of a printmaker's test print for evaluation of the plate or master for an edition, but also a proof of concept for the productive quality of the composition, as the generative definition of a class of outputs.

The work of art exchanges its status as a unique object, as its purpose or meaning shifts to representation of the class of objects to which it belongs, for a new value: artist and viewers invest less in objects and more in what Iannis Xenakis called the "logical structures" of works of art (Xenakis 1964), whether visual, acoustic, spatial, contemporary, or traditional.

This kind of work by Nake and others has been under ongoing development since the 1960s, concurrently with the digitization of fields as diverse as cartography (Geographic Information Systems), CAD, digital animation, video, and music production/postproduction. As networked microcomputers have become a de facto common medium for the conduct of the day-to-day business in all of these domains, their interconnectedness promotes convergences of practice.

2.4.2 Architecture

Architects currently design with software tools capable of providing at least general information about the physical requirements and performance of the structures they propose for construction. To the extent that a CAD program like Autodesk Revit or Digital Project is designed to automatically set appropriate dimensions for structural elements, or predict the thermal insulation value of a particular wall, it is actually a *simulation* environment, rather than a drafting tool.

Engelbart's framework for the "augmentation of human intellect" had proposed online sharing of computing power by elite groups as an approach to providing for the ability to solve complex problems, both by aggregating individual intellectual capacities and by putting massive computational power at the disposal of engineering teams. The embedding of simulation capabilities in architectural design software (or other authoring tools) provides for a new order of simulation: a synthetic mode, in which the constructed object (whether a building, sculpture, or urban-scale system) is a kind of simulacrum in reverse: a "performance" or copy of the optimized form of a complex virtual system, representing an original or actual form *before the fact*.

2.4.3 Planning

Urban planning, unlike the arts, is traditionally identified with algorithmic composition—proceeding by the formalization of goals, in the service of which rule sets are defined to direct private and public investment. As the stakes and the variety of stakeholders with a claim on the outcome escalate from the work of art to the individual building to the city, so do the legal and political checks and balances.

In a smart city (Singer 2012), day-to-day operations can be optimized in real time: Traffic lights and direction can be instantly reconfigured to provide for alternate routes, services can be redeployed across a whole system to allow for daily cycles of change in need or sudden emergencies, and the lights can turn themselves off if no one is in the office.

In a New Soft City, the ongoing development of plans for particular neighborhoods and regions can synthesize any number of performance requirements; but might they not also provide for an ongoing and active process of capacity development and engagement among a broader pool of stakeholders than politicians, planners, architects, and engineers? If the form of the city provides the aesthetic, symbolic, as well as technical conditions for urban life, is it not a massively public work both of art and service?

In urban planning terms, this is not actually a novel question. Since Paul Waddell first offered UrbanSim as a prototype open-source urban simulation system in 1998 (Waddell 2000), it has evolved to provide a variety of types and scales of simulation, down to the level of individual agents and "walking scale," i.e., the limit of relevance of a tool whose graphic representations are in the form of 2D maps.

2.4.4 Software

The consistency and rigor with which the UrbanSim initiative has approached public participation might surprise scientists and engineers familiar with physical system simulation environments built with similar tools. In *Laying the Foundations for Public Participation and Value Advocacy*: *Interaction Design for a Large Scale Urban Simulation* (Friedman et al. 2008:311), a group of researchers affiliated with the project since its early days discusses in detail the process of designing a simulation system of the complexity required to competently address planning factors that is also competent to address human values, to provide for a planning tool which is *legitimate*. While primarily focused on engagement of a broad range of stakeholders in defining performance indicators for the simulation, it also refers to the associated issue of interaction design for the application itself: they predict the "legitimation potential" of the simulation tool in terms of stakeholder assessments of "(1) coherence, (2) informativeness, (3) usefulness for supporting diverse opinions, (4) usefulness for advocating for certain views and values, and (5) usefulness for supporting the democratic process."

This may seem absurd as a set of performance requirements for a mathematical simulation tool—how can anyone be expected to adequately quantify the term "usefulness for supporting the democratic process" to the point where a working piece of software can actually be built to meet it, as a functional specification? Worse (or crazier) still, the legitimation potential rests not with a qualified expert but subjective assessment by participants, i.e., *non*-experts.

However, a software tool that purports to support the development of cities in democratic societies, cities whose overall quality (not just efficiency) as human environments IS the actual software performance requirement, implicitly claims to be at the service of citizens. A software platform that proposes to serve as an intrinsic part of those cities implicitly accepts this difficult assignment, on terms analogous to those implicitly accepted by architects, planners, and civil engineers as they undertake alterations to the physical world….

2.5 The Multiple *Auteur*: Social Sculpture Meets Distributed Design Online

The concept of an "auteur" comes out of film theory, specifically originating in François Truffaut's essay *Une Certain Tendance du Cinéma Français* (Truffaut 1954), in which he laid out the idea that a film director could work as an "auteur de films" (author of films), whose personal and distinctive vision could control and inflect every aspect of a film, from story to lighting, casting, editing, and thereby creating a film with the same degree of individual creative authorship as that understood to be undertaken by a writer working alone, notwithstanding the essentially industrial character of the film production process.

When Joseph Beuys created *7000 Eichen—Stadtverwaldung statt Stadtverwaltung* (7000 Oaks—City Forestation Instead of City Administration) for Documenta 7 in 1982 (Hulbusch 1984), he set out very deliberately to produce a "social sculpture," a manipulation of existing institutions, markets, and genres of art-making intended to culminate in a large-scale alteration of public space. Seven thousand local basalt stones, each of a characteristic roughly hexagonal section and about 6 ft long, were dumped at the fair, in a parody of minimalist and "earth art" genres then current on the museum circuit. The pile was not for sale, but a stone could be acquired for free by anyone willing to plant an oak and the stone in the ground next to it. A row of street trees in the Chelsea gallery district near my house has these stones, through local sponsorship by the Dia Art Foundation. This was sculpture to the extent that the artist was creating a situation, shaping a collective action by closely defining and directing the form and terms of participation by citizens and third-party organizations to produce both a coordinated action and a physical result in the world, a new arrangement of living (tree) and nonliving (stone) forms. A *fully* collaborative social sculpture in which multiple artists are actively engaged in defining the work, rather than all but one following a scripted procedure, would be another genre altogether.

Subsequently, many artists have worked within the general framework of what Nicolas Bourriaud (Bourriaud 2002) calls "relational art," i.e., works intended to produce or provoke new social processes and situations. In fact, some network-based art practices have been tending in this direction for a while. Curator Christiane Paul has clearly articulated the positive affinity between "media" and "public" genres in/as contemporary art:

> Networked new media art existing in the public space of networks—be it internet art or art involving mobile media such as cell phones and PDAs—can be understood as a new form of public art. Compared to more traditional forms of public art practice, Internet art, which is accessible from the privacy of one's home, introduces a shift from the site-specific to the global, collapses boundaries between the private and public, and exists in a distributed nonlocal space. As opposed to public art in physical space, artworks in the public space of networks are largely not regulated and sponsored by the government but often develop their own systems of governance. (Christiane Paul, *Digital Art/Public Art*: *Governance and Agency in the Networked Commons* First Monday 2005)

This aligns with Douglas Engelbart's Framework for Augmenting Human Intellect in a very particular way: where Engelbart envisioned an approach to engineering problem-solving that amounted to connecting really smart people's minds together via a shared computer, using expert-friendly (tricky to learn but powerful and efficient for trained users, like a church organ or jet cockpit) interface, the possibility emerges of augmenting creative media simply by virtue of the fact that they are now practiced with more evolved forms of Engelbart's "architecture." Now that real-time distributed creative collaboration in 3D virtual worlds is no more esoteric than Second Life and Minecraft, Innes and Booher's community of inquiry brought together to solve a local planning problem might foreseeably meet and work 24/7, bringing in outside experts or broadcasting its ideas about how an area might be changed for the better without the logistics or costs associated with lots of in-person

meetings. More and more of the citizenry can be more and more of the many-headed auteur of the city: as visions and collective will evolve, so may the built environment: community *as* self-creator.

2.6 Are We There Yet? Mirror and Virtual Worlds

Speaking of architecture…

David Gelernter predicted Mirror Worlds as an infrastructure for public information and participation, 3D graphic representations in which citizens would eventually find public information resources, and a vehicle for participation in debate:

> The *software* model of your city, once it's set up, will be available (like a public park) to however many people are interested, hundreds or thousands or millions at the same time. It will show each visitor exactly what he wants to see—it will sustain a million different views, a million different focuses on the same city simultaneously. Each visitor will zoom in and pan around and roam through the model as he chooses, at whatever pace and level of detail he likes. On departing, he will leave a bevy of software alter-egos behind, to keep tabs on whatever interests him. perhaps most important, the software model can remember its own history in perfect detail; and can reminisce pointedly whenever it is asked. And everything is up to date, to the millisecond.
>
> Such models, such *Mirror Worlds*, promise to be powerful, fascinating, and gigantic in their implications. They are scientific viewing tools—microscopes, telescopes—focused not on the hugely large or small, but on the *human-scale* social world of organizations, institutions and machines; promising that same vast *microscopic* increase in depth, sharpness and clarity of vision. Such Mirror Worlds don't exist, yet. But most of the necessary components have been designed, built and separately test-fired, and we are now entering the assembly stages that will produce complete (albeit small-scale) prototypes. The intellectual content, the *social* implications of these software gizmos make them far too important to be left in the hands of the computer sciencearchy. (David Gelernter, *Mirror Worlds*: *or the Day Software Puts the UNiverse in a Shoebox… How It Will Work*, *and What It Will Mean* 1993:5)

Gelernter did not, however, predict the possibility of using those graphical environments as a vehicle for proposing or developing ideas for *alterations* to the world being mirrored…. Rather than a living lab, the experimental phase of urban "development" might be a socially created artwork, altering the mirror world as a newly possible creative experimental phase of a key class of urban deliberation, debates about physical change to the real city.

Changes to the urban fabric share characteristics with new software applications, whether at the relatively small scale of a new public sculpture or the larger scales of buildings, parks, roads, or entire districts. In many cases, public/end-user participation is typically undertaken as a formal requirement of the planning approval process, unfortunately quite typically at the *tail end* of an arduous and expensive commercial or public-sector enterprise (Al-Kodmany 2001). Even in cases where full community engagement is desired by proponents, the perceived technical requirements and the financial burden of current tools and practices to support interactive mirror worlds for participatory planning and design may limit expectations

(O'Coill and Doughty 2004). Architects, urban designers, and planners are not, as a matter of course, virtual reality software engineers.

It is also true that the technical capabilities of software and of the expanding network of personal computers have evolved rapidly since the first recorded participatory software design project was undertaken at the behest of a Norwegian Metalworkers' Union in 1970 (Ehn 1993). Concurrently, the tremendous commercial success of computer games for entertainment has stimulated not only the spread of powerful networked graphics computing to the mass consumer level and consequently a pool of young people skilled in the navigation and manipulation of complex virtual environments. Among those young people, many with creative and programming talent have ambitions as game designers and developers. Have conditions changed to the point where fuller creative, critical, and technical participation in the means of development of new plans is practicable and potentially effective? How can we find out what more needs to be in place? Which approach offers the best likelihood of success for the long term? What might we be putting at risk in testing the potential? How can government contribute most effectively to broader participation through online "public development environments," making the most of existing abilities and desires while helping to ensure that the integrity of the public process is safeguarded and developed?

Gelernter's Mirror Worlds have yet to be taken up by the public sector as open data browsers *OR* immersive forums for citizen deliberation and debate, although aspects of his schema show up in the private sector: navigable model of the real world as browser—Google Earth; avatar-based social interaction in editable "virtual worlds" where users can dig, plant, build, and negotiate—Second Life, SimCity, ActiveWorlds, and Minecraft.

In the passage quoted above, Gelernter made the claim in 1993 that "most of the necessary components have been designed, built, and separately test-fired" for Mirror Worlds as he conceived them. By 2008, we found the same to be true for Betaville: all of the necessary software functionalities were already available, ready to be brought together–not only to provide current information through a recognizable and interactive online "world" but also to support the presentation of at least schematic representations of proposed changes and additions to that world in a qualitatively meaningful context. The technical ability to host an iterative asynchronous cycle of proposals, comments, and discussion at low-enough cost, and using widely enough distributed skills and infrastructure, could indeed support new levels of citizen engagement, participation, and robust innovation.

The ready availability of Betaville might change any number of games—from unequal competitions between expert and stakeholder groups to providing accessible and effective working environments that might extend the logic of Peirce and Dewey's communities of inquiry and Lave and Wenger's communities of practice to something like communities of design—shared creative-solution spaces that could be set up as easily as any other simple web service or to be as powerful as the best of the current distributed collaborative design platforms.

2.7 Coincidence or Convergence? Participatory Design in the Computerized Workplace and Online Role Play Worlds

By 1998, Kensing and Blomberg (Kensing and Jeanette 1998) could retrospectively study a broad range of participatory design initiatives and provide a set of general guidelines for success:

Clement and Van den Besselaar (1993) in a review of ten PD projects in the 1970s and the 1980s reiterate three basic requirements for participation outlined by Kensing (1983:223): (1) access to relevant information, (2) the possibility for taking an independent position on the problems, and (3) participation in decision-making. They add two additional requirements: (4) the availability of appropriate participatory development methods and (5) room for alternative technical and/or organizational arrangements. The participation of the intended users in technology design is seen as one of the preconditions for good design.

During the same period, Chip Morningstar and Randy Farmer built and operated Lucasfilm's Habitat, the first graphically based online role-playing game. During Habitat's pilot run from June 1986 to May 1988, Morningstar and Farmer's world-management approach shifted substantially from prescripting in-world activities to supporting emergent ones:

> …we shifted into a style of operations in which we let the players themselves drive the direction of the design. This proved far more effective. Instead of trying to push the community in the direction we thought it should go, an exercise rather like herding mice, we tried to observe what people were doing and aid them in it. We became facilitators as much as designers and implementors. (Chip Morningstar & Randall Farmer, *The Lessons of Lucasfilm's Habitat* 1990:289)

Since then, "God Games" like SimCity and Civilizations, in which players design and manage urban-esque systems over time as pure recreation, have enjoyed huge commercial success, and indeed playing them may have occupied the equivalent of thousands of entire human lives. In this light, adapting such games to prosocial/constructive outcomes seems like an idea worth investing in.

The increasing complexity of urban development and infrastructure issues calls for improved communication and cooperation between sectors: cultural, civil, government, and commercial. Current software tools for urban planning are optimized for the workflow from design to engineering, but not particularly for vital exchange with nontechnical stakeholders through a mature design and deliberation process.

At the point at which the threshold of access to such authoring tools, both in terms of their use and their distribution, collaborative development, and advocacy, gets as low in people's minds as it has become in technical terms, it becomes normal for cities to be reimagined day in and day out by the people who live there. If a user-generated TV network is possible (YouTube), why not a user-generated city? How could this not be fundamental to the concept and practice of citizenship?

Beth Noveck puts this problem directly, but still in terms of a gap in the practice of public participation:

> While, it turns out, that individuals are good at critiquing or saying "no" to a suggestion, more effective tools allow them to make nuanced, positive proposals. Reactive, push–button voting on the ideas of attenuated representatives does less to foster engagement than taking action for oneself about school policy, workplace management or urban planning. (Beth Noveck, *A Democracy of Groups* First Monday vol.10, n.11 2005)

This gap is precisely the space that Betaville proposes to open: an online environment in which the primary mode of participation is iterative proposal-making, within a virtual space that is accessible, intelligible, and open to evolution as a vehicle for the further development of new ideas, rather than after-the-fact "public comment" or the take-this-leave-that dynamics of voting on *finished* schemes by a small number of design firms.

Peter Weibel, in *The Concept of Culture* (Weibel 2006:124), offers a useful conceptual kernel: "In a situation in which there is overlap between our culture and a foreign culture, interculturality rising from the accumulated characteristics of both cultures can develop and thrive." Why not extend this quite simply to the level of subcultures: state, market, and civil? "Participation" *by* the cultural sector is another simple move: recognize its mandate and legitimacy as an interzone between the three "fixed" ones.

We do our best to recognize that in a metropolitan culture, this level of interculturality is a priori also going to map on a tangent plane to the more usual definition of "intercultural": multiple languages, tribes, social classes, religious affiliations… in extremis, it might even be useful to treat certain agencies within the mainstream as legitimately culturally distinct and see if that helps: Cultural Affairs, Department of Transportation, and Neighborhood Association.

Moving from the concept of an individual artist through the model of elite teams to the (at least technical) possibility of a blended-reality Agora to a self-creative community would be, in principle, the next evolutionary step, or simply the full use of a new form of shared creative space, safer than the so-called living lab of the city itself—as something on which one might legitimately experiment from the outside, without directly betting a community on it, and as something from within which one might safely imagine and discuss improvement with the support of expert third-party guidance.

A design proposal could be offered, taken up, challenged, tinkered with, combined with others, disseminated, refined, dropped, or campaigned for in Betaville until it became robust as a practical proposition and a coalition of stakeholders and allies to back it up as it migrated to the tangible world of urban art, design, planning, and construction. New ideas could be built and tested and developed in tandem with new levels of participation and new coalitions to play them through… although "play" may not be quite the right term:

> Virtual Worlds, in all their visual, textual, spatial, coded, and theatrical aspects, are clearly expressive works of art. (F. Gregory Latowska & Dan Hunter, *The Laws of the Virtual Worlds* California Law Review January 2004:61)

Betaville, as a working synthesis of the existing smart mapping of Geographic Information Survey (GIS), community-scale distributed 3D design environment, and multiplayer online creative play space infrastructures already current, was clearly *possible*. We could clearly foresee a New Soft City one of whose public domains could provide for the kind of collaborative participation in future-making at the local level would provide for citizen knowledge-building as well as informal development of concepts that would always be available as a resource for potential proponents and a vehicle for consensus-building… but could we make it look obvious, *normal*, to a critical mass of users, with the right combination of high ease of use, low operational overhead, and extensibility?

2.8 Users, Developers, Citizens, and Gods

Morningstar and Farmer advocated for an open approach to virtual world design that would privilege users as a varied group, but cumulatively an active partner in the ongoing development of the world and its situations, approaching Richard Bartle's more explicitly political "cooperative of Gods" (Bartle 2006), in which users are developers in their own right.

This is not anarchy by any means or even strictly speaking a democracy, insofar as the originator–coordinator always ultimately decides which ideas are in, and which are out, subject eventually, of course, to the willingness of end user–codevelopers to opt in over time. Whether this originator–coordinator governance is undertaken as service (facilitation) or power (dictatorship) may ultimately be more a matter of how personalities mix than ideology per se.

These relationships between hosts, developers, and end-users map reasonably well onto the possibility of an editable mirror world at a neighborhood or urban scale, through which virtualization of "real" cities and districts might enable more open design/planning/governance approaches over time.

The concept of a Cooperative of Gods also opens up an approach to relationships between people who come up with ideas and people who develop them into mature components of the cultural domain…. If the measure of an avant-garde is its systemic impact on the terms of individual experience and social space, might Douglas Engelbart and Alan Kay turn out to have been more radical and successful artists than Joseph Beuys and Andy Warhol? The democratization of access to powerful computers capable of processing complex 3D graphics in real time and exchanging oodles of data with universities, governments, each other, and Google represents a transformation of the fact and potential of human "space" beyond the visions of the constructivists, the Bauhaus, Robert Moses, Jane Jacobs, Joseph Beuys, William Mitchell, or William Gibson.

Art historians and cultural anthropologists may well discuss this or that clique as "the last avant-garde": the constructivists, the Bauhaus, the Situationist International, and the Sex Pistols. If culturally transformative innovation defines an avant-garde, the avant-garde has been mostly engineers and industrialists for the last few decades, albeit with a mixed record in regard to accepting responsibility for the human

effects. Raoul Vaneigem may have written about the "Revolution of Everyday Life" at a theoretical level, but Hewlett and Packard and Gates and Jobs have worked more successfully to impose it at a practical one.

The concept of "design patterns" for software development derives from the work of Christopher Alexander, an architect and design theorist who set out to provide a pattern language or grammar for building and urban design. In 1996, he was invited to give a lecture to computer scientists at the ACM conference on Object-Oriented Programs, Systems, Languages, and Applications (OOPSLA) in San Jose. Addressing his ACM audience, Alexander set out to raise the quality assurance bar:

> If there really is a way of looking at structures which both deals with real functional structure in the ordinary technical and practical sense, and simultaneously has its roots in human feeling, there will be a very huge and positive step. (Christopher Alexander, *The Origins of Pattern Theory*, *The Future of the Theory*, *and the Generation of a Living World* (1996))

He went on to enjoin software developers and computer scientists to develop software design patterns as a generative grammar for software that would—as an *architecture*—help "shape the world" for the better. "…you must realize the extent to which the world is gradually now being shaped more and more, indirectly by the efforts of all of you…." The idea of design patterns for houses and towns whose form directly supports and promotes sustainable human well-being and civil society may not map particularly well onto software engineering in daily practice, but better at other levels: embodying and supporting the development of creative and civil online public spaces designed to offer the fullest possible access to public information, opportunities for individual and collective self-skilling, designing public information resources to the extent possible as "white boxes" so users can find and assess not only the presented "information" but also the underlying data, its provenance, and the mathematical models used to draw conclusions (or interactive graphics)… and, of course, a generation of transitional applications for nonnative speakers of machine-readable public data. Using an interactive virtual representation of a familiar physical environment to present new information, or providing opportunities for constructive multimedia social discourse as a virtual mode of engagement, might structurally promote creative civility, while directly enabling its orientation to the physical city itself as a "public beta": a version of the built environment, as in software, that's working well enough for adventurous users who might contribute effectively to its improvement, but not yet (in a physical city, really ever) final.

2.9 The Deep History of Betaville Technologies: From Renaissance Perspective to Distributed 3D Authoring

Like any contemporary interactive graphic technology, Betaville was conceivable and constructible, thanks to prior art, as a new synthesis of existing technologies. Some of those technologies are informatic in the computational sense of the term, and others better understood as technologies of representation and processing of quantitative and qualitative information.

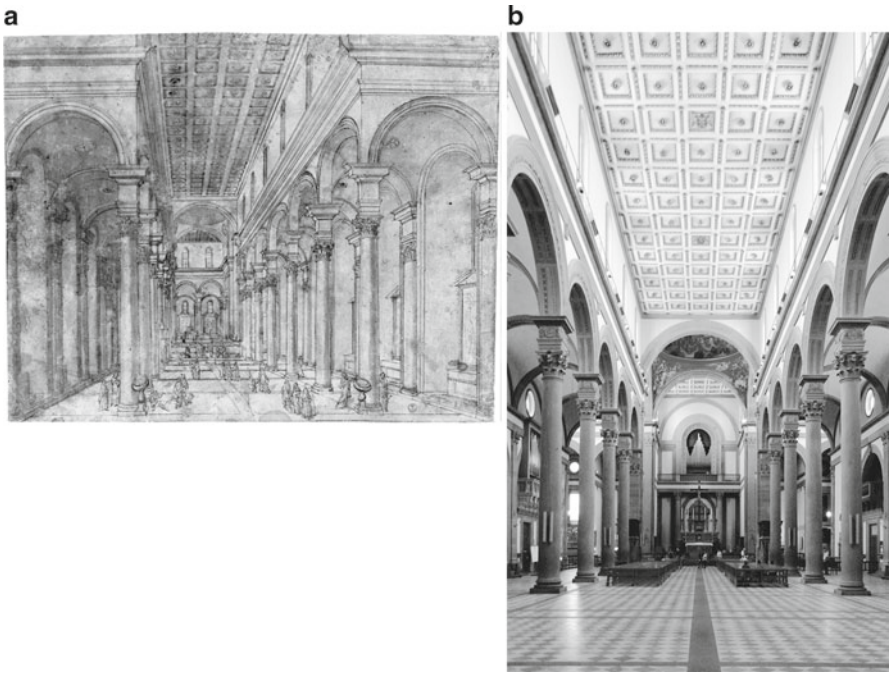

Fig. 2.1 (**a**) Perspective rendering of Santo Spirito interior, sixteenth-century (anonymous) collection Uffizi, Florence. (**b**) Filippo Brunelleschi Nave and choir of the church of Santo Spirito, Florence 1,428–1,487

2.9.1 Perspective

The history of the invention (or reinvention) of geometric perspective drawing in Renaissance Florence is hazy in its details. The extent to which goldsmith–sculptor–architect–engineer Filippo Brunelleschi actually used perspective renderings of proposed designs to explain his ideas to prospective clients, and to which he actually worked out a complete system of foreshortening based on the experiments described by his semi-contemporary biographer Antonio Manetti (Manetti 1970:44–46), is not fully documented. The extant rendering in the Uffizi collection of the interior of Brunelleschi's church of Santo Spirito is unattributed and dated to the sixteenth century (well after Brunelleschi's death and the completion of the building itself) (Fig. 2.1a).

By the end of the fifteenth century, however, it is clear that the development of optical/geometric perspective provided both a tool for illusionistic representations of physical architecture relating directly to dimensionally accurate plans and elevations and the means to construct persuasive renderings of *fictional* built environments, like the Città Ideale (Ideal City) panel of ca. 1480, seamlessly and coherently combining depictions based on existing structures like the baptistery in Florence and the Roman Colosseum within an idealized arrangement of public space.

Fig. 2.2 Fra Carnevale *Città Ideale* 1480–1484 oil/tempera on panel, collection Walters Art Museum, Baltimore

Variations on the math used by Brunelleschi, Alberti, and others to achieve this have been elaborated since and constitute the common underlying logic not only of illusionistic painting but also of 3D graphics authoring and rendering software from AutoCAD on an architect's workstation to Grand Theft Auto on the laptop computer of a teenager who ought be doing his or her math homework. Perspective provides a common visual language and coherent abstraction of space for very different orders of representation of buildings and spaces: equally correct perspective renderings can be documentary (Fig. 2.1a), fictional (Fig. 2.2), propositional (Fig. 4.12), or speculative (Fig. 4.17).

2.9.2 Charts

Where perspective provides two-dimensional graphical representation of space and spatial relationships *as they would appear from a particular point of view in space*, charts display statistical information graphically in a very different way, using visual phenomena like proportion, relative placement, and color to *explain* relationships between facts: data visualization.

The contemporary vocabulary and grammar of data visualization developed somewhat later than perspective, but still well in advance of computers: William Playfair published his Statistical Breviary, featuring most of the now basic types—such as pie charts, bar charts, and timeline graphs—in 1801. In his Commercial and Political Atlas of 1786, he had already laid out the purpose and strategy for these kinds of visual presentations:

> Information, that is imperfectly acquired, is generally as imperfectly retained; and a man who has carefully investigated a printed table, finds, when done, that he has only a very faint and partial idea of what he has read; and that like a figure imprinted on sand, is soon totally erased and defaced. The amount of mercantile transactions in money, and of profit or loss, are capable of being so easily represented in drawing, as any part of space, or as the face of a country; though, til now, it has not been attempted. Upon that principle these Charts were made; and,

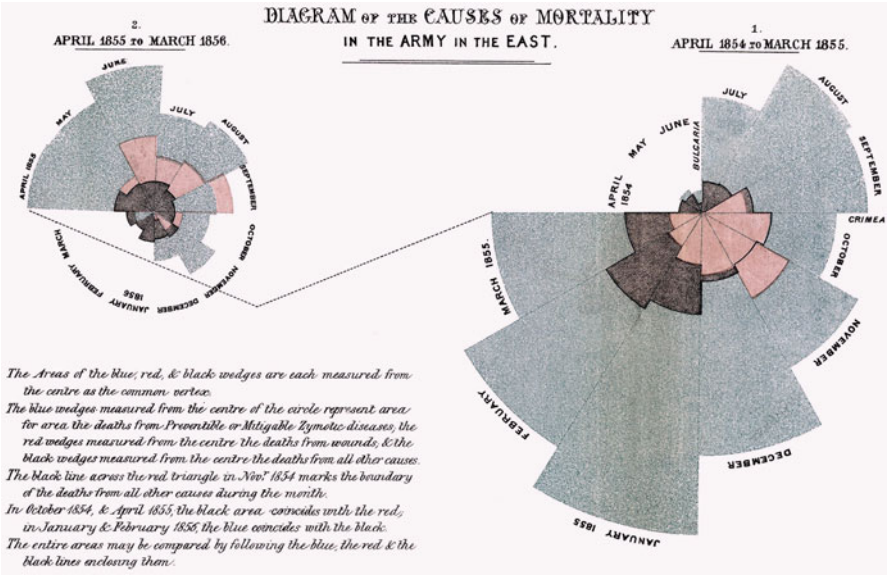

Fig. 2.3 Nightingale (1858). Diagram of the causes of mortality in the army in the East

> while they give a simple and distinct idea, they are as near perfect accuracy as is in any way useful. On inspecting any one of these Charts attentively, a sufficiently distinct impression will be made, to remain unimpaired for a considerable time, and the idea which does remain will be simple and complete, at once including the duration and the amount. (William Playfair, *The Commercial and Political Atlas*, *3rd Edition and Statistical Breviary* (1801:3–4))

By 1858, Florence Nightingale could use a complex variant, the polar area map, to chart causes of death in field hospitals in the Crimea (Fig. 2.3) for a dual purpose: both as an analytical tool and as a rhetorical one to advocate for change in the management of care. The key fact represented here is the dramatically higher incidence of death from "zymotic" (acute infectious) disease than from actual combat.

As the number, complexity, and variety of sources multiply, the need for effective and flexible visualization tools required to convert machine-readable raw *data* into human-intelligible *information* becomes more acute. In situations calling for the active engagement of citizens in informed decision-making, open data policies may only be as effective as the software available to make sense of statistical and other data resources, and in particular to grounding that information in a recognizable set of representations of the real world.

2.9.3 Maps

In the simplest terms, a map associates two dimensions of spatial distribution with data: political boundaries, names, types, etc. The particular map above, showing the old section of Tallinn, is an artifact of significant change. When I was there as a member of a cultural delegation from Toronto in October of 1988, it was actually

Fig. 2.4 Screenshot showing Tallinn old city in OpenStreetMap

illegal even for an Estonian to have an accurate street map of the city or for foreigners with cameras to be allowed in high places. Now, it's a simple matter of typing in a search term, thanks to openstreetmap.org, a worldwide effort to provide a complete, current, and freely available/usable street map of everywhere. Some of the information comes from large commercial databases and some from volunteers uploading from their own mobile devices in the field. The map, however, conveys no qualitative information about what it was like to be there (Fig. 2.4).

2.9.4 Geographic Information Systems

Maps and plans had already been in use as navigation, construction, and governance tools for centuries when Roger Tomlinson approached IBM in 1960 on behalf of a Canadian aerial survey company to develop digital survey maps. The idea here was that computers could automate data management and produce graphical renderings of specific categories of information (maps) on demand. Soon after, the Canada Land Inventory bureau was building out the Canada Geographic Information Survey (CGIS). The data stored this way from the 1960s to the 1990s was converted to current formats and is accessible online. The original CGIS work launched what has become an industry of GIS mapping. A variety of commercial and open-source software tools are available, each suited to particular combinations of technical know-how and purpose from topography, demographics, land use, and property data to regional planning and social justice advocacy.

2.9.5 Simulation

The term "simulation" is VERY often misused, even by professionals, that it needs disambiguation here. An illusionistic rendering of a building or city, even an interactive fly-through, is *not* a simulation unless the model is actually emulating something about how that building or city would function in the real world, beyond its appearance from particular points of view, based on a mathematical model of the building's functions and situation.

To build a simulation, first define a system (say, an economic region) as a set of mathematical properties and relationships, creating a "mathematical model" of it; second, define an initial set of conditions (parameters or arguments); and third, apply the model to those conditions. If your model is good and your inputs are appropriate, the simulation will effectively mimic a real system, providing useful predictions about how the modeled system might behave if you did build it. Newton defined a law of gravity, but also a "model" of it: an object near the surface of the Earth falls at an accelerating speed. The rate of acceleration is defined as 9.8 meters per second *per second*, i.e., that much faster every second than the second before; however, that acceleration is offset by a "drag coefficient," i.e., the increasing resistance of the air the falling object pushes aside on its way down; at the point at which the drag coefficient is equal to the rate of acceleration, the object stops accelerating, continuing to fall at a constant speed, i.e., terminal velocity, or until it reaches sir Isaac, whichever comes first. A computer simulation of this would be a piece of software in which the model is encoded, to predict the velocity of the apple at any given point in time after being dropped. The output of such a simulation can be, but isn't necessarily, presented graphically.

A flight simulator IS a simulation (both physical and graphical) because the virtual controls are programmed to mimic the behavior of the ones in a real plane, and the software calculates from user inputs how a real plane would react in real air, displaying the view through the imaginary windshield and instrument readings accordingly. The interface shows you what a real plane would do if you used those controls that way, based on a model of how the real machines respond in real space and time to analogous inputs by actual pilots.

Even an interactive fly-through model isn't really a simulation unless the model can emulate and therefore predict effects of wind, erosion, or building and land-use regulation or traffic patterns. The purchase/licensing cost of software to do some of these kinds of things has dropped dramatically, to the point where a student or fledgling firm can afford a piece of software that will do an LEED evaluation of a SketchUp Pro model, algorithmic form generation for Rhino 3D, or a an interactive online animated 3D model of a building's construction schedule, derived directly from the construction documents, which are actually a database…. This is already a requirement for major construction projects administered by the General Services Authority in the United States (GSA 2013).

UrbanSim extends the concept of GIS mapping from data visualization to simulation in 2D: if you have data about a region and a model of how urban systems

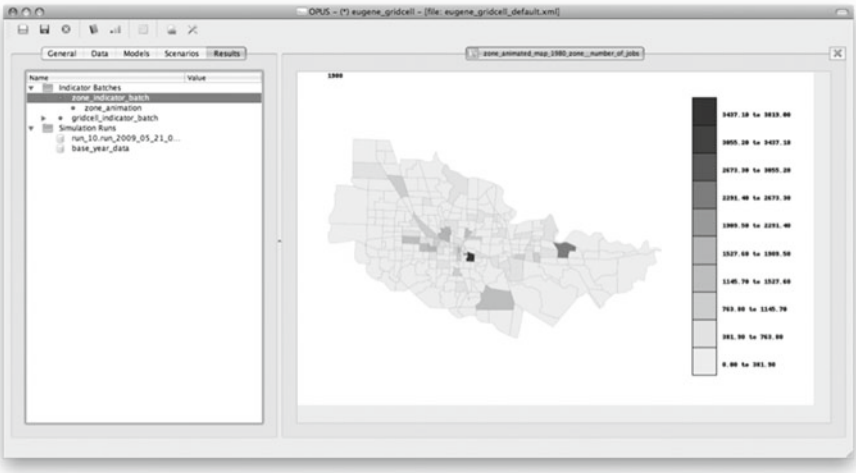

Fig. 2.5 The UrbanSim graphical user interface (courtesy P. Waddell)

evolve and respond to regulations and inputs over time, it becomes possible to predict the likely effects of particular combinations of change, and through experimentation with the simulation, to design combinations of regulations and policies to serve particular social and economic goals (Fig. 2.5).

The UrbanSim group has been integrating software engineering and human–computer interaction in the service of value-driven design: not only with a view to providing useful quantitative tools to professional experts but also to broaden participation in planning processes by helping to make planning issues and tools more accessible to citizens themselves, whose needs and aspirations are fundamental to the legitimacy and efficacy of leaders, agencies, and advocates.

There are multiple levels of accessibility. For the time being, UrbanSim provides most effectively for use by professional urban planners, who have not traditionally had good access to powerful computer simulation tools. To the extent that this makes it possible for those same planners to easily show the expected effects of particular policy or regulation changes to stakeholders in a workshop or other public consultation process, a new level of due diligence and feedback are made possible.

2.9.6 MapHub

Some of the software tools and datasets to build interactive GIS applications are as arcane, expensive, and difficult to use as one might expect from a field that grew out of a collaboration between IBM and a federal government agency. Others, however, are a viable proposition for a small research or advocacy group that might actually want or need these kinds of capabilities. Carl DiSalvo, Jeff Maki, and Nathan Martin

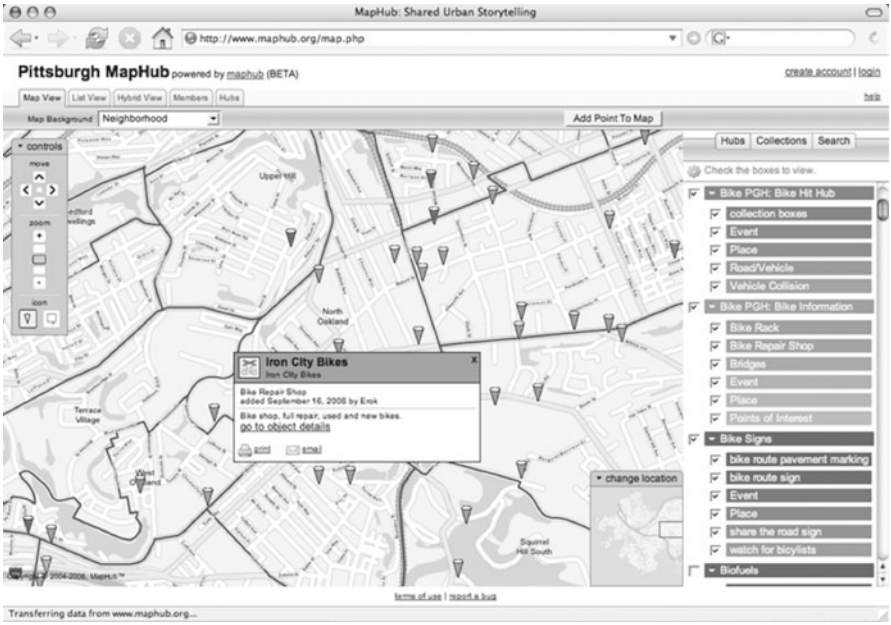

Fig. 2.6 The MapHub interface (courtesy C. DiSalvo)

developed MapHub as a GIS wiki for their own use in eliciting local stories at the STUDIO for Creative Inquiry in Pittsburgh in 2006. Individuals and groups can use MapHub in situations where the official GIS maps fail to account for the fine-grained and qualitative information that add up to the lived experience of a district, where local citizens find that municipal agencies' datasets are out of date or tendentious, or where a community feels that its members should have "read–write" access to information about their own neighborhood as a matter of course, without undertaking the expense of commercial systems or the steep learning curves of research-oriented platforms and frameworks (Fig. 2.6).

Democratization of access to mapping technology goes hand-in-hand with democratization of access to the underlying data. Whether those democratizations are accompanied by parallel development of the usability of the software for non-specialists and autodidacts will be equally crucial in determining whether the inclusiveness is genuine and effective.

The most fundamental limitation of 2D map-based tools is that they, like any architectural plan drawing or map, do not provide qualitative information. In dense urban contexts, where different types of land use or infrastructure may be stacked up on top of one another to great depths and heights, even the quantitative issues may not be intelligible to the most practiced eye. The UrbanSim researchers have more recently teamed up with a computer graphics group at Purdue to build a tool to address this UrbanVision.

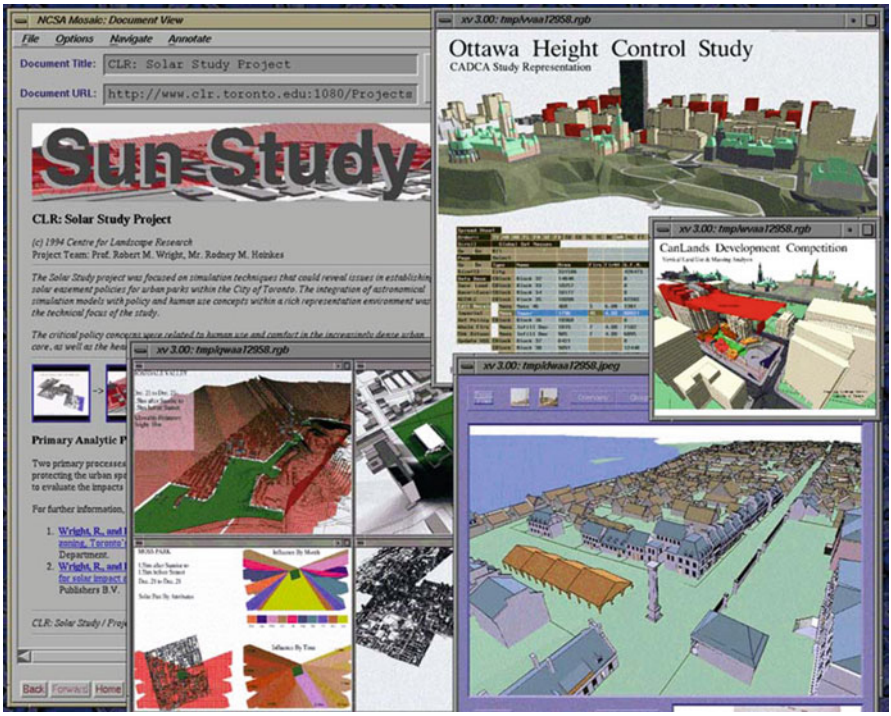

Fig. 2.7 PolyTRIM interface, 1994 (courtesy J. Danahy)

There's a particular class of use cases in which a 3D fly-through *is functionally* a simulation: a fly-through perspective rendering simulates the qualitative effects of an existing or proposed built environment—what will it be like to walk or bike or drive through it? What will the sightlines be like? Where will shadows be cast? How will it be different from what's there now or affect a human being's experience of what's there now? This is exactly the point-of-view construct of the first-person shooter game genre, in which a player moves through an architectural environment and sees what they would see if they were "really" there, plus their hand holding whatever weapon they have chosen to kill the next Ork, Mujahedin, or other foe. This is also, of course, the perspective from which Jane Jacobs advocated planning and design decisions be made, as urban life is lived: eyes on the street. A mirror world is the best place to see proposed new buildings will cast shadows over adjacent public and private property and how they will change sightlines and skylines. To the extent that these are functional attributes of the proposals and the shadowing can be properly defined from within the software they *simulate* (Fig. 2.7).

John Danahy and Robert Wright, at the Centre for Landscape Research (CLR) of the Daniels Faculty of Architecture and Urban Planning at the University of Toronto, have been building their own visualization/simulation tool, PolyTRIM, since 1985.

PolyTRIM is designed to provide a hybrid 3D visualization environment for GIS topographical and other data combined with models detailed enough for specific buildings to be recognizable, to support decision-making about things like building height restrictions in and adjacent to historic districts, but also to support community-based initiatives like the Lakeview Legacy Plan of 2006. PolyTRIM is not, at this point, optimized or intended for use by nonprofessionals, but it is designed to support urban planning and design work by broad working coalitions that can include any or all of the spectrum of stakeholders: government agencies, community groups, preservation advocates, commercial developers…. Bringing together dimensionally accurate models of sites, proposals, and solar orientation, with the ability to recognizably represent qualitative issues like sightlines and scale, provides for a fully "intelligent" shared ideation and design development space. PolyTRIM therefore aligns with the Habitat, rather than GNU/Linux, on the spectrum of God Games: the developer here acts as scribe and facilitator for users as content developers, but there is no attempt to provide for users as autonomous (software developers).

When the CLR was starting out in 1985, the required skill and tools were exotic: their SGI workstation cost $500,000. That was what you needed to do this kind of stuff at the time. Now, every one of John Danahy's students takes for granted a laptop with a more powerful graphics card and more processing power in general, not to mention teleconferencing on demand (Skype) and videoconferencing, free development tools for massively multiplayer online interactive graphics from the underlying physics to lighting effects tied to real-time hour, date, and weather conditions.

Michael Kwartler is another veteran developer–consultant; he founded and directs the Environmental Simulation Center (ESC) in New York City, a few blocks from where I write. Like John and Rob in Toronto, Michael has been doing this kind of thing since the days when graphics software development was a lot more arduous. Not only were the tools more expensive and less powerful, but an awful lot more had to be done from scratch. One of ESC's current projects is assisting a developer in meeting the requirements of the Visual Simulation Ordinance passed in late 2009 by the city of Glen Cove, Long Island, for development proposals beyond any one of several definitions of scale. Among the ordinance's requirements:

> Real-time animation—An immersive three-dimensional digital model of a place or environment which is dimensionally verifiable. It supports freedom of movement by the viewer by rendering the flow of images as the viewer moves freely though the virtual environment of the three-dimensional digital model. This permits a viewer to "walk through" a three-dimensional model at eye-level, look around and choose their own path or location to view a particular development action. All verifiable real-time animations must document the sources used to create the 3D model of existing and proposed conditions. (*Local Law No. 8–2009* The Code of the City of Glen Cove, NY (2009))

Part of the fun here is that the ESC has been retained to assist the proponent in meeting the letter and substance of a requirement that they helped write, at the behest of Glen Cove's mayor. Of course, the use of the term "simulation" in the ordinance can be confusing. There is no predictive mathematical model at work, only an interactive perspective rendering of a virtual model of the proposed

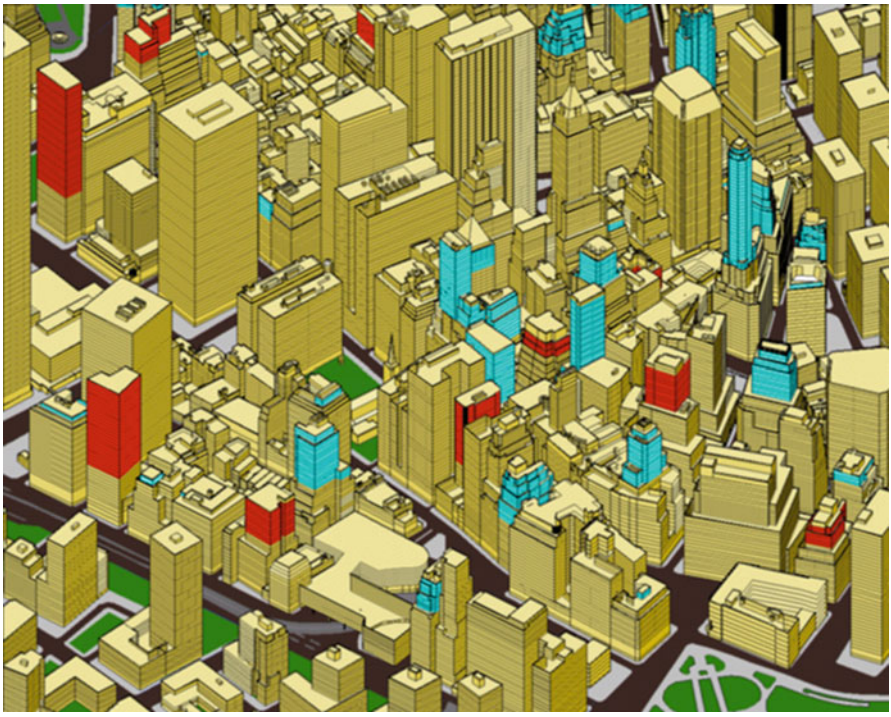

Fig. 2.8 Decision support for rezoning in the lower Manhattan financial district: perspective, data visualization, and simulation combined to support regulation redesign (courtesy M. Kwartler/ Environmental Simulation Center)

structures, as they will appear in context. For a true simulation, consider the ESC's Adaptive Reuse Study for lower Manhattan—the graphic is rendered in aerial perspective from an Oracle GIS database, containing floor-by-floor information about each building's size, shape, age, and vacancy rate. A user can set parameters to see how much of how many buildings might be suitable for residential rezoning, to help adapt the district to the fact that much of the New Soft Wall Street is relocating to the Internet (Fig. 2.8).

It's not just Wall Street. It's also City Hall and the marketplace. A lot of government services, including public information services, have also gone online, right down to their databases and public consultation mechanisms. The tools of the creative/tech entrepreneurs the city is working to attract to the neighborhood still eat and sleep in the flesh, but their tools have dematerialized and are co-mutating fast. CAD can now mean everything from virtual drafting to parametric modeling, project timeline audits, thermal performance simulation, direct control of fabrication machinery, and teams working together from anywhere they can get online.

Where Brunelleschi could derive a specific perspective geometrically from a set of plan and elevation drawings in the fifteenth century, fellow architect Frank

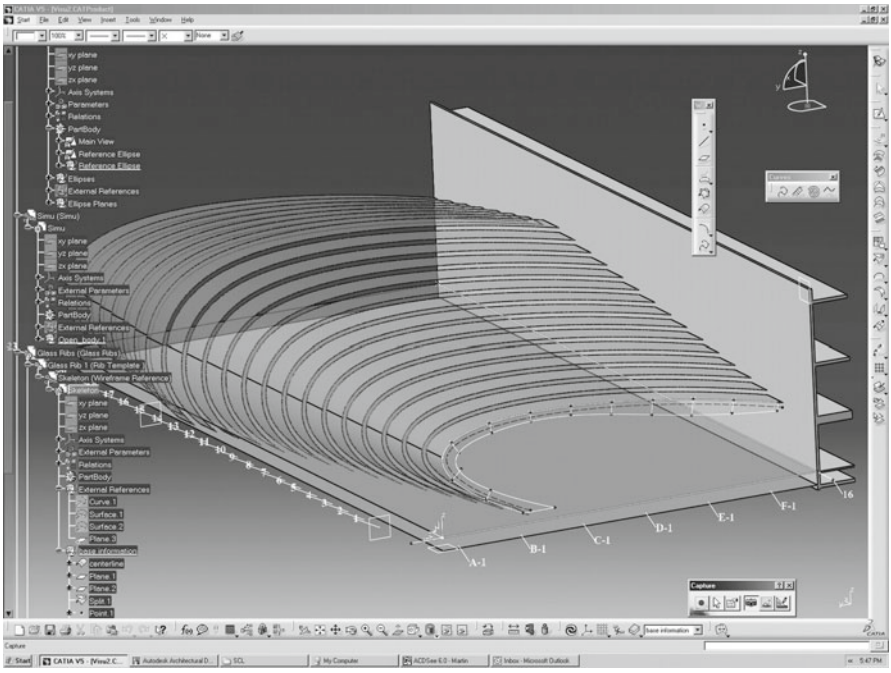

Fig. 2.9 Design for SCL Glass Headquarters Front Inc. 2004: detail in CATIA

Gehry's Digital Project software suite can derive cutting and bending instructions for metal-forming machines to create custom structural components to support free-form building envelopes, pre-visualizations of mechanical systems in place to spot and remedy "clashes," and beautifully rendered animations of any or all of it.

According to Martin Riese, who has worked with CATIA and Digital Project at Gehry and Front, this potential has yet to be fully exploited. If the software already knows what kinds of structures are required by particular sizes and shapes of space and you can tell it enough about how many people need to do what in there, how the sun and seasons will need to be mitigated, and the physical properties of the materials, it can automatically define and render technically valid designs for evaluation and further development, as demonstrated in the 2004 Front Inc. design for the SCL glass company's headquarters (Figs. 2.9 and 2.10):

This amounts to advocating that CAD software tools operate as simulation, rather than visualization or data storage environments—it's all about the quality of the analysis behind the design of the parameters and the quality and relevance of parameters to eventual built form. It's also ultimately going to be critically important that such tools make their assumptions and methods both obvious and malleable: if you can't tweak the priority level of a parameter in the determination of ultimate form and/or run variations, it's a safe bet that most of the design outcomes will be, at best, inappropriate to any particular real-world program. If, on the other

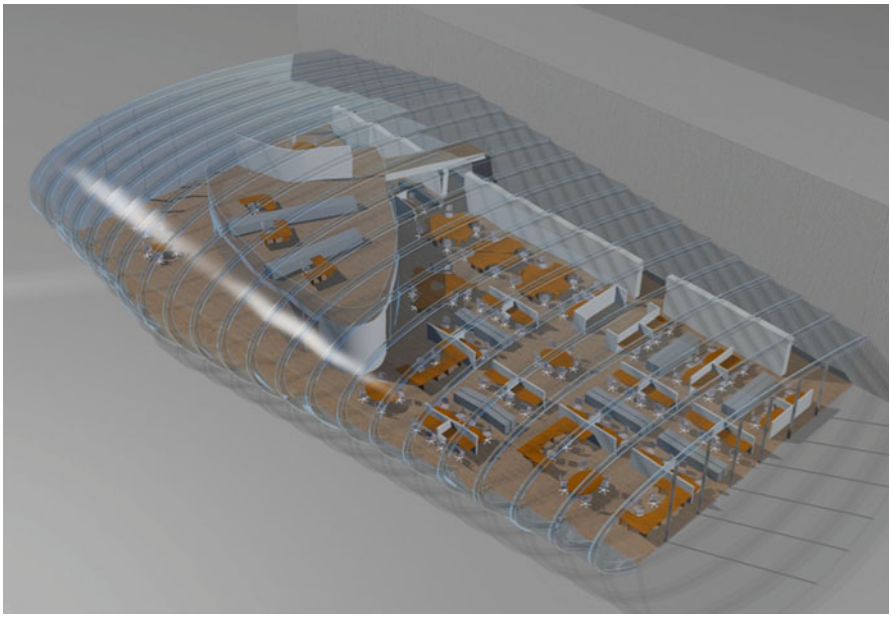

Fig. 2.10 Design for SCL Glass Headquarters Front Inc. 2004: rendering

hand, such tools provide the right kinds of explicitness and flexibility, they can make it possible to undertake new levels of innovation (by offering logical but unexpected configurations that directly answer novel requirements without preconceptions) and new levels of optimization at the outset of the design process.

The difference here isn't so much between professions or personalities as it is between two modes of parametric design: an environment in which the user directly manipulates forms, constrained by parameters which can include floor area as well as structural properties of materials, is called "passive" software; "active" software can actually develop forms automatically, based on a combination of general and user-defined requirements. In principle, these contrasting approaches can be combined or alternated according to the project.

While Gehry has been able to both adapt and extend specialized software tools from outside the domain of architectural CAD to provide for disciplined execution of out-of-the-box architectural forms, the Gehry practice represents a rare continuity from initial conceptual "sketch" development through to construction, with the help of tools built to suit that practice in particular. Contrast this with a world in which architects hand off fully articulated designs to structural and other engineers, the ensuing conflicts, not to mention change orders on the eventual construction site as unresolved discrepancies between exquisitely complex sets of instructions become obvious and urgent.

Gehry Technologies has gone some way to addressing the day-to-day issues presented by typical architecture–engineering–construction workflows with its recent

announcement of GTeam, which they are calling a "collaboration platform." Where Digital Project was a rather esoteric variant of architectural design software, with a steep and specialized learning curve, GTeam is a set of deceptively simple and familiar-looking web tools for project management: a file-sharing application that looks and works like a specialized variant of DropBox, but with more sophisticated user management and file browsing setups; a 3D model navigator that will be instantly easily usable by anyone who has ever built a 3D model, or even used Google Earth, with lots of automatic file format conversion in the background, so the folks making the presentation animations and the folks designing the building can actually use each other's work efficiently; and another application for tracking and auditing work packages that will make sense to anybody who can handle a Facebook page.

GTeam might seem like exactly the opposite of Digital Project: where one was esoteric (literally, rocket science for architects) and the other is congenial to every digital multimedia communications skill level, from student intern (usually high) to senior engineer (usually low). In fact, Digital Project and GTeam are components of a coherent effort to combine and adapt existing technological tools and practices from multiple domains, to make idiosyncratic specialized design realizable, through disciplined execution leveraging consumer-level informatic infrastructure and skills.

Buildings and cities are, and must become, ever-more-complex hybrid systems of data, energy, and material exchange just to maintain a reasonable approximation of their current form (this is what sustainability means), let alone evolve to new levels or entirely different orders of competence and quality (weirdly, there isn't a good word for this yet, since "progress" got wrecked by Mao Tse Tung, Robert Moses, and Madison Avenue). The complexity of the software and professional evolution on the horizon is already well under way. When we get to the point where architectural design is undertaken as a matter of course as an alteration to the local fabric, rather than as a freestanding object whose curtain wall radically isolates solid property from empty public "space," we'll be getting somewhere.

It's no coincidence that the term "high-performance architecture" is a play on "high-performance automobile." A "smart" building is designed more like a car: the various basic functions are still happening, but optimized by means of a battery of electronic sensors, displays, and controls. Energy-intensive systems like heating, cooling, and lighting can be managed by varying their output according to logic that takes sensor inputs as instructions. The building is operated, rather than inhabited, with systems grafted onto an old configuration. In either case, you're looking at a lot of new electronics grafted onto old forms, which may no longer be appropriate or viable.

A "smart" city is analogous: the streets and buildings are right where they were when they were "dumb," but now there are lots of sensors producing LOTS of data in real time about traffic volume and speed, presence and levels of chemicals in the air that might indicate or predict everything from asthma risk to terrorist attacks, unauthorized public assemblies, or the need for more snow removal. Day to day, vendors of such systems promise optimization of the built status quo, in exchange for added overhead (Singer 2012): ambulances can be dispatched and routed more efficiently, so better service can be provided with less stations, conventional equipment,

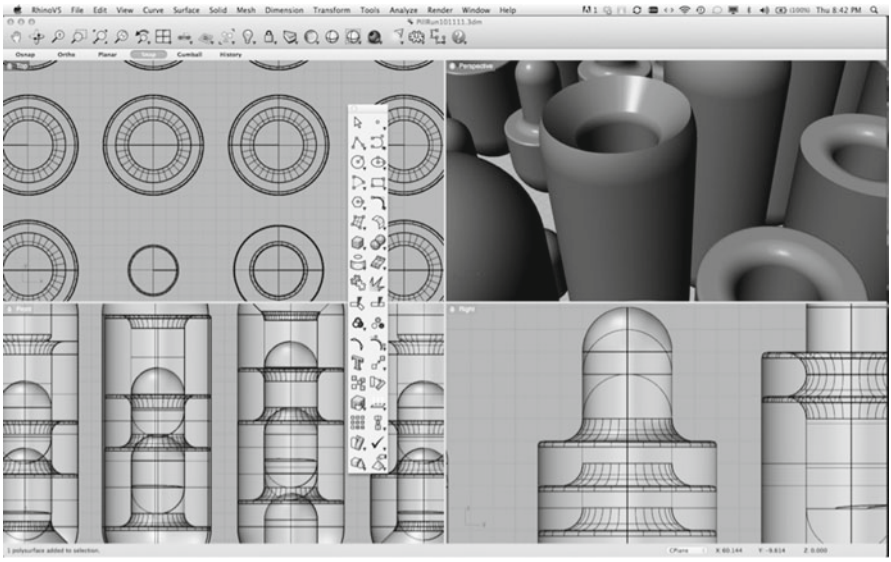

Fig. 2.11 The Rhino 3D interface, showing standard views of a set of parts designed for rapid prototyping by the author

and union personnel; traffic can be re-routed around construction, repairs, or parades more efficiently and effectively; and so forth. Over the long haul, visualization-supported analysis of the data ought to provide for the development of new mathematical models and simulations to develop and evaluate planning and design for a fundamentally better next generation of buildings, cities, regions… right?

Maybe, for that to be a serious proposition, it's going to have to be normal for designers to not only collaborate productively with engineers but to do so with the full and competent participation of the only people they hate and fear more than each other….

Management? Elected officials? No, the customers.

This issue plays out and offers potential for radical transformation in the next couple of generations, in different ways for different sectors. For software tools oriented primarily to (appropriately) standardized trade, like 2D drafting, video editing applications, or accounting, the commercial "black box" framework for developing and distributing software makes lots of sense: the people who use it need it to do it and would lose more they might gain by "getting under the hood." There can be provision for particularly expert users to write scripts or software plug-ins to extend the software without actually altering it (Fig. 2.11).

The combination of simultaneous orthographic (front, side, top) and auxiliary perspective views of a 3D object to be fabricated has been used for technical drawings since well before there was any such thing as a computer (Fig. 2.12).

These levels of user scripting could be mainstream soon in planning and urban design applications, well beyond visual effects into the pretesting of regulatory

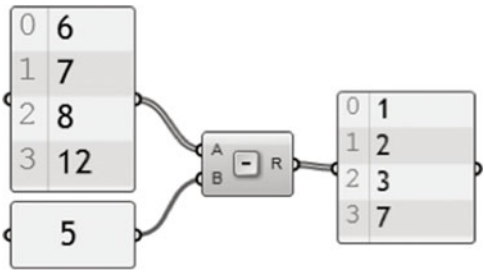

Fig. 2.12 A simple subtraction setup in Grasshopper…. You can also use it to generate exquisitely complex shapes for digital fabrication, with a bit of trial and error and lots of time on the user forums

frameworks and augmented design: rather than designing the shape, design the logic whereby a thousand shapes you never would have thought of are constructed by the software, from which to choose or undertake further development.

This order of meta-design may be profoundly attractive to engineers, effectively shifting gears in matters of building to something more like planning, in which the protagonist designs and tests rule sets against formal outcomes, rather than designing and testing worked-out designs against requirements. Well handled, it could provide support for a new level of clarity in the design of program requirements or reveal new forms implicit in new functional needs and technical capabilities, unconstrained by habit or the unsmart atavisms of pre-smart buildings and cities.

It sounds like science fiction, but so did notebook computers in 1970. In fact, resource management games like SimCity and Civilizations work like this: algorithms have been designed to "play out" the effects of resource allocation by players over time. Adding a meta-level to the game, in which players might actually experiment with scenarios on "smart" models of real cities, using real data and/or the state of the art of predictive mathematical model design, is perfectly feasible. The necessary computers and networks are already in place. Imagining students and social leaders getting collectively smart enough to use them might not be that crazy.

For some categories of software-based design, the competence and the legitimacy of the design process may ultimately depend on effective engagement of end users in the definition of requirements, process, and ultimate outcome. This is significant in any situation where a nonstandard problem or purpose is in play where there are significant human stakes (workplace design, for instance), and particularly acute in the public realm.

In the New Soft City, open public data can be used for optimization of power grids, e-marketing, social policy development, citizen engagement, or spying on immigrants; algorithmic composition methods can provide for new levels of richness of form in built environments or dumb architects down to a level of gee-whiz creative passivity that privileges self-spewing ornament over spatial viability. Broadband and personal computers provide effective near-parity between professional planners, designers, engineers, artists, and the rest of us at the level of means of information gathering, information processing, creation, and mutual broadcasting: the "infrastructure" for massively consensual design development for physical public spaces and places, as a key sociocultural praxis in a new soft polis, can

preempt as easily as it can be preempted by the negative social and cultural potential of the same machines and networks (Sennett 2012).

The hard and soft technologies that have made the Betaville project possible have also therefore made it, or something of the kind it makes conceivable and plausible, urgently necessary: distributed consultation and design development processes including citizens in direct collaboration with professional experts, supported by distributed visualization and discussion/development tools.

Betaville, as an environment for one of many modes of creative social engagement of possible urban physical situations and environments, is not premised on anything quite that simple. Rather, it is designed as one set of tools within a possible ecosystem of the aesthetic–parametric–generative, simulation-based design and decision support and other segments of a new generation of art–design–governance pipelines.

Chapter 3
Strategy

In the fall of 2007, Eric Redlinger, by then an alumnus of the Integrated Digital Media MS program at Brooklyn, put me in touch with Martin Koplin at the Hochschule Bremen, whom he knew through the network of SHARE experimental multimedia collectives, for which Martin had organized a node in Bremen.

In July of 2008, I was on my way to an international urban media symposium at the Media2Culture (M2C) Institute for Applied Media Research, which seemed to have been set up at least partly because they were interested in Eric's description of a project I was working on, an interactive online platform for collaborative city-making. I wasn't.

What had happened? I had gotten embroiled in exactly the kind of pseudo-collaboration nightmare that gives the term "interdisciplinary" its eerie ring, with Robin Bargar and Insook Choi. At the time, Robin was dean of something called "Entertainment Technology" at the technical college across the street in Brooklyn, and Insook was working as a visiting assistant professor with me at the Polytechnic. They wanted access to my program's technology mojo (mostly in the form of grad assistants with programming skills), and I was intrigued by the possibilities of what we were calling "BrooklynX," an interactive 3D visualization of the area around our respective institutions. We agreed to work together on developing the idea into an interinstitutional collaboration.

What I gradually came to realize was that everything about the project as they had developed it up to then was already set in stone: Scoregraph, their own 15-year-old multimedia performance software platform, running in front of an ontological database, for what eventually got presented as Insook's "interactive documentary" with a rather complex graphical interface… there had never been any real possibility of what I understood as working together. I only came to understand somewhat later what a tight corner their project was in by the time they came to me and by what signs I should have recognized the real constraints.

What I also came to realize was that I had not only misinterpreted their needs and intentions but my own: all that rethinking of the relationships between digital media and the arts and social action, for the sake of a new academic program, was at least

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in part my own struggle to construct an expanded definition of creative practice, per the phantom platform for collaborative future-making at urban scale—a likewise unrealized and hitherto incoherent ambition from MY past.

The list of ideas I had put forward to them, and which they had so systematically fended off, amounted to a design specification for that development environment. Accordingly, I went to the symposium in Bremen with two presentations: a short one about the initial premise of the not-really-collaborative "BrooklynX" and a longer one about a new hyper-collaborative idea, as yet untitled.

At the end of the presentation, Martin Koplin and his partner at M2C, Helmut Eirund, offered to collaborate on the new idea. Where Robin and Insook had been committed to a long-established prior arrangement and starved for skilled support, Martin and Helmut were wide open and had plenty of their own wherewithal. The capabilities and goals (I had triple-checked this time) seemed to be a genuine and great fit. I said: "Can We Call it Betaville?" I forget which one of them replied "Yes. That's a good name." We went for a drink and worked out a plan. One detail that we did NOT work out at the time was whether Betaville would turn out to be a work of "software art," a social media tool for participatory public art and urban design development, or a pure experiment in software engineering.

Beyond the understanding between me, Martin, Helmut, and the ideas embodied in our respective programs, we agreed on a couple of key principles:

"Experimenting" on/with the neighbors is wrong. However convinced I might be of the power, delight, and necessity of a Betaville-empowered body politic in Brooklyn, Bremen, or elsewhere, barging into the middle of debates about particular districts in which real communities might be vulnerable, without a new level of due diligence beyond what an academic IRB might address, was OUT. The business of disciplined and thoughtful staging of any eventual technology transfer into the mainstream would need to be handled with care and partners.

The first few stages would be within the framework of our respective academic programs: a direct research interest for the participating faculty, a use case for project courses, and a rich context for a range of possible undergraduate and graduate capstone/thesis topics.

3D Modeling: Within the Brooklyn curriculum, building architectural models for game worlds or other applications quite naturally starts with making a disciplined representation of an actual building: accurate dimensions, verisimilitude, and efficient geometry. Quite naturally, real buildings in the districts near our respective schools would be most convenient for the students and present the best opportunities to secure supporting information (GIS data, building plans, etc.). Ensuring that we could meet these requirements without distorting the program or impeding its capacity to serve the needs of students with a wide range of creative and professional goals would be a matter of careful course and project design, but also of ongoing "ethical maintenance" of the course offerings.

Interaction Design: The idea of an editable mirror world combined recognizable features of established software types, but in an exotic combination—virtual worlds like Second Life and Wonderland, GIS data viewer-editors, "God Games" like SimCity and Civilizations, and locative browsers like Google Earth. We proposed to

build a 3D world in a genre of interest to citizen advocates, community organizers, architects, artists, planners… starting from an application type associated with youth-oriented escapist entertainment. The road from escape to engagement clearly could be neither straight nor short.

Game Programming, Particularly Massively Multiplayer Online (MMO): Having settled on a schema outside of any specific game genre, with the intention of dramatically altering the performance requirements, and proposing a use case that would need to work for nontraditional "gamers" implied the requirement for some deep-down rethinking and reengineering of the game, while setting a particular kind of bar at the level of usability. Between the range of available MMO engines, the generally excellent programmers in Bremen, and a mix including a few great ones in Brooklyn, we could confidently approach the underlying software challenges.

Web Development: There were several novel dimensions to the web development work that we wanted for Betaville, beyond what could be provided within the game environment itself: account management, provision for updates and links to projects and events in Betaville, and a portal for the user and developer communities. There would need to be a professional-quality set of privacy and security provisions, especially because we were working with our own students and proposed to collaborate with other schools, whose privacy obligations vis-a-vis students are appropriately stringent.

Deeply Social Media: This was the most abstract level of our agenda—designing a socially constructive real-world use case for students in the programs was only the first step; the ultimate ambition was to build a new kind of creative open medium online, a synthesis of the creative space afforded by digital authoring tools, the social space provided by the Internet, and the potential of those spaces to "add up" to an augmented creative political space, capable of shifting (at least to some extent) questions of changing specific built environments a little bit away from competition over control, in favor of the kind of creative collaboration digital media professionals practice on their best days, days in which the engineers and artists empower each other to do exactly the things they would do if they had all the time and money in the world, with full and open peer-to-peer communication with the actual and competent end users of their work, which turns out to include artists, engineers, the neighbors, and the future.

3.1 Virtual Public Art AS/OF/FOR Urban Design and Planning

Here was the point at which the Betaville project undertook a radically integrative bit of dot-connecting. Douglas Engelbart had laid out his *Augmenting Human Intellect: A Conceptual Framework* (Engelbart 1962) in terms of a specific mode of "intellect": small elite teams solving complex (but implicitly specific) problems, augmented through the fastest possible real-time interaction between team members supported by a shared computer system. The extension of such an agenda to the rather different

mode of synthetic/creative work, particularly now that computers are primary authoring tools for many creative professionals, would constitute a specific "upgrade."

Iannis Xenakis, in his "Five Points" letter to UNESCO of 1964 (Skelton 2012:258), proposed, in the context of a mixed agenda of disciplinary and pedagogical redefinition, "deepening logical structures," both at the level of statistical analysis of prior (traditional, non-European) musics and in the service of the creation of new works, supported by computers and new architectural forms as necessary; this proposition may have been a distant cousin to analytical and generative mathematical "Information Aesthetics" based on information theory (Nake 2012), at a point when computers were understood primarily as mathematical devices—capable of vast numbers of automated calculations and exquisitely simple graphical outputs. In due course, explicitly algorithmic composition would propagate across all kinds of creative domains, from graphic design (John Maeda's work for Shiseido) to architecture and engineering (the "blue cube" swimming pavilion at the Beijing Olympics) and music—for which the history of algorithmic composition methods and gadgets has a rich precomputational history as well (Nierhaus 2009:36).

In the years since Engelbart submitted his *Augmenting Human Intellect* report to the Air Force Office of Scientific Research, the development of computers and computer networks has supported—and perhaps to some extent driven—the development and democratization of personal computers as powerful graphics workstations, moving from the level of statistical analysis through to interactive geometric and atmospheric perspective rendering, in real time: fictional and experiential environments from pre-visualization of architectural design "fly-throughs" to combat simulations like America's Army, or fictional worlds with their own imaginary ecosystems, virtualities, and societies (such as James Cameron's *Avatar* of 2009).

The softness of Jonathan Raban's city was a matter of the evanescence of human relationships and communities within a more or less stable physical infrastructure, whose layout and buildings (and communications infrastructure) expressed and enforced public space as "outside" the halls and laboratories of power. Jürgen Habermas' characterization of this architecture is appropriately evocative of a mechanical (pre-digital) civilization:

> In advanced industrial society, research, technology, production, and administration have converged to form an obscure but functionally interlocked system. This system has literally become the basis of our life. Our relationship to this system is peculiar-intimate and at the same time alienated. On the one hand we are tied to it externally, through a network of organizations and a chain of consumer goods; on the other hand, it remains remote from our knowledge and even more from our reflection. (Jürgen Habermas, *Dogmatism*, *Reason*, *and Decision*: *On Theory and Practice in a Scientific Civilization* (1989:*31*))

The architecture of the New Soft City is a direct outcome of this prior arrangement, but its digital realm is radically different in the variety of its hierarchies and its general permeability. According to the 2010 New York Census, available online from data.nyc.gov, 70 % of households in the least-advantaged demographics in New York City have an Internet-connected computer in them. High school students have access to computers as a matter of course, university students are typically required to carry one with them to class… and they are all connected to each other. The whole space is a strange new kind of public: privacy is hard, but reciprocal access is easy.

In the new soft post-advanced blended-reality network/polis, where "remote" is NOT the contrary of "accessible," the habit of alienation may persist, but its enforcement is gone. In principle, this ought to mean that many more people could participate in experimental reconfigurations of the city itself, through what is becoming a perfectly feasible massively participatory editable mirror world.

Betaville does not directly address the very broad range of levels of authenticity in formal participation development schemes or participatory frameworks simplified by Sherry Arnstein (1969) into a "ladder of participation" from Manipulation at their worst through Therapy, Informing, Consultation, Placation, Partnership, and at their best to Citizen Control. Betavilles are intrinsically only the *means of production* for concept presentation and commenting.

Betaville's architecture does offer one new guarantee of public openness in its technical design: it can be obtained and deployed at no greater cost than the personal computers and network access already in hand among citizens and professionals in the public and private sectors. The ability of any one "host" to dominate or manipulate the process is limited by the fact that any or all of the participants can opt out of that Betaville, into one of their own.

At the very least, inhabiting a Betaville provides opportunities to perform in new fictional city-forming roles, at escalating levels of complexity and verisimilitude. At each stage, the software proves its competence at a technical level, while the use case can take on higher-stake games.

3.2 From Parallel to Integrated Development: A Consortium and a Prototype

If the word "interdisciplinary" makes you nervous, suspicious, or nauseous, read on. We have seen our share of dabblers and charlatans too. We have learned the hard way that a Ph.D. in one subfield, even from the best school, does not qualify ANYONE in any other subfield, even less in any entirely unrelated domain of inquiry. The methodology of the project relies on collaboration between competent professionals and people with concrete experience in the broader community.

At the same time, there's an inverse relationship between the effectiveness/relevance of any given research specialty and the degree to which a project actually operates "in the field." The traditional hierarchy of basic research, applied research, and practice must give way at some point to a coalition including a mix of deep knowledge/competencies, including some negotiation between their respective protocols, checks, and balances, and the complementary mechanisms—formal and informal—beyond the institutional framework, including everything from community associations and nongovernmental organizations to City Hall and the real estate market.

A preliminary list of just the ACADEMIC areas implicated in the Betaville project would look something like this: Software Art, Digital Media Design, Social Media, Software Engineering, Public Art, Urban Design, and Urban Planning. Within that breakdown, there's a strong practical distinction to be drawn between study/theory and practice, always a delicate subject in universities, whose

diversification into applied fields can be fraught, as an n-dimensional mismatch of competencies and subcultures. Leaving aside the infinite question of whether it's the work at hand that's mismatched to the world beyond the ivory walls, or vice versa, we might not be surprised that an idea like the Betaville project would take so long to come together as a program of creative/research work.

This was always an obvious set of connections to make from the point of view of a creative professional. As an artist active in the 1990s, I was spending more and more of my time working at a computer—not just for paperwork and correspondence but increasingly with tools like Photoshop, Final Cut Pro, Maya, and assorted web tools, to make the work itself.

However you might feel about the assimilation of art education by universities, it's now expected in the art education system that a professional artist is also a competent cultural critic of his/her means of production, as well as of the institutional, commercial, and cultural ecosystems within which that production participates. This represents no more or less than the general definition of any profession, whose membership can be trusted to regulate itself, like medicine and law. This is handled formally within the arts as a subset of the degree-granting, hiring, and tenure-granting processes, which in turn rely on art galleries, publishers, and curators to provide a full complement of checks and balances. "Peer review" is therefore spread over three distinct sectors: the cognizant academic community, the commercial art market, the trade press, and ultimately museums and scholars.

The matter of critical competence vis-a-vis one's means of creative production is particularly sticky with digital media. I've written elsewhere (Skelton 2006:193–198) about the "generation Beta" effect, in which a generation trained BEFORE digital media was teaching students NATIVE to the web, Internet-enabled laptops, and so forth. We elected for a synthetic, rather than analytical, process: there doesn't seem to be too much point in developing a "definition" or "geography" of the Internet as public space, simply because its properties are (still) changing faster than we can write doctoral dissertations about it. The spread and capability mix of personal computers and skills, the availability and usability of development environments, and the expectations/capacity of particular prospective user groups are evolving fast, as evidenced by World Bank statistics on Internet penetration worldwide (World Bank 2013). The form that collaboration has taken, and the results it has obtained, amounts to a performative compte-rendu of what we found to be practicable under experimental conditions that have NOT been consistent. Every time I write "we did such-and-such," it can be interpreted as "under the conditions that obtained on that day, we demonstrated that such-and-such was possible for the particular people who were involved, by their actually doing it."

We make NO claim of adherence to experimental protocols in scientific or engineering terms, vis-a-vis the experimental method advocated by Ibn-al Haytham and many others since; neither is this "experimental" in art-world terms nor in the commercial sense of market-testing, with a view to persisting in whatever behavior generates a financial return for a proponent.

MMO games were by then an established entertainment genre. Even real-time collaboration on 3D design tasks was not only a demonstrated possibility; it was a basic feature of more than one online world already passing out of fashion as entertainment: Second Life.

The novelty of the work was at two levels: the scale and form of collaboration that could build a competent platform and the application to distributed community participation in redesigning urban environments. There had been encouraging experiments with this but of limited scope (Maher 2010) or fraught with technical limitations (O'Coill and Doughty 2004).

The development of the technical infrastructure (the software itself) was to be undertaken by two faculty/student teams with some inevitable flux, separated by six time zones.

Beyond what Gelernter would call the "complex but unmysterious" issue of the development of the various components of the software, we were taking on two or three new challenges in terms of the use case: development of elaborate base models, i.e., of cities and districts as they are, proto-users for the developers to work with, and a conceptual framework outside the scope of conventional GIS or architectural design applications.

The broader question of whether that order of possibility would beget the next, of adoption and use, or a third, that such adoption would be for the better, would be deferred until "unmanaged" deployments were a concrete prospect.

The Betaville project, in the first instance, set out to demonstrate an emergent possibility of a new social medium: the hack-able mirror world as public design space. As a piece of science fiction, this comes down as media or software ART. As an experimental tool for professional groups, or groups under professional supervision/care, it's a LAB. Online, it's a new form of public space. Does that make it civil software engineering? Once we accepted that Betaville is or might be some combination of these things, there were several layers of development that needed to be thought through from first principles:

1. Was it technically practical?
2. Could we make it effectively usable by the intended people, in the intended ways?
3. Who should be on the team? How could/would they collaborate?
4. What workflow management and precautions should attend the development process?

Betaville did not have to decide whether it was a work of art, an infrastructure, or both at first; it only had to decide whether it could be built without undue risk to the world around it. If the process itself could be useful in terms of creation, research, and education, that would be a good start.

3.3 The Team: Crucial Elements of Research Group Subfield Interests

In principle, Betaville's mix of domains was short of the triumvirate identified by Olinde Rodrigues (Rodrigues 1875:15) in his original definition of an avant-garde that would be social, rather than military: "l'artiste, le savant, et l'industriel" (of the artist, the scientist, and the industrialist), we were working as fully integrated artists and engineers: the artist and the research "savant" were accounted for, but the

commercial "industriel" was deferred in favor of an open-source approach, consistent with the premise of a software environment as *public* space.

The Betaville project is actually pretty straightforward in practice, but very difficult to categorize within the discrete domain of contemporary art practices. To make sense of Betaville in relation to art theory/discourse, you would have think of it as an amalgam of three "extreme syntheses": software art, social sculpture, and art as infrastructure. For those unfamiliar with oddball contemporary cultural genres like "installation," "performance," and "process" art, this next section is going to be somewhat confusing. I have made and tried to offer less esoteric analogies, wherever possible, and some redundant definitions. If you're lost in one explanation, skip to the next; they overlap quite a bit.

What we had to work with in-house: two small academic units embedded in technology schools, with a strong orientation to social and cultural domains; two program directors (one artist, one media producer–entrepreneur–sociologist); three software engineers; and students across a spectrum from art to computer science and from first-year to doctoral levels.

3.4 Betaville as Art Meta-Mash-up

As the artist on the team, I thought of Betaville from the outset as some new combination or synthesis of a social artwork and/or medium, taking Beuys at his word:

> I cannot say that anyone has to believe in what I have done, quite the contrary: everything that people place out there—and this should also be how it is with the new concept of culture—should exist in the world as a question to be augmented, improved, enhanced. (Joseph Beuys, *What Is Art?* (Harlan 2004:13))

This "new concept of culture" maps well to gnu.org's definition of "free software":

> "Free software" means software that respects users' freedom and community. Roughly, the users have the freedom to run, copy, distribute, study, change and improve the software. With these freedoms, the users (both individually and collectively) control the program and what it does for them.
>
> When users don't control the program, the program controls the users. The developer controls the program, and through it controls the users. This nonfree or "proprietary" program is therefore an instrument of unjust power.
>
> Thus, "free software" is a matter of liberty, not price. To understand the concept, you should think of "free" as in "free speech," not as in "free beer".
>
> A program is free software if the program's users have the four essential freedoms:

- The freedom to run the program, for any purpose (freedom 0).
- The freedom to study how the program works, and change it so it does your computing as you wish (freedom 1). Access to the source code is a precondition for this.
- The freedom to redistribute copies so you can help your neighbor (freedom 2).
- The freedom to distribute copies of your modified versions to others (freedom 3). By doing this you can give the whole community a chance to benefit from your changes. Access to the source code is a precondition for this.
  (gnu.org, *The Free Software Definition*)

…which in turn seems to refer directly back to the nineteenth century:

> Plagiarism is necessary. Progress implies it. It closely grasps an author's sentence, uses his expressions, deletes a false idea, replaces it with the right one. To be well made, a maxim does not call for correction. It calls for development. (Isidore Ducasse, *aka* Comte de Lautréamont, *Poésies II* 1870 (Lautréamont 1994:240))

In the sense that any cultural form, intellectual property notwithstanding, evolves iteratively in this way from one performance to the next but more radically from one artist or generation of artists to the next, a social creative space that could explicitly provide for an iteration cycle shared by any number of participants 24/7 might manifest not only as an acceleration, but as a new dimension of the publicness in "public art."

Public Art: Nothing more or less complicated than works of art in or addressing public places, from the Colossus of Rhodes to Anish Kapoor's *Cloud Gate* (affectionately nicknamed "the Bean") in Chicago, public art represents one extreme of the spectrum of approaches to the plasticity of urban environments: by the placement of a bronze portrait of the mayor, or a patron saint in the middle of a square, the identity of a place is enshrined or imposed; by the installation of a large Calder "crab" or Serra "arc" or Bourgeois "spider" in front of an office building, other relationships are performed between the building's owners and the people who work in the offices or nearby. As an artist with experience in the public realm, I was very much interested in the possibility of more effective communication tools and engagement processes.

Software Art: A somewhat controversial category, even among its practitioners and theorists. Simply put, there are artists who make their work either in part or in whole out of code. Betaville is, after all, a software (Java, OpenGL, MySQL, and PHP, mostly). Christiane Paul construes such works as expressions of instruction sets: the medium of presentation may be visual, but what is actually expressed is composed at the levels of language and logic:

> What distinguishes software art from other artistic practices is that, unlike any form of visual art, it requires the artist to write a purely verbal description of their work. In traditional art forms, the 'signature' and 'voice' of an artist manifests itself in aesthetics of visuals and execution. Every medium may have its specific language but in digital art, this language has a quite literal rather than figurative manifestation. In software art, the visual results of the artwork are derived from the language of code. Languages are defined by grammar and complex rules and at the same time leave space for individual forms of creative expression. (Christiane Paul, *CODeDOC/From the Curator* Whitney Museum of American Art, 2002)

3.5 Media/Software Artwork as Infrastructure (Looking Ahead and Living There)

Martin Koplin and I discussed this almost obsessively in the early stages of Betaville's development. Trained as a sociologist, and experienced as an organizer of large-scale research and arts projects, Martin could easily make a weak

distinction between the process of organizing a creative project and art-making per se: the experience and ontology of organizing a rave or a node of the SHARE collective blend seamlessly with the process of participating in them. Running a research project is a lot more like research than curating is like making art, or software project planning is like programming.

We had good reason to believe that Betaville was buildable, simply because all of the necessary informatic functionalities were already at work, albeit in different applications from online games to architecture and cartography. This meant that Betaville, as a "social software sculpture," was a practical possibility. At the same time, though, we undertook the development project as an integrated research and pedagogy initiative. Where a work of art can legitimately be fictional, in a mode of "what if" or "as if," the engineering and education mandates required that we set an achievable specification for the technical work, but within a use case that could be speculative.

A working demo of Betaville would amount to indirect science fiction, by actually creating an artifact *of* (as if it were *from*) an alternate version of the world, in which people actually use Betavilles to do the things Betaville is for, as a matter of course; the dramatic form in which the work of art that is Betaville would be its development as a real-world software project, making that fictional scenario possible, and thereby making it a newly practical proposition in two ways: first, by removing one of the (false) technical barriers; second, by legitimating the fictional variant of urban life as something concretely achievable. With a little bit of outreach and organizing, we could then arrange for some nonfictional users to develop new science fictions within Betaville; in due course, their success in driving the construction of new forms in real cities could stimulate the broader adoption of Betaville and Betaville-oids, spawning new cultural forms and communities and built forms, not to mention lots of new generations of software and extensions.

In this scenario, the development cycle does not distinguish between software development and use, or between the processes and products of that use, or between speculative and pragmatic scenarios. The respective plasticities of the code, the community, and the physical city are fully integrated—the work, the medium, and the culture all making the same kind of lived sense. This was, by no coincidence, consistent with some of the reintegration we hoped to stimulate in approaches to the built environment itself.

Our experience with architecture and urban planning process (except for my professional work creating public art installations) was primarily informal. Accordingly, we sought external expertise—Norm Jacknis (Cisco systems), Vin Cipolla (Municipal Art Society), Susan Gladstone (Levien & Co.), David Turnbull (ATOPIA Research and Cooper Union), and David Lieberman (University of Toronto Architecture).

Our education partners, from the Urban Assembly to the New York Hall of Science, were chosen not only for their mandates but for the kind and quality of their engagement. In principle, we had all the necessary parts and partners… nothing left to do but build it and test it.

3.6 Soft(ware) City Engineering: Joel Wein, Helmut Eirund, and Thorsten Teschke

When Betaville was getting under way, Joel Wein was working at Brooklyn as an associate professor in Computer Science. His research specialties were in network scheduling and software optimization. I had advised him informally and lent him a lab to support his effort to design a multiplayer game/simulation to help teach real-time network management, in which teams of students would face off, each trying to maximize throughput in its own network while trying to take down or at least bog down the other teams. The idea was to provide for a student experience to mirror the real-world excitement of large-scale network management, with which Dr. Wein was well acquainted through his work at Akamai but which he found hard to share with students in a lecture hall. In return, he had helped me make sense of an instrumentation framework for Betaville, initially as a co-principal investigator at the Games for Learning Institute. Whether we were going to want to instrument Betaville for evaluation and assessment purposes as pure research, or as part of the development cycle, or to provide for a massively scalable online platform down the road, Joel's involvement provided a crucial level of expertise and discipline in Brooklyn, where the core web technologies would be built.

In Bremen, Drs. Helmut Eirund and Thorsten Teschke at the Hochschule were already working with mobile augmented reality and experimental mash-ups on a social media-multiplayer games spectrum with projects like NewsFlash and Gangs of Bremen. From their perspective, Betaville presented a familiar combination of conceptual and technological challenges: the Gangs of Bremen (Eirund et al. 2004) already engaged a middle way between games per se in which players perform set tasks more or less proficiently and virtual worlds in which the narrative unfolds as a series of exchanges authored by participants: "The player creates his game history at runtime (Der Spieler entwirft seine Spielgeschichte zur Laufzeit)." Both NewsFlash and Gangs of Bremen, as Augmented Reality projects, were of necessity embedded in local built environments.

If Apple designed a city, would you want to live there?

"Design" is a chronic dilemma in the public realm in a democracy: by the time a city, or more typically a district, has been designed according to what that implies vis-a-vis norms of formal, material, and functional consistency, it's not necessarily the kind of place many of us would want to live or to be compelled to "reside." At the same time, any kind of infrastructure has to be designed to be built. To the extent that DESIGN imposes form on a city, and therefore on citizens, its very purpose is antisocial. Architect Adolf Loos, even within his own modernist polemic *Ornament and Crime* (Loos 1908), was prepared to accept shoes with old-fashioned decorative details for the sake of his shoemaker: "I tolerate ornaments on my own body, when they constitute the joy of my fellow men." Jane Jacobs put the same problem more specifically:

> To approach a city, or even a city neighborhood, as if it were a larger architectural problem, capable of being given order by converting it into a disciplined work of art, is to make the mistake of trying to substitute art for life. (Jane Jacobs, *The Death and Life of Great American Cities* 1961:373)

But can a community actually design itself or rather engage in ongoing agile self-development through daily collective engagement of the evolutionary potential of its built forms?

Betaville is designed to bring capabilities already at the disposal of professional engineers, planners, and architects within reach of artists and communities: spatial and temporal modeling skills; collaborative 3D design; visualization, particularly the ability to "fly through" a proposed scheme from a human occupant's point of view; and continuity between computing, creative disciplines, and participation in debates about middle- and long-term design of common resources (such as roof gardens, parks, buildings, roads, transportation networks, and public cultural assets).

Functionally, Betaville recalls certain features of the Google Earth/SketchUp suite, including the invitation to users to upload their own better-quality models of specific buildings. Of course, embedded links and contributed models must fit within a very narrow band of documentary (simple models textured with photos of the surfaces of the actual buildings, photos of actual locations) and promotion (links to websites promoting restaurants, museums, and shops). Google Earth is maturing as the product and vehicle of a very large advertising conglomerate. Even so, its integration with a free 3D authoring tool (SketchUp) has attracted all kinds of volunteer modelers who, for one reason or another, are willing and able to add to the model by rebuilding, detailing, and skinning individual buildings in exactly the spirit and practice of creative play advocated from very different perspectives and within very different sets of expectations about technology.

Betaville is designed to offer capabilities that should be considered fundamental to participatory urban art, design, and planning: proposing, developing, and ultimately implementing changes to the world that's being mirrored. New works of public art, new ideas for urban design, even new real estate development, supported by an appropriate and effective platform, which is always going to be accessible both as infrastructure (software) and location (the game world itself) beyond the range and purpose of a commercial "world," even one with web 2.x proclivities for user-generated content, environmental philanthropy, and founders with happy memories of Montessori schools. Issues of governance in Second Life or World of Warcraft are quite properly constrained to the limits of what constitutes legitimate or desirable "house rules" (de Zwart 2009). How open or closed the codebase for a game should be is likewise a matter of commercial prerogatives, tactics, and ethics.

A Betaville, on the other hand, as an open-source infrastructure for open design development, could actually provide a MORE public space in virtual form, or rather augment the public-ness of any given built environment it depicts and offers as open to virtual changes as precursors to physical ones.

The name "Betaville" was more than a pun referring to cities as always-not-quite-complete designs. It actually started out as a play on the title of *Alphaville*, Jean-Luc Godard's classic New Wave movie of 1965, in which Alpha 60, a malevolent and dictatorial mainframe computer, makes life hell for its subjects.

This would, in principle, have methodological implications for the software project: if our ultimate aim really extended beyond the scope of an academic experiment, and our initial design program aimed to address (and ultimately serve) a broader community, the issue of how to engage that community as openly and effectively as possible as early as possible as partners in defining the purpose and limits within which to determine requirements and thereby the technical specification led unavoidably to the question of how to get who in on it and what to offer up front.

The Egg: Our desire to build Betaville as an open space from first principles which we would not have to dictate but rather as much as possible co-construct within the framework of that "Cooperative of Gods" mentioned above.

The Chicken: Enough of an exposition, and a basic prototype, to make the very idea of Betaville intelligible, as well as what Eric Raymond, under the heading of "necessary preconditions for the bazaar style" (open-source programming), calls a *plausible promise*:

> When you start community-building, what you need to be able to present is a plausible promise. Your program doesn't have to work particularly well. It can be crude, buggy, incomplete, and poorly documented. What it must not fail to do is (a) run, and (b) convince potential co-developers that it can be evolved into something really neat in the foreseeable future. (Eric Raymond, the Cathedral and the Bazaar)

We had to start somewhere. We went for the chicken.

At the level of technology choices, we were already coherent in terms of driving values and pragmatic utility:

While textures and dynamic lighting were likely to be important for fine qualitative nuances in Betaville at some point, we were never going to need PlayStation-style commando action, and indeed dispense with any kind of real-time character or avatar features, at least until a later phase of development in which we would first consider agent-based simulation of urban-scale-relevant crowds and motor traffic. While the inclusiveness component of our agenda meant that we would be building for basic hardware and network bandwidth to the extent possible, the assumption that "basic" would only get more powerful over time seemed safe. Without having to assume that Moore's law (doubling in chip performance every 18 months) would apply in the consumer market indefinitely, we could safely say that the personal computer's processor and graphics handling capabilities in 2012 would be at least up to the standards of late 2008.

Strictly speaking, we weren't looking for a massively multiplayer game at all. The point of an editable mirror world was to provide a usable, accessible, and meaningful shared space in which anyone could see (and move freely about) a proposed installation or configuration in its built/natural context as well as associated information resources and get in on the discussion by participating in a chat attached to that "object." Any given comment must therefore be linked to its author and a specific version of a specific project. If the proposal were to change ad hoc in real time, any subsequent user/neighbor would not be able to reliably associate any given comment with any given state or stage of the proposal's development. We would therefore want to present the "base model" (the scene as it is, out there in the real

world, as of now); proposals would be marked with hovering "flags," any or all of which could be triggered to offer the full sequence to date of proposal versions, linking each version to the comments pertaining to it and each comment linking to a user's profile on the website. Any alterations made by one user, particularly by adding a proposal or version, would be available to users logging on afterwards.

Relinquishing avatars, real-time world-sharing, and assorted game effects would, hopefully, give us room to provide for much more complex world geometry (i.e., level of detail in the models) than is typical in a game application, for which the accepted wisdom is that the environment should have the simplest possible geometry: simple shapes and not too many of them.

Betaville as Geographic Information System (GIS): Between the need to provide for a robust and consistent geometry, the need to provide a world which would be reliable and credible for planners, architects, and engineers; the possibility of working with third-party assets to build base models; and the potential for linking geocoded public data as a category of background information to support serious planning and design deliberations in the proposal development process, building Betaville to conform to open geodata standards was obvious: there were already quite a few open resources online that held the promise of providing for autogeneration of at least an accurate street grid and ultimately quite a bit more [more about how this evolved in the X and Y sections]. This much was a simple extrapolation or implementation of David Gelernter's "Mirror Worlds" concept of the platform as an informational infrastructure, to (as much as possible) support informed debate by embedding reliable information in the world.

This also might, if it went well, go some way towards addressing a systemic gap in the "open data" enthusiasm then current: Betaville could provide a much-needed open front end for the machine-readable data being clamored for by researchers, NGOs, and independent application developers… if the application, by connecting geodata to the readily navigable and recognizable 3D models of familiar cities, streets, and land forms, could provide a user-friendly "open data browser," the data might much more meaningfully be available as human-readable information to the public, as well as large organizations with sophisticated programming capabilities in-house.

File format 3D models can be created with any number of authoring tools. The prospect of building an in-world model-building capability was clearly beyond our reach at the outset; there were already lots of 3D applications in circulation, from free novice-oriented (SketchUp) to open-source (Blender) and including others which might not be open OR easy to learn, but already part of the workflow of professionals whose engagement and expertise were sure to be valuable in the mix: AutoCAD for engineers and architects in large firms, 3DStudio Max and Maya for animators and game designers, and Rhino for architects in smaller firms. Ideally, we would want to provide the shortest detour for any one of these prospective user profiles, including no-cost options for citizen and student users with well-developed and manageable learning curves and lots of documentation and other bootstrapping resources already being provided by third parties. In every case, there could be some kind of "model pipeline." Even in some far-off future where a full-featured modeling tool could be built in to Betaville itself, we foresaw that it would be useful to

allow for anyone already habituated (or required) to build their designs on some other platform and would be better served by a good translation/import solution than the need to build everything all over again.

Our technology choices were motivated in part by principle—to some extent ideological—but also as a simple matter of coherence of purpose and tools. It simply made no sense to try to build an open digital space, or its infrastructure, with closed tools. If we proposed to maximize access and engagement opportunities at the level of what would go on IN Betaville, wouldn't our promise simply be more plausible, as well as clear, if we were consistent in regard to the openness of the underlying frameworks and formats?

As we might hope eventually to seed a Betaville developer community "out there" that would be continuous with its user community (as in any other participatory democracy, in which the designers, builders, stewards, and end users are the same people), the simple practical matters of ongoing adoptability and adaptability seemed best served by the use of maximally open tools.

John Frazer has been experimenting with computers in relation to architecture at the Architectural Association in London and other leading schools for over 30 years. In December 2005, he gave a series of five lectures: *Accelerating Architecture*: *The Art And Science Of Autotectonics—The environmental and social imperatives for a self-organizing architecture*: *Defining new roles for the Citizen*, *the Architect*, *Construction*, *the Computer and the Environment*. Over the course of the lectures, Frazer outlined a potential future fully augmented design–construction–use pipeline:

> "Active Software": Taking as inputs initial project requirements and conditions like building functions, budget, and site location/orientation, and as parameters the thermal and structural properties of the materials to be used, automatically and autonomously generates a large variety of possible design solutions, essentially seeding the design process per se.
>
> "Active Architects": The architect chooses among the auto-generated "sketches", and/or their performance profiles, finding along the way any number of duds, expected solutions, and thoroughly counter-intuitive but correct "answers" to the input requirements. From these, he or she selects a few for further development.
>
> "Active Users": The user/citizens who will eventually occupy the finished building then responds to the options, also actively—engaging in a collaborative creative dialog with the architect, as they jointly cycle variants back into the software to assess and optimize technical performance.
>
> "Active Buildings": Those solutions, through a secondary genetic algorithm-driven process, are optimized for build-ability and building performance: light, thermal, ventilation… the "finished" building is designed to respond directly to changes in local environmental conditions, participating actively in the energy and information "grids". As environmental conditions change, so does the building's behavior, as well as its optimal form.

Betaville was designed and built to provide for the third segment of this pipeline, in which designer and user-citizen trade ideas for alterations and alternatives informed rather than constrained by software-derived solutions by the initial definitions of requirements and constraints: in a shared visual language of annotated interactive 3D models analogous to BIM, but much simpler to navigate and alter, from wherever they happen to be when they have time to consider a design, or an idea about it, they can comment/add/reconfigure. Over time, the design can mature, its various stages of development constituting the process by which the general

expertise of the architect is informed and developed through a verbal–visual dialogue with the ultimate holder of informal knowledge about how the building must do its work, and the specific knowledge of the user-citizen develops through dialogue with the professional expertise of the designer. Betaville further scales this ambition of sustained asynchronous collaboration over the network between their computers to the district and regional scales, both physically and socially.

Whether Betaville was ultimately to be undertaken as a work of software art, a software infrastructure for a new collaborative tool, or a mode of public participation in governance, its technology/features/design choices were derived as straightforwardly as possible from a coherent definition of its key functionalities. The Brooklyn team, accordingly, set out to build a prototype and to begin to seek out partners for preliminary deployments, accordingly to a strict sequence of stagings.

3.7 Learning from Humboldt and Gropius

The von Humboldt model of academic practice had integrated teaching and research, a model that's precisely compatible with one possible approach to creative or engineering programs: students participate directly in the work of their professors, gaining expertise through daily contact with a practitioner at work.

This model was atypical in the programs I had known as an art student in France and Canada—professors' studios were off campus and their studio practices only intermittently glimpsed in exhibition catalogs or excursions. The idea of working WITH students, within a construct of teaching and creative/research work as the same thing, came to the fore in the context of our respective engineering schools and their polytechnic roots. In Brooklyn, it was more a matter of stories of the school's heyday as a leading institution in chemical engineering (the legendary Donald Othmer's engagement of students in his global consulting practice from the 1930s to the 1970s, Ilan Juran's direction of the Civil Engineering Department as a miniature Grande Ecole des Ponts et Chaussées in the early 1990s). The "German Model," however, also included specialization of professors—and therefore their students—in specific disciplines. There wasn't any such thing as a digital media project that could work this way. Whether as students or faculty, none of us could really get much of anything done without the direct participation of peers with complementary expertise.

Furthermore, von Humboldt's framework of knowledge sought in "Einsamkeit und Freiheit" (Clark 2008:446), not only apart from other academic disciplines but from the broader social context, was precisely what we hoped to transcend. In creative social media fields, basic research cannot be undertaken in isolation.

For an undergraduate-level game design studio project course to function at all, it was necessary for students to work in teams: the absolute minimum division of labor included a story developer, a programmer, an interaction designer, and a 3D model world/character designer. The mix of backgrounds and skills in the

undergraduate and graduate students at Brooklyn worked well for this, as every studio course would include a mix of "digital media" majors and computer science or electrical/computer engineering students, and the course sequence could provide for carrying a semester's worth of preliminary conceptual/preliminary work through to another semester's of development. In Bremen, two groups of students were involved—"digital media" students in an interdisciplinary international program organized between the Hochschule, the University, and the Art School and media informatics students in a graphics-oriented specialty of computer science.

This mirrored the faculty-level consortium's underlying logic, interdisciplinary integration/despecialization of the project, precisely in order to promote the integrity and rigor of the participating disciplines, at a point in the development of "Applied Media Technology" where its ethology needed to be engaged through a nested interdisciplinarity—a broad range of expertise within the faculty team, engaging an even broader set of partners in our respective urban contexts.

By ethology, I mean here the development of the project in its context, i.e., within a network of relationships: not just in terms of the interdisciplinary collaboration that would be required to make the software itself technically functional, but in terms of its evolution as one of many developmental factors—of a creative and effective community. The broader question of the possibility, utility, or necessity for our practice from within academic institutions to abrogate the implicit traditional status of the ivory tower as a *hortus conclusus* (a walled garden), in which a social contract exchanges freedom to explore and experiment with heresies of all kinds within the walls in exchange for a promise not to mess about beyond their social and cultural engagement… *Freiheit ohne Einsamkeit*?

How about *Einheit*? The Bauhaus (in its *initial* form in Weimar 1919) set out to undertake a reform of higher education as radical as von Humboldt's—not in the University, but in a fusion of arts and crafts *practices*, which would converge and collaborate as constituent elements of architecture:

> The ultimate goal of all art is the building! The ornamentation of the building was once the main purpose of the visual arts, and they were considered indispensable parts of the great building. Today, they exist in complacent isolation, from which they can only be salvaged by the purposeful and cooperative endeavours of all artisans. Architects, painters and sculptors must learn a new way of seeing and understanding the composite character of the building, both as a totality and in terms of its parts. Their work will then re-imbue itself with the spirit of architecture, which it lost in salon art. (Walter Gropius, *Program of the Staatliche Bauhaus in Weimar* 1919)

At this stage, the Bauhaus concept derived at least as much from the *Bauhütte*—medieval masons' lodge (Wick 2000:52)—as it did from the *Neues Bauen*, the German manifestation of architectural modernism. By 1923, the "composite character of the building" as a neo-Gothic communal and devotional synthesis of the fine arts and crafts under the aegis of architecture had evolved. Gropius titled his opening address for the first major Bauhaus exhibition "Art and Technology—A New Unity." This corresponded with a fundamental change in the orientation of the Bauhaus from art and craft to art and industry, i.e., design. The "new unity" retained

the grandeur of the neo-Gothic rhetoric of 1919, but clearly oriented to unification of emerging tools and genres:

> Der beherrschende Gedanke des Bauhauses ist also die Idee der neuen Einheit, die Sammlung der vielen 'Künste', 'Richtungen' und Erscheinungen zu einem unteilbaren Ganzen, das im Menschen selbst verankert ist und erst durch das lebendige Leben Sinn und Bedeutung gewinnt.
>
> *The dominant idea of the Bauhaus is thus the idea of the new unity, the bringing together of many 'arts', 'tendencies' and phenomena into an indivisible whole which is anchored in Man himself, and won primarily through the vibrant purpose and meaning of life.*[*check trans.!*] (Walter Gropius, *Idee und Aufbau des Staatlichen Bauhauses* Staatliches Bauhaus Weimar 1919/23, Weimar/München 1923)

Laszlo Moholy-Nagy, who took over the foundation curriculum after the departure of Johannes Itten (precipitated in large measure by this shift in the Bauhaus program), built on Gropius' "new unity" as "the new vision":

> Gropius reintegrated artists into the daily work of the nation. The results were surprising. By uniting artistic, scientific, and workshop training—with tools and basic machines—by keeping in constant touch with advanced art and techniques, with the invention of new materials, and new methods of construction, the teachers and students of the Bauhaus were able to turn out designs which had decisive influence on industrial mass production, and in the reshaping of daily life. (Laszlo Moholy-Nagy, *The New Vision* (1947:21))

Moholy-Nagy's conception of the relationships between art and technology expanded the vocabulary of Gropius's new unity and loosened its structure: sculpture and architecture could open, move, and light up, freely mixing in existing or yet-to-be-built technologies from the theater and advertising. The following may seem fanciful as an education program, but perfectly reasonable as a description of fireworks, Times Square, one of Iannis Xenakis' Diatopes, or the interiors of the Guggenheim museums in New York City and Bilbao:

> Openings and boundaries, perforations and moving surfaces, carry the periphery to the center, and push the center outward. A constant fluctuation, sideways and upward, radiating, all-sided, announces that man has taken possession, so far as his human capacities and conceptions allow, of imponderable, invisible and yet omnipresent space. (*ibid*. (1947:64))

In fact, I built the Digital Media programs at Brooklyn on precisely the mix of principles and fields articulated by Gropius and Moholy-Nagy, including both the synthesis of art and technology *and* the interoperability of multimedia fine/performing arts with digital design.

By then, though, the concept of collaborative unity was less a matter of vision and more one of simple necessity in praxis. Even at the introductory level, building a website or a game or a multimedia installation or a video short is a shared endeavor, requiring that creative groups organize themselves at least provisionally as interdependent specialists. At the same time, convergence of digital media authoring skills and tools in the various domains and genres had made this kind of collaboration seem as obvious as it was necessary, as more and more possibilities demanded more and better-coordinated collaboration for big ideas to be realizable.

3.8 Modularity: Multi-year Distributed Development

The practical necessities of the software development, within a nonstandard approach to its implementation, were going to require some clear-eyed project design. Joel Wein, whose practical experience as a software engineer and project manager spanned academic and commercial realms, felt strongly that we couldn't expect to get far if every component were to be organized transatlantically. Accordingly, we agreed to separate development initiatives: the web server and client pieces would be built together in Brooklyn, and the Bremen team would take charge of building first a mobile application, and subsequently an NUI (touch table) client, for different use scenarios.

The initial concept, of an online mirror world that could serve as a shared conception and development studio for distributed groups of proponents and stakeholders, left a strategic gap consistent with the often-heard criticism of digital design tools in conventional workflows that they fail to account for the subtle but crucial qualities of real on-site experience…. The seduction of unmaterial and unphysical representations of a concrete, specific, and physical location can too easily be forgotten as the abstract "vision" comes to take on a life of its own. An "on-site" variant of Betaville, with which a participant in any particular Betaville discussion might be able to go to the place itself, and see a model through their mobile camera with an Augmented Reality application, under real conditions of access, wind, and noise, and then be able to add to the online chat/comment tools or even make adjustments of scale, orientation, and placement on the spot, seemed like a potentially valuable complement to the web-based tools. The technical issues involved in connecting such a mobile application seemed tractable in terms of the software development logistics. Likewise, a touch table variation on the screen-based navigation could provide for small groups to undertake the kind of occasional in-person group discussions that might be required to integrate some of the traditional planning and design practices long used in working out urban contextual issues like traffic patterns and impact on the overall form of a whole district or city. Touch-based user interaction as a user-friendly alternative for nontechnical users could also lead to new insights with regard to general usability and alternative display scenarios for outreach purposes.

The web server and client clearly would have to be built together, for the core capabilities to be viable, and the distribution of capabilities put them in Brooklyn: we were in a better position to construct complex base models, thanks to our 3D modeling skills (and pool of participating students), and the combination of Joel, myself, and a couple of students who were already building their capstone and thesis plans around it. Helmut had a research interest, and a crew, to build quirky Android mobile applications like NewsFlash, and the prospect of building a touch table from scratch was appealing to a subset of the participating faculty and students in Bremen.

The format was coming into focus: the Brooklyn team would handle the core technical development of the Betaville server, client, and ancillary website design tasks, while pursuing whatever experimental use case partnership opportunities might arise in New York City, while the Bremen group would build the mobile AR client and NUI interface prototypes and seek out user–partners and use cases in Bremen and among their extensive EU network. We would endeavor to seek funding as necessary to support our respective efforts and coordinate/interact on an ongoing basis through student exchange and regular reciprocal in-person meetings in Brooklyn and Bremen.

Through M2C, Betaville-focused coursework would drive their technical development; in Brooklyn, we built a mix of optional projects within the regular course offerings in 3D modeling, game design, and interaction design, while encouraging (but not prescribing) capstone and thesis work for students, paid assistantships for Digital Media and other master of science students and a recurring elective Betaville project course whose participants would include not only myself and the students but also third-party participants.

3.9 Due Diligence in the New Soft City: From Least Vulnerable to Most Beneficial

We proposed to move as far beyond the "art world" as the constructivists and situationists; we were giving up the regulatory framework of galleries, curators, museums… an entire industry of regulation and segregation from mainstream urbanizing. The social potential of 7000 Oaks was all positive, from inside Documenta 7–8: the trees might or might not be planted, and the art manifestation might or might not achieve the difference. Betaville, if taken up in a world where entire districts could be bulldozed for the sake of a "new vision" or "redevelopment," and the most vulnerable populations and communities would be first in line for disruption and dislocation, must at least come into the broader community through groups with locally effective checks and balances of their own.

At the same time, the art "world" might well provide a very safe zone within which to experiment. This approach to institutional culture as a kind of sandbox shouldn't be construed as cynical about its value as an engine of cultural innovation, but rather an effort to make appropriate and clear-eyed use of it.

Tech-wise: To offset the risk of actually damaging the development of a mainstream culture of creative and participatory urbanism by associating it in people's minds with an immature, frustrating, ineffective technology, we would—in a first phase—use the prototype ourselves; once we are able to use it effectively, then it would be the time to collaborate with third parties, soliciting along the way whatever improvements or alterations might better suit in the field, in the hands of relatively small groups otherwise expert and/or experienced but also with the kind of sustained interest in the issues that would both motivate and support the right software development program: beta-testers and expert users in the sense of the "use

case," and the general communication infrastructure, if not necessarily of the current design software tools per se. At the point at which Betaville had proven itself a nontoxic asset at the relatively small scale, with already-engaged and well-supported "expert stakeholders," we might honorably propose to let the technology loose.

Social-wise: The first level of social engagement was as simple as an effort to responsibly and concretely include the public sphere as a field of action within the respective curricula of the two participating schools and other educational partners we might work with or inspire. The Brooklyn and Bremen academic programs both led to bachelor and master of science degrees, in areas spanning the creative and technological aspects of interactive media creation. In principle, the host institutions, as hybrid polytechnic-universities, would provide a liberal arts foundation for citizens, commensurate with their empowerment as innovative creators and developers.

Whatever assumptions the students might have made about digital media as experimental art, a commercial trade, or the power to change the world, a genuine effort to build a real-world locally oriented synthesis of social–cultural use case, user-centered design, and technology innovation would provide a good opportunity to at least have access to genuine sustained engagement as preparation. The extent to which such a project might be sustainable over time, while providing the right learning opportunities, was a design problem worth approaching. Whether the project ultimately succeeded by fledging into a fully open community-sustained medium, or as a useful soft teaching laboratory, we couldn't predict. Ideally, and quite possibly, a network including the schools, students, and third-party developers and users might provide for an ongoing social practice.

The cardinal requirements of Freiheit und Einsamkeit (Freedom and Solitude) for the von Humboldt model of Bildung durch Wissenschaft (Education through Research) were hopefully less necessary than they might have been under the imperial and religious governance norms of the early nineteenth century in Germany. They were certainly less consistent with potentially heretical work in the physical sciences than with potential basic improvements in the exploitation of communication technologies by wired democracies in the early twenty-first century.

City-wise: Open-source software development communities, which have provided tools like Apache, Linux, and jMonkey, have led the way not only in toolmaking but also in the development of cultural practices that could be brought explicitly into the cultural and civic realms, with immediate effect and long-term benefit. Arguably, critical considerations of virtual world governance issues have been compromised by a conflation of virtual worlds as private property (which commercial ones are) and public space (which many virtual worlds represent or mimic to some extent). In such situations, the debate can never extend beyond the conflation of community standards with house rules. As an example, Timothy Burke's notion of the developer as sovereign (Burke 2004), while compelling from the perspective of an avatar, may not offer a particularly useful model for "upgrading" constructive political processes for the un-virtual public realm. A priori, a virtual public participation environment must itself be public both in its etiquette (terms of use) and its infrastructure (software). On the other hand, the possibility of providing a 24–7 network of communication between mutually irksome user–developers of

common informatic resources oriented to urban future-making that would emulate or port the open-source software development communities, and indeed help develop a few of them further with this explicit purpose in mind, could provide for exactly the kind of broadly inclusive ad hoc bootstrapping culture through which many software engineers have developed their own and each other's technical expertise and common goods.

Betaville, of itself, might not fully constitute an open-source city, but it could well help define the physical contours of one through web-based networks and mutual development of social media ecosystems over time, to the benefit of those virtual networks as civil sub-societies in their own right. There was and is real potential for a general *augmentation* of engagement, and in due course aggregate skill, commensurate with the fantastic development of the required resources—hardware, software, networks, and information—since 1970.

Every aspect of the project was to be—and to date has been—verified in two modes:

1. Professionally, in camera: verification of specific aspects of the work by competent qualified specialists.
2. Empirically, in the aggregate: we know Betaville as engineers, as developers, as users, as concerned artists, and as citizens. As a public space, Betaville must be viable in all of its domains and as an integrated whole.
3. Openly, in the field: the end user is always right, for now.

Chapter 4
Development

> The administrative structure itself is at fault because it has been adapted beyond the point that mere adaptation can serve. This is how human affairs evolve. There comes a point, at increased levels of complication, when actual invention is required. (Jane Jacobs, *The Death and Life of Great American Cities*, 1961:415)

4.1 Square One: Designing the Initial Performance Specification and Methodology

By the time we agreed to collaborate on the Betaville project, the bachelor's and master's programs at Brooklyn were up and running, and most of the bugs were out—the rich mix of student backgrounds, the foundation curriculum, and team project course structures, all seemed to be in reasonably good tune, including enough electives to provide for a semester abroad… a reasonably good fit with the rather more mature and flexible Digital Media and Media Informatics requirements at Bremen, including long-format courses and a much larger fraction of "special topics" courses which could be re-tooled without too much fuss as components of a regular changeover of research initiatives.

The physical facilities and equipment selection had been focused through my own experience as a student, teacher, and artist: learning to redefine on an ongoing basis what tools, materials, and facilities might best serve a purpose, with a minimum of overhead. The related question, of selecting software and development environments for the various course sequences, was beyond my direct competence to evaluate. At the same time, the people who might have advised me seemed to feel so strongly about one programming language or framework over another, that it was hard even to refer to experts for sound advice. The experts around me would advocate passionately for one solution or another… invariably, it would agree with what the particular expert might be an expert AT, and invariably, no consensus would emerge. Should we use the well-documented commercial Max/MSP for our visual programming environment for real-time multimedia, or its open-source variant,

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PureData? Should we have our command-line programming foundation in C++, like other "Poly" (the nickname for Brooklyn/NYU Polytechnic) freshmen, or Java, which would integrate much better with our use of Processing for graphics and web development?

At that point, a lot of indie game development was still being done with Adobe Flash, and I had a strange association with the NYU Games For Learning Institute, which initially called for the use of Microsoft's XNA to please its sponsor… John Klima, who had developed our Game Development course sequence, had set it up to run with Torque, and his successor (Mary Ann Benedetto) had followed suit.

There are dozens of game engines, i.e., software development frameworks for building computer games, providing pre-built physics and scenegraph components with which individuals and teams at every scale can build games without having to code everything from scratch. Engines for development for the major consoles like XBox and PlayStation may be more or less expensive, according to evolutions from year to year in the marketing strategies of the publishers; as the market evolves, new development environments or long-established languages may wax or wane as creative tools, learning environments, or career assets for new graduates.

Accordingly, I performed a simple controlled experiment, with what ultimately became a sequence of American and German students, with good general preparation but no prior investment in the question: I would define a coherent performance specification, and charge them with identifying the game development tools that would meet the stated requirements.

The specification was simple enough:

1. Open source—in a situation where half the students were capable and inventive programmers, and we might at any point need to be able to radically alter the underlying framework itself for projects we could never completely define in advance (experimental, remember?), the code must always be accessible, down to the last curly brace.
2. Liberal licensing terms—one of the founding premises of the program was that students were encouraged to think entrepreneurially about their work, for which they retained the intellectual property. The possibility that a student might want to develop a personal project to take to the marketplace, or even that they might be motivated to do better-quality coursework by the idea, should be crucial.
3. Licenses must be affordable—for the school to equip workstation, for students to be able to set up their own laptops, and for third parties to eventually be able to participate without cost as a barrier to entry.
4. It had to really work—it would be crucial for the environment to provide for a professional level of overall quality, from stability and scalability to documentation and production values.
5. Those virtues must be efficiently achievable, i.e., by students with mixed levels of technical expertise, working in small teams for short periods.
6. Good-quality documentation. This was reasonable to expect from commercial products, by no means to be taken for granted with open-source code.

The first student with whom I did this was Greg Becker, an undergraduate who had transferred into the program at Brooklyn from Mechanical Engineering.

Starting from the Wikipedia list of every known game engine and/or development environment, he came back with all the candidates still in the running before the crucial test of trying to make a prototype game: the list had one item on it, jMonkey.

This was CRAZY. Of all the game development environments we might have expected to adopt, it had never occurred to any of us that the durned thing might be written in Java.

When Arne von Ohsen and Robert Brauer duly arrived in Brooklyn as the first two exchange students from Bremen, I repeated the experiment, without telling them anything about the prior result, as their first assignment, and the added charge of producing a simple prototype game to prove out whatever conclusion they might have come to about what our first choice should be.

At some point, Arne asked me timidly if a Java solution might be acceptable, knowing full well the accepted wisdom that java is too verbose, too slow, and too inefficient in general for game applications… when they finally appeared together at my office door, they were both clearly nervous. I had had plenty of nervous students at my office door before, but this was the first time I had students this fearful in front of me who HAD done the required work…

Students express nervous agitation in very different ways. Robert, a quiet sort at the best of times, was completely silent. Arne, a happy extrovert when relaxed, was giggling nervously… After rather a long pause, and a short titter, Arne blurted out: "Do you like cats?" to which I replied more or less that I did, though we didn't have any at home, for the sake of my wife's allergies. "Well, perhaps you will not like our game." And he tittered again.

Their prototype consisted of a very simple game, running on one laptop while communicating with a server on the other. In the game window, a square island with a very complex jpeg texture sat in the middle of a shimmering ocean of beautifully rendered waves. At one corner of the island, a volcano spewed what looked like giant marshmallows, clearly a crudely modeled approximation of sulphurous steam. A sort of brick, which could be made to move with the keypad, sat on the flat part of the island. At intervals, the laptop would give out a sound like a very small cat screeching, and a very complex 3D model of a dark green cat would fly out of the volcano, and fall to earth somewhere n the island. The object of the game was to move the brick to the cat's location to "squish" it before the cat disappeared, a matter of a few seconds, for a point, which was duly recorded on the server machine.

Java combined relative ease and efficiency of use for a mix of programming skill levels, free IDE's, and (as of 2008–2009) no-fuss OS compatibility. We could work with a school, ngo, or agency without having to ask them to buy software first; we could work with a very large pool of developers; the Bremen and Brooklyn programs already both worked with Java as their language of choice; and, of course, the one game development environment we had identified as most promising for our purposes was written in Java.

We were in what I now think of as the "Stallman Window" with Java, the period during which it was effectively free and robust on what were then the three major operating systems: Mac OS X, Windows, and Linux. Sun had released Java SE and ME under a GNU GPL license in 2006, and was yet to be acquired by Oracle in

April of the following year. We decided NOT to try to make sense of claims and counterclaims about Java's general performance as against C, C++, or Objective-C, but rather to seek out the specific frameworks and engines that would meet our needs, as well as we could anticipate them.

Our range of use cases, or rather our intended hack of the massively multiplayer game format, was unlikely to suffer from the known side-effects of Java-based programming and/or game development. The MMO genre is all about real-time rendering of complex character animation with elaborate effects from physics to smooth shadow-casting, pyrotechnics, and so forth, at very high framerates.

For a moment, both were silent, not realizing yet that they had verified a result, and demonstrated jMonkey's ability to provide Betaville's basics: graphics performance, build-ability, remote journaling.

They had proven our first point: Betaville's core functions were implementable.

4.2 New in Town: Working with the Existing Codebase and Developer Communities

Work on the Betaville as an eccentric implementation of jMonkey started in earnest in late 2008, just as the jMonkey developer community went through a "changing of the guard" from its original founder-leaders, Mark "MojoMonkey" Powell and Joshua "Renanse" Slack. They had set out to build a graphics API in Java, in spite of the accepted wisdom that Java itself was too slow for such applications, and to address the related lack of a Java-based game engine. They had intended to work from first principles, based on David Eberly's 3D Game Engine Design (Eberly 2001).

By the time Betaville showed up, jMonkey 2 was an effectively (though not officially) stable release in some commercial use, including the work Josh had undertaken for NASA to upgrade a hitherto Java3D weather simulation project. Josh had moved on, to build Ardor 3D, whose brand image might be better adapted to professional contract work, and whose codebase could have cleaner code provenance than seemed possible to him from within the ad-hoc jMonkey scene.

While Josh was working on the more professionally/commercially oriented Ardor 3D engine, the second wave of jMonkey core developers, including Betaville's own Skye Book, were starting to think through what would eventually become jMonkey 3.

Skye started to get involved with Betaville as an undergraduate. Thanks to the Rockefeller foundation's support of the Betaville project through its Cultural Innovation Fund, I was able to provide him with a full assistantship as Betaville's "lead hand" in Brooklyn—possibly the best and most crucial investment Betaville made in its early development.

Engaging the developer community up front was a proven method for the experimental media center. Frustrated by the quality of the school's own web services (Cold Fusion, Blackboard, Peoplesoft), eager to have the school's networks connect to related professional and creative communities in general, we had undertaken a multi-year "dating" project with the Drupal developer community: putting up our own

website built with Drupal was actually only one piece of a teaching/development ecosystem, which included hosting the annual Drupal Camps, and offering courses and support in-house. When Skye took charge of establishing the working relationship between the Betaville and jMonkey crews, we had a pretty good idea that the combination of codebase, developer community/network participation, and a multi-year cross-curricular development project, fit together well (if not necessarily neatly).

It was no surprise that Skye eventually became one of the core jMonkey developers, or that his experience with real-time interactive geodata got him his first job through fellow alumni. Like many sophomores, he had struggled mightily with the elements of programming, but had invested the right kind of deep personal obstinacy in mastering it, and the right kind of openness to what it might ultimately be good for. As of this writing, Skye is working with two other alumni from the program for Technicolor, developing mobile video applications, but still active in the jMonkey community, and with Betaville.

The value of the codebase as a software resource to build Betaville is obvious. Freed from the need to build out an entire engine from scratch, we could seriously undertake an experimental implementation within the scale and other constraints of a small research and development group, within the calendar and attention span of an academic research project. Less obvious, but equally crucial, is the ongoing support provided by the engine's developer community of both the application development and the learning curve adventures of participating students, a critically important informal complement to the formal curriculum. Even less obvious than that, and all the more valuable for being otherwise difficult to demonstrate from within academia, is the lived experience of voluntary exchange, mutual support, and common investment of software engineering as a mode of civic engagement.

Betaville, as a participatory design platform, could only make complete sense as a cultural initiative and process as open-source software in precisely this kind of arrangement, on the understanding that the use of Betaville and its software infrastructure are ultimately two modes of the same kind of civil exploitation of prior generosity, reinvested with interest as an informal public good, with ancillary personal benefits in the form of social intercourse, ongoing informal development of individual skills and understanding, and an ongoing process of upgrading of the social networks and physical built environment.

This was not so much an ideological commitment as a pragmatic design response to the mix of faculty and student needs within practical constraints, cross-referenced with a program calling for scaling into broader public use and development over time.

4.3 The New Soft (City) Pipeline: From Radical Prototype to Robust Testbed to Soft Public Space

Betaville is an extreme interpretation of the massively multiplayer online game genre, to the extent that it can easily be confused with the distinct category of virtual worlds, crossed with the very different domain of 3D design tools. There are dozens

of each category in development and use, at every level of development and adoption from one artist working alone on a multimedia performance project to major multinationals supporting the work of networks of professions for everything from movie production to skyscraper architecture, engineering, and construction.

Both as a software suite, and as a shared design-development environment, Betaville would need to grow in distinct stages, with very different mixes of capability and usability. Accordingly, we broke the project pipeline down into segments.

First, to verify and demonstrate the practical possibility of the general category of applications: what the national Science Foundation would call a "socio-technical system" in which a convincing and reliable representation of an existing urban place could be shared online, and provide for the very separate functions of information gathering, informed discussion, and iterative design display/development appropriate to collaborative participation in a virtual environment designed to address a real world understood as itself an "open interactive system" (Innes and Booher 2010:2). At a technological level, the radical element was simply virtualization, or literally construction of another order of "open interactive system." At a socially creative level, we would experiment with the possible alternative forms of sample places in complete freedom, on the understanding that there was no direct engagement of the physical city's planning process.

Second, to provide an experimental infrastructure for hypothetical and speculative projects, both in terms of software development and urban "future-making": Betaville, as a toolkit, could be used to build any number of variants from abstract sketching tools at a regional scale to physical simulations or emergency response planning. As a mirror world, it could provide everything from presentation/visualization of public data to role-play and science fiction scenarios. Somewhere in between the extremes of the technical and creative possibilities, we bracketed the core experiments in open creative collaboration on viable alterations to current physical districts and cities over long periods of time.

Third, to provide a robust development environment for real people and communities to use in potentially high-stakes situations, and ultimately to develop into new variants as their evolving needs and abilities might call for.

4.4 Evaluation and Assessment: Instrumentation and Study Survey Implementation

One of the most counterintuitive engineering issues turned out to be Betaville's instrumentation schema. In principle, there would be some statistical measures of use patterns and/or system performance. Software instrumentation is the set of components of an application or system that record and present data about its functionality in use—traditionally built by and for developers and system administrators to track the system's performance, and as diagnostic tools for interaction designers to identify and fix those parts of an application where an unexpectedly high proportion of users get stuck or give up.

In the visual arts, quantification and quantitative analysis have a strange history, from the mysticism of Pythagorean mathematics and neoclassical theories of formal harmony to le Corbusier's Modulor scale based on two twined Fibonacci series, which Iannis Xenakis had used to great effect by essentially randomizing sequences of window mullion spacings based on it for large buildings at Chandigarh and La Tourette. As far as I knew, the first generation of Information Aesthetics had been the last serious attempt to quantitatively define aesthetic objects or experience a priori, although any number of artists had gone on to develop generative works—both in modes of the first generation of information aestheticians' less ontologically ambitious efforts to automate the composition and performance or construction of particular sets of new forms, in situations where the expectation was either aleatory (chance effects) stochastic (actually, variation IS the theme! again!), or simply ornamental.

As a community organizer, I had the deepest suspicion of the motivation and utility of quantitative analysis in the domain of urban planning and design, having dealt more than once with traffic engineers who could not understand that higher average speed was not in itself a public good.

The expectation that Betaville would somehow produce findings in tabular form was a given, but we did expect that performance metrics would usefully inform the design and development cycle for the Betaville platform.

Accustomed as we were to the idea of software instrumentation as a class of utility for developers rather than end users, and (still) to the idea that end users and developers were separate sub-communities, we took quite a while to realize that much of what we thought of as instrumentation actually belonged in front of Betaville user-developers as components of the public record: Where did large concentrations of proposals indicate community interest? Where did large numbers of long comment posts about particular proposals indicate controversy, or many iterations of a proposal indicate a sustained and coherent initiative?

As a researcher affiliated with the Games for Learning Institute, I had raised (first question, first conversation about the proposal) the issue of instrumentation as fundamental to the project of designing educational software in general. Accordingly, I had found myself as one of the engineering school crew and the proponent, assigned the direction and execution of the instrumentation component of what was to be at least a 3-year interdisciplinary research collaboration. Unfortunately, the collaboration was subject to another of the pitfalls of loose research consortia: I, and Joel Wein whom I had recruited to help me actually deliver on this responsibility, were in charge of a component that could only properly be developed downstream from the rubric-defining and prototype design components of the collaboration, whose timeline was concurrent! The outstanding obligation to deliver something of useful substance to Microsoft Research in exchange for their money was definitely on my mind, and including a serious instrumentation component to the otherwise separate Betaville project seemed like a reasonable solution to the otherwise intractable problem of the distributed G4LI project workflow.

In addition to the near-term value (and demonstrated ease of provision) of a basic instrumentation utility for Betaville in the studio and lab, there was a long-term

Fig. 4.1 The Betaville interface, showing proposal/version menus

possibility that usage statistics might at some point become useful information resources in use: how many people saw a particular proposal, commented in favor or against, contributed or built alternatives or improvements, etc. would be relevant to deliberations about how to decide between proposed alternatives, or for a city councilor to gauge the actual level of community interest in an issue, rather than responding to any one persistent advocate, on an ongoing basis.

In practice, however, our real needs were more than provided for by the combination of server logs on the back end and the fact that Betaville was already explicitly self-documenting on the front end. Acting on the one hand as an open information resource and aggregator for a scale-accurate context model, information and external links to specific objects, and a recoverable sequence of iterations of any given proposal model, with each iteration of the model signed and time-stamped along with every comment along the way (Fig. 4.1), supported by user and project profiles through the associated website.

Insofar as the core functions of the application were variants of "instrumentation" in the sense of providing records of patterns of use over time, we didn't have particularly efficient or effective access to usability expertise at the research level, and the team might well not be big enough to both build Betaville effectively AND undertake a formal study of its use… and our first year or two were going to be taken up with basic development with user groups too eccentric and too small (a couple of dozen at a time) for what would amount to a whole other research project, we elected to proceed with a combination of disciplined technical development and close collaboration with first-round users, rather than systematic study of them.

This was a difficult choice to make, and even to consider. The appetite of many funding bodies for formal evaluation and assessment protocols is substantial, and of course consistent with academic research mandates and standards.

Mariela Alfonzo, a postdoctoral fellow at Brooklyn, created a general-purpose user survey on the expectation that all of the users in our managed deployments (with partner schools for enrichment programs, or workshops we would organize), and that some proportion of our "wild" users would also participate. By the time it was compete, however, the questionnaire was 17 pages long! This did NOT include the question about household income, to which I had objected. That particular issue came to a head as we were organizing an informal brainstorming workshop cosponsored by the White Box gallery and Issue Project room, to which we had invited a variety of professional planners, artists, architects, and real estate developers. The idea of asking participants to disclose their household income as part of their introduction to an open collaborative technology was clearly bad etiquette and bad rhetoric, in the context of a party of peers… which raised the issue of what it might mean in contexts where we had gotten inured to analogous indignities under the rubric of "social justice." If I wasn't willing to subject my peers to this kind of invasion of privacy, what business did Betaville have putting the same question to high school students? Closer to home, what sense would it make to ask the collaborating students in Bremen and Brooklyn to answer the questionnaire? Many were engaged in the project as coursework, or a research assistantship. IRB protocols for procedural protections against compelling students to act as study subjects would not guarantee that the derived tabular results would have any substantial value/integrity for evaluation or assessment purposes.

I was in talks at the time with the Urban Assembly Gateway school principal, about a proposed Betaville deployment there as an after-school enrichment program. The school was prepared to provide every kind of demographic information about participating students, subject to parental consent. Insofar as the school itself was mandated to serve ambitious students from underserved communities throughout New York City, a certain level of means assessment was par for the course, and they were even willing to provide blinded data if I needed it, i.e., a set of averages over the whole group. On balance, I decided that it would make more sense to engage students as creative partners with ideas and skills, rather than test subjects with statistical profiles.

This helped refocus the instrumentation strategy on the kinds of working relationships Betaville was ultimately intended to foster and support: citizens seeking information about the quantity, kind, and engagement level in new proposals for a particular location; city councilors eager for current information about community sentiment in regard to proposals under consideration, and/or alternatives; prospective developers interested in early-stage feedback about new projects, and the potential for win-win variants that might not have to go through contentious approvals if key concerns could be addressed early on; prospective investors or residents interested in local opportunities and issues; artists and designers committed to proactive collaboration with local stakeholders.

In some sense, Betaville might actually serve as instrumentation of the physical city, including (see Sect. 5.4), but also beyond acting as a front end for official geodata: a presentation medium for public databases, but also an always up-to-date public record of its own process.

4.5 Both-Ends Usability: Designing for Initial Skill Levels in Users and Implementers

In the effort to conceive, design, and build Betaville with a view to its intended use cases, or even within the operational framework we had in mind, implied a new level of engagement of an unusual assortment of usability issues.

In relation to end users, Betaville's interface specification was already a "perfect storm" of requirements. We were proposing to build an application to be shared by the broadest possible cross-section of the full spectrum of communities, from students to neighbors of every age and background, while providing access to deep information resources and a rich mix of navigation, commenting/discussion, and 3D content contribution, in a form that would be recognizably "true" in qualitative terms (Hey, there's my house! and that's just what it's like there!) but also compatible with a planner or engineer's idea of meaningful information, from curb heights to topography and building envelopes. Could the same interface be intuitive and un-intimidating for extremely novice users, while providing for the kind of deep engagement that the underlying use case would require?

As researchers engaged in ongoing development of strategies and tools for formal informatics and digital media education at the college level, and as directors of a multi-year project that would require the effective engagement of several cohorts of students to build out in the near term, and eventually networks of volunteer and third-party contributors to a robust codebase, we (gingerly) approached the issue of developer usability, and in analogous terms: what combination of development environments and code architectures (not to mention documentation) would best provide for a wide range of initial skill levels and also promote and support the long-term development of upgrades and extensions?

The difficulties of providing the right mix of up-front ease-of-use and long-term power weren't enough to fret over. There was a related set of usability issues to consider at the back end of the project, i.e., in terms of the usability of the codebase for prospective developers and administrators of future Betavilles.

One of the performance specifications for the choice of a platform had been the quality of the documentation, but there is of course more to it: it ought to be reasonably easy for a novice to set up and run, and clearly enough organized for ongoing development to proceed efficiently.

Beyond a predilection for clarity of structure and purpose, we had our own needs to consider, in view of the near-term distribution and hand-off cycle for software development, within which the project time unit was about 13 weeks, i.e., a

semester for one student programmer to find their way around, code, troubleshoot, document. Even if the very same student is coming back after the holidays, that's the unit of attention span.

4.6 Content Development: Case-Specific Approaches to Base Model Production

The New York City College of Technology, in Brooklyn, offers a Bachelor of Science degree in Architectural Technology. Originally set up to train architectural and engineering drafting technicians, the program now operates as a large and competent para-architecture program. They have 900 students. Every year, every freshman is instructed to produce an accurate 3D model of an existing structure. This is one of several architecture, landscape architecture, digital media, and civil engineering programs in the city with similar requirements.

It is typical for a design/build proposal to include production of a 3D model of not only what is proposed for a site but also of the site itself. For major projects, this can include entire neighborhoods, at least to the level of detail of an accurate massing model. For public-sector projects, competitive bidding requirements actually necessitate the production of the same context models by several firms at a time.

The first case we had to deal with was of course the core Betaville team's needs for our first set of base models. Architects expect very detailed geometry at the building level: mouldings, mullions, door handles… and precise alignment of building components. Planners and engineers expect geographically accurate maps. Game designers expect very simple geometry for the world and any architectural elements in a scene, with richly detailed texture bitmaps to make up the difference: relief, materials, any cast shadows "baked in."

The current mass medium of any relevance was Google Earth: proprietary massing models (the simple grey ones) derived from commercial Sanborn maps licensed by Google, supplemented at that point mostly by volunteer contributors. The idea of volunteer modelers contributing so many hours of work to upgrade what seemed to be more than anything a prototype for a commercial locative browser, operating at the behest of the world's biggest advertising firm, was both terrifying and inspiring: if they would do it for Google, they might well do it for each other! The quality of the models, on the other hand, was typically unsatisfactory for even our immediate purposes: very crude geometry, augmented with very heavily compressed photo textures.

Readily available references like maps might or might not offer the right terms of use. When we set out, New York City's GIS information was available by paid subscription, with ambiguously worded terms of use. It wasn't going to be prudent to simply lift them, and hope that "fair use" would cover us as academic experimenters. After all, if things went well, we were going to be spreading the models all over the internet! While many online GIS viewers, for instance, were expressly designed

to keep the actual data on the server side, jMonkey managed assets by caching them on the user's hard drive. This was great for download times and animation/interaction, but meant that we would sooner or later have to be working with the models as freeware, including any proposals uploaded by users down the road.

The business of providing an efficient way for users to geo-reference (or ideally auto-generate) models of new locations to initiate new Betavilles was also a goal. Suppose you want to set up a new Betaville in Montreal. Even if you have 3D models in hand, in a format that will readily upload or convert, AND with the right level of geometric complexity/detail, making sure the scale and placement are accurate could be more trouble than it's worth.

Skye imagined, and then built, a good solution: at the press of the right button, the scene would pull down openstreetmap geometry (this was possible thanks to the adaptation of Betaville to the GIS standard UTM projection, not a typical feature of an online game). That geometry could then be simply dragged and dropped from the user's cache directly in AutoDesk Maya, our default modeling tool.

This provided three crucial utilities: first, a way to auto-populate an empty location in Betaville itself, to orient someone coming to a new location, or show how the grid might extend beyond the model as built so far; second, to provide a starting point and reference for hand-built models in 3D authoring environments to set up a Betaville; third, a fast way to geo-reference a freshly imported base model, verifying scale, placement, and orientation with one click. The auto-generated geometry resolved as a lot of little triangles in rows, without metadata, but it did group them according to the imported entities. In principle, this would make it pretty straightforward to build a district out of complete streets, each of which might be tagged or associated with external links in its entirety, rather than separate single-block segments—a lot easier, a lot faster, and a lot more accurate than trying to register a large base model by checking corners against coordinates.

We started with the Brooklyn campus and its vicinity. Not only would it provide the best experimental approximation of a typical use case, i.e., people working on familiar environments but it would also provide the most conveniently verifiable subject matter for the modelers to work from and check against as they proceeded. We had access through the civil engineering department to a full set of plans of the campus itself, and the hope of a partner in model development and ongoing use at City Tech. Furthermore, there was a real prospect of other uses for the model in-house: plans for building out the campus and changes to MetroTech Center, the corporate-academic-public agency district in which the school sat, and the availability of a ready-built "world" for use in game design and modeling classes might be valuable assets for them, or students interested in building experimental wayfinding applications or other great ideas that hadn't occurred to anyone yet.

This was also a good opportunity to experiment with different graphic approaches to the landscape and buildings (Figs. 4.2, 4.3, 4.4, and 4.5).

The general approach was to provide, in recognizable form, the basic graphic capabilities and effects common to CAD, maps, computer games, and architectural rendering in a single environment.

Fig. 4.2 Combining strongly simplified geometry with a detailed photo texture, consistent with standard game world design approach

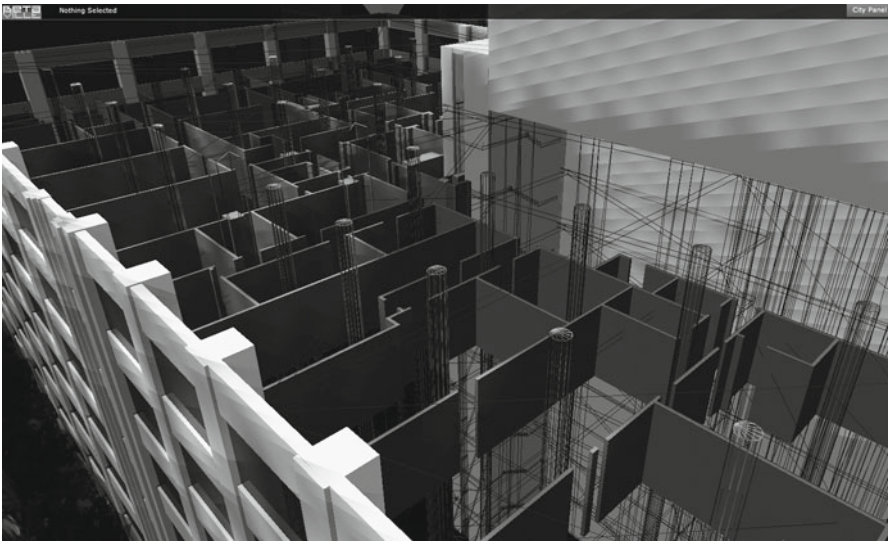

Fig. 4.3 Cutaways

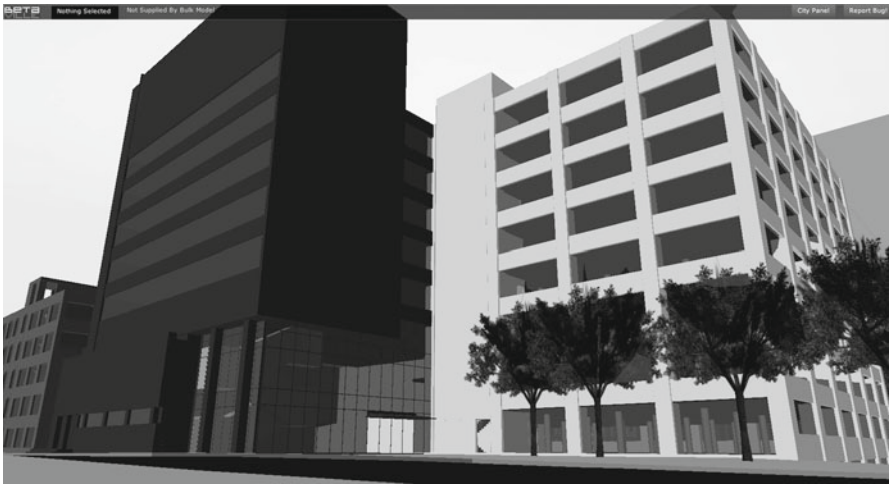

Fig. 4.4 Simplified perspective rendering, pedestrian point of view (see also Fig. 4.18)

Fig. 4.5 Integrating cartographic scale: Liberty Piers

4.7 Features: Assumptions and Early Feedback

Jane Harrison, a principal at ATOPIA, has been working with computers and computational logic in the context of innovative architectural design practice and teaching longer than most, starting at the Architectural Association in London, she went on to teach the first architecture studio using McNeel Rhinoceros® at Yale in 1998,

and others thereafter at Princeton and Columbia, with various combinations of equipment and software.

At Yale, Harrison was struck by a new fact of CAD (computer-"aided" design): any student armed with a few carefully deployed number-pattern tricks could effortlessly produce endless formal variants of only one actual idea. For her, the conclusion was obvious: architecture as the production of novel "cool" (or less cool) forms had reached a new level of triviality, forcing a new level of engagement of the aspects of design which were NOT being augmented by digital tools. Harrison saw then that the outburst of formal elaboration enabled by CAD would inevitably force architects to rethink architecture in terms of agency: how, what and why architects might do with new forms, and what difference those forms would make in the world.

For Harrison, ubiquitous 3D modeling in the studio has become a fetish, adding more hazards than aid or augmentation to the design process by short-circuiting the rapid iteration and recombination of ideas that is the core of the creative/design process, particularly in nonstandard situations that call for designing from first principles rather than standard practice or design patterns. In her words, "Computers are wizards, seducing us into the feeling we are being creative and working through problems."

In essence, she argues that many architecture students have given up sketching in favor of computer modeling and rendering, and more and more professionals are coming to rely on chance or automated/parametric software tools to provide variations from which to choose, essentially simulating the ideation-invention-iteration process, with the seduction and authority of digital precision at every stage masking the lack of what it actually thwarts, if used inappropriately early in the workflow: the creation, evaluation, and evolution of new ideas for built environments.

A seemingly long way from work they did at the AA in the 90s, Jane and her partner David Turnbull recently completed work on the Water Bank School in rural Kenya, communicating with their site team by means of Flickr, email, functional parametric diagrams, and in lieu of construction documents or conventional working drawings, a (of all things) Rhino model, the most effective medium through which to communicate the completed design to the Swahili-speaking rural builder (Fig. 4.6).

There are certainly counterexamples to Harrison's critique. The Beijing National Aquatics Center, nicknamed "the Water Cube," is one particularly encouraging precedent. The famous bubble surface is actually a spaceframe, i.e., the support structure of the building, developed for the combined value of its imagery AND its load-bearing capacity as the structure of an insulated greenhouse (Fig. 4.7).

Arup's Tristram Carfrae, one of the lead engineers on the project, characterizes the workflow as "highly collaborative and proactive to the point the Water Cube does not have a single 'author' but is the creation of a team of Chinese and Australian engineers and architects from Arup, PTW, and CCDI."

In 2003, the Water Cube team of Australian and Chinese architects and engineers were able to develop a simultaneously symbolic and technical solution—Carfrae:

> The geometry was prescribed and adjusted initially using spreadsheets and Microstation, later using a bespoke piece of software. But the sizes of the structural elements and interconnecting nodes was then decided by an active system made for this project. This iterative system determined the structure based on material properties, input geometry, and applied

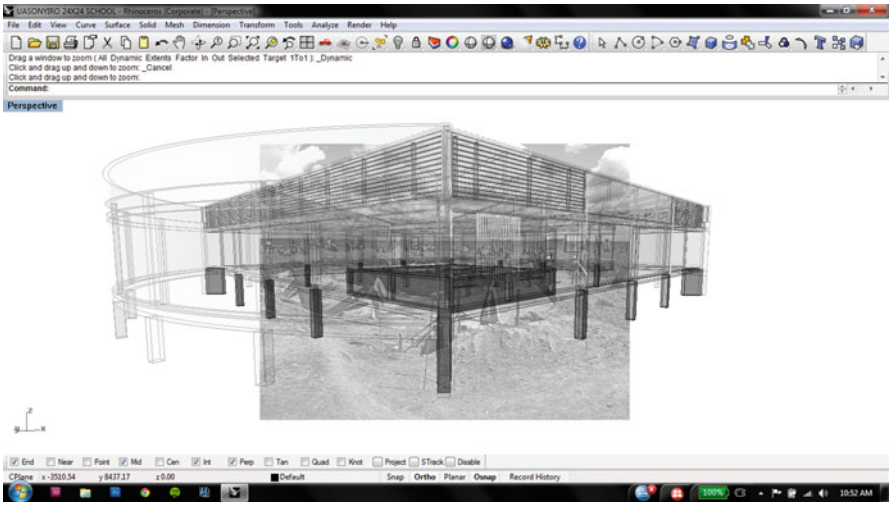

Fig. 4.6 Rhino rendering of the Water Bank School, Kenya, superimposed on photo. Image Courtesy of ATOPIA

Fig. 4.7 Beijing National Aquatics Center (the Water Cube)

loads (gravity, wind, snow and seismic) and member strength formulae contained in the Chinese codes for structural design. The output from this process was in the form of calculations that could be directly submitted to the Chinese authorities for approval and a 3D CAD model that had all the geometric information necessary to build the actual structure… most design outcomes were considered simultaneously by a team of twenty or so people who communicated intensely for a four week period until the solution crystalised, fully formed, from the melting pot of ideas and desires. (from an email he sent in reply to my query, July 2012)

That 4-week process happened 10 years ago. Now, the free Grasshopper 3D generative modeling extension for Rhino can be used to do this kind of work on a garden-variety laptop. For a student, that's less than $200 in software, and they have to have the laptop to go to college (or play SimCity, which is entertainment) in the first place. Software extensions to predict the technical performance characteristics of CAD designs go from LEED plug-ins for Sketchup to visualization and simulation suites for AutoCAD (many of these are available to students for free).

As the demand and drive for high-performance buildings develops, the working relationships between architects, engineers, and software developers will continue to mutate… fast. At the other end of the scale, the willingness of key subconstituencies to participate at all may yet require that we provide for different levels of intellectual property within the Betaville ecosystem: artists, architects, and others may be much more willing to "share" their first ideas for discussion and development in an open forum if they don't have to give up ownership first. The modeling pipeline: Our ambition at the outset had been for Betaville to include an in-world modeling tool, so that there be no need for third-party applications to build proposals. This turned out to be impractical in the near term, unnecessary, and even potentially counterproductive.

We assumed that it would be more desirable for users to simply build directly within the Betaville world, as they might in Second Life. However, the process of actually creating a fully functional model-building environment inside jMonkey was either altogether beyond the reach of the team, or at the very least likely to drain coding resources from the development of the world itself.

In Sweden, Rikard Lundstedt had built what he called "first-person builder" applications with jMonkey: a participatory tool for laying out furniture and equipment and furniture in a neonatal hospital ward, and another for "curating" virtual exhibitions in a model of the Konsthall (art gallery) in Malmö. In either case, though, they worked by importing pre-built objects or extruding simple shapes. Rikard was certainly willing to help us take the approach further, but it would be a whole other project to build a modeling tool as fully featured as Sketchup, Blender 3D, or the Rhino beta release for Mac OS X, all of which could be downloaded at no cost, and were supported with lots of professional documentation, Youtube tutorials, and user communities of their own.

More importantly for the already-professional users who might be looking for new ways to engage stakeholders, we didn't want to require them to rebuild their models from scratch within Betaville… both for the nuisance, and the likely deterrent effect of the extra chore. We therefore concentrated on providing for the simplest possible file conversion and upload paths from open file formats, noting along the way whatever might be needed to convert or export from proprietary tools to file formats we could work with within our licensing requirements to keep Betaville free and open: Wavefront (.obj) and Collada (.dae).

The Betaville initiative presented a disconcerting echo of my original imprecise sense of the need, as an artist and community organizer back in Toronto, for a "phantom platform": the typical use case was much easier to define than the technology, combining as it must elements of disparate software types. Was Betaville to

be a public information browser like OpenStreetMap, a location-based social media application like Foursquare, a virtual world like Second Life, an online game like Minecraft, a design platform like Rhino, or an IDE like NetBeans? What kind of "good-looking mutt" hybrid (or monster) would we actually be able to build?

4.8 Affordances: Experience Design for Collaboration by a Broad Range of User Types

The default navigation schema for Betaville, based as it was on a multiplayer game engine, would be the standard use of the WASDQZ keys for navigating forward, left, back, right, up and down with the left hand, coupled with the arrow keys for rotation of the user's point of view, with the option of using the mouse to rotate and zoom in/out. For the first year or two of Betaville's development, all of the actual operation of the controls was in the labs in Brooklyn and Bremen, or our group giving demos to third parties. It never occurred to us that the schema, ubiquitous as it was for PC game design without specialized controller hardware, might not be obvious and intuitive for everyone.

When we finally did start working with prospective end users outside the research and, development group, it became obvious that there were three very different first-time user profiles to account for, only one of which was well served by the PC game UI setup—students, or rather school-age: having grown up native to computer games, they found the right keys instantly, and flew to and from in Betaville effortlessly within moments of launching the application.

On the other hand, prospective users without any experience of keyboard and mouse as game control interfaces tended to need the whole setup explained more than once, or even a "chauffeur" who could use the controls for them, translating verbal commands. Insofar as we proposed to offer Betaville for community use, the business of providing for this kind of two-person interaction might call for specific approaches to introducing its use in workshops or community board meetings, where retirees are typically abundant, and students quite rare. This is consistent with experiences reported in the UK (O'Coill and Doughty 2008) and the United States (Gordon and Koo 2008) of efforts to apply game technologies to participatory urban design and planning. In both cases, they opted to use game technology to augment a public meeting/charrette or workshop format; both reported on the perceptual effectiveness of the 3D visualization in giving residents a better sense of location and scale than conventional plan drawings, but that participants without daily experience of computers were reluctant to "drive." O'Coill notes that "the number of people who have grown up with computer technologies—or 'digital natives' are growing. Expectations of online serious computer games type [sic] technologies will grow as more people expect and rely on these methods of interaction and visualization." This does not necessarily require that the "digital immigrants" die off before Betavilles can be viable media of broad participation, only that a critical mass of "natives" be available to the "immigrants" within a given stakeholder group.

The other category of users who turned out to run into trouble with the Betaville UI schema were actually digital professionals: architects and engineers with a great deal of experience using specialized 3D modeling tools, but with very different navigation schemas.

Even within the Autodesk suite of tools, moving around in the 3D authoring environment and manipulating objects are handled with different sets of key commands by default. Designers working with combinations of authoring tools on a daily basis will customize their keyboard and mouse controls to a common set wherever possible. The process of working back and forth between Rhino and Maya, for instance, without doing this is incredibly frustrating: every few key strokes, you hit the wrong button or try to move in the wrong mode… anyone who had to work with both Windows and Apple machines in the days of the one-button Apple mouse can remember the urgent desire to scream, throw things, or hurt the person next to them. Definitely NOT the kind of user experience we were looking for in a creative collaboration environment.

Tim Bell, a collaborator on the Haiti project, at one point simply refused to work in Betaville himself until we made it possible for him to customize the interaction to match the way he worked with Rhino, in particular providing for the ability to harmonize with the keyboard shortcuts in Rhino, and also provide for focusing (zooming in to make a selected object fill the viewport) and orbiting (so that the user's point of view can move around an object while facing it), so an object can be viewed from various angles without having to fly to another vantage point and then rotate to find what you are working on. Arguing about whether this kind of interaction makes more sense in an authoring tool than in a "world" ultimately matters less than Betaville's ability to attract and support a range of users including those whose interaction habits have formed around games, modeling tools, or not yet formed at all.

For many other prospective users, and for our range of intended use cases, it was less a matter of conforming to habits than functional expectations: Could the proposals have multiple components, that could be made either invisible or translucent at will, to reveal subsystems? Could the elements be precisely placed and fitted? It seemed that setting out to provide the right mix of functions and interaction mechanics from the separate conventions of games, CAD, animation, and mapping would call for a straightforward approach to the graphics: not necessarily the lowest common denominator, but a clear balance of simplicity and clarity: enough information for the places and things in Betaville to be recognizable, and for proposal models to suggest the eventual qualities of built change—a graphical environment that would say to a broad range of new users: "Yes, YOU can get there from here, and do what you do when you arrive."

4.9 Base Model Complexity, Data Richness, and Ubiquity

Complexity—We opted to strip out all of the game features of jMonkey that didn't directly serve the development of the richest and most complex possible models, on the expectation that this was the one critical dimension of the world's capacity to

provide for convincing and useful levels of detail. If anything, this turned out to be more important than we had originally anticipated, for two reasons: first, because users are accustomed to richly detailed representations in situations where qualitative judgments are to be made, and too-schematic models were often taken to represent designs that would be built as they appeared in Betaville. If there weren't any ornaments on a model, the expectation was that the built objects would be likewise. Secondly, the discipline of building very "clean" geometric models may be expected in a professional modeling pipeline for real-time interactive applications in industry, but even novice designers with professional game-design ambitions had trouble paring down their vertex count to anything close to what the engine was built for. A recognizable model of one large or ornate building might add up to several thousand polygons, and several of the obvious conversion paths would introduce artifacts into the geometry, a great source of frustration if the base model (as in the case of our first major deployment, New York City) was already over two million polygons! These issues were common to both amateur/student modelers and architects unused to real-time modeling, whose stock models of trees, people, and furniture might EACH add up to tens of megabytes. Early on, we had to add an alert to the upload dialog warning users who tried to upload single models of more than 5 MB. Managing this issue also ended up requiring quite a bit of user support, to help explain the issue and/or demonstrate solutions. A library of standard details (lampposts, fire plugs, trees and shrubs) is under construction for use by the Betaville community, or to serve as technical samples where variations are required.

Data richness—We assumed that many users would link models to external sites. This turned out to be much less typical than the desire to provide long text explanations through the model's information panel, well beyond the 200 words that would fit into its text field. As soon as even a moderately sized group of university students got to work, it became clear that the project profiles on the Betaville website would have to provide for quite a bit more exposition. On the other hand, we greatly underestimated the effective availability of online data at the outset of Betaville's development! As New York City adopted more liberal terms of use, and made its data resources open as a matter of general policy, the potential for the platform as an "open data browser" blossomed. For a detailed description of the prototype extension to integrate this new opportunity, see the "Datapalooza" in the Deployments section (Sect. 5.4).

Base Model Ubiquity—What I mean by this is that every user should initially "land" in the base model, i.e., the city as it is now, every time they launch the application, rather than into a state that is already altered to one extent or other by other users. We felt that the user experience should always be grounded in the present facts of the physical built environment as a starting point. While any number of proposals could be invoked simultaneously, or indeed concurrently within different phases of their respective version histories, the first moment should be as familiar as possible. The only proviso that emerged from the initial deployments was a common request from user-proponents was to be able to send a link or launching widget to a third party, so that their partners or intended audience might be able to launch the application, and find themselves in the right location, at a particular vantage point, with the proposal's most recent iteration and its information panels already open.

This is a GREAT idea. We haven't implemented it yet.

Asynchronicity: Here, the expectation was that something like version control would be an important feature of the world, if we could not provide for real-time collaborative model-building, which would have called for the in-world modeling capabilities we had already sacrificed or deferred: on launch, a user would find markers for proposals which had been uploaded before the logged in, but would not be faced with real-time updates of the proposal flags during a session. Insofar as the most time-consuming engagements would actually be undertaken with whatever modeling software a user might be working with, the user's menu of proposals would never be out of date by more than the duration of a single session. Insofar as any given proposal could be annotated or have its version history added to, but never retroactively altered (remember the importance of the integrity of the chat and version histories as public records), and that competing proposals or versions could coexist as links in the base model, this "distributed version control" logic seemed viable. The only objection we got was from users who expected the chats to be in real time as a matter of course. This was to some extent an artifact of the graphic presentation of the comment fields as chat windows rather than blog post replies, but it did lead to a useful discussion: as long as the individual chat posts were time-stamped, and associated with specific objects or proposal versions, having them in real time would not compromise the demarcation between uploads. It could also provide for a livelier exchange between stakeholder-users online, and for "guided tours" through places and ideas.

Uploading proposals: this was the most technically demanding user task, and accordingly received the most fastidious and drawn-out debates within the design-development team. Beyond the fuss of navigating a "wizard" widget, a sequence of six dialog boxes to identify and locate the source files on the user's computer, specify a location, adjust placement and orientation of the model in the world, and take a snapshot for use as a "thumbnail" image in the project menus and on the website, there was the matter of providing for the right mix of privileges for other users: do you want any, a select group, or no other users to be able to edit (or even see) your proposal? As use cases multiply, the desired mix of levels of visibility and editability continues to grow. It may be useful to enable users to download elements from the base model, to provide context or detail or sample geometry to support their own design work. Someday, it may be normal for a city to offer an up-to-date 3D model of itself for download as part of the open data ecosystem, rather than requiring every research group, planner, architect, or advocate for alternatives to build part or all of it from scratch. Betaville may yet set a precedent.

4.10 Graphic Identities: Building the Right Visual Language to Elicit Full Use

Betaville, or any given implementation of Betaville, starts by providing a virtual urban space mapped to an actual one. Assuming that any particular member of the community CAN find it online, and get the hang of moving around in it, an effective Betaville would also need to be recognizable as a particular place—as it is

experienced—by a user "walking through" with their point of view at a reasonable approximation of eye level, augmented by the ability to "fly" up high enough in the air to get a fresh sense of the district/regional context (the God's Eye View), and back down to an on-the-street perspective.

As a term of art in graphic design, "identity" means the set of design elements and visual grammar deployed by an organization across all of its media, from the business cards and stationery used by employees to the logo, website, advertising, signage, and often the products themselves. When BP changed its logotype from Raymond Loewy's chunky green and yellow escutcheon to the radiant "beyond petroleum" sunflower, it sought to dissociate itself from its image as "big oil" in favor of a diversified, sophisticated, and environmentally conscious something else: somehow transforming itself from a conglomerate into an ecosystem. Ralph Alexander, a senior Vice-president at BP (or should I say "bp"?) during the transition, described the change to me as more than a simple matter of public relations—it was also intended to change the way British Petroleum's employees saw themselves, and the purpose of the company. The graphic identity was designed to alter the deeper culture and thereby the direction of the firm, worldwide.

One of the trickier elements of teaching visual design fundamentals at the undergraduate level is that every student comes to issues of color and composition with their own graphic identity, a set of visual habits strongly associated with their personal identity.

For Betaville, this represented two entirely different sets of challenges: Betaville would need a look-and-feel for its interface that suggested the right things about what it is for, how easy it is to use, how powerful its technology is, and who it is for. What makes this especially challenging as a graphic identity design problem is that it's really for everybody.

The world itself would have a related but distinct identity to construct: it would have to present as a recognizable and credible model of the "real" world, and at the same time a readily changeable one: a world that can be changed, that is worth changing, by somebody like you.

There was never any question of producing a photorealistic rendering of every shrub and crosswalk stripe, for two entirely different kinds of reasons: technical and rhetorical.

Technically, it simply won't be practical for some time to come to put every little bit of everything into an OpenGL scene and expect it to run satisfactorily, or at all, in real time. While it's true that mass entertainment genres of 3D graphics have led to very high expectations of production values in professional work, it's just as true that actually producing base models to those standards would represent such a huge investment of time and skill, that base model production would likely preempt any genuine invention by the tiny minority of students or volunteers who might wish to contribute to the actual purpose of an open ideation and iteration process. Pushing the best of the end user machines to their limits would also either exclude many by setting the hardware and network performance thresholds too high, filtering OUT many of those we propose to bring IN.

Rhetorically, an inclusive process would need to be welcoming to new arrivals across a broad spectrum, AND provide satisfactory performance for experts.

The quasi-vernacular visual language of architectural and urban design renderings used by most professionals to present-sell-justify designs for proposed projects is instantly recognizable. To get a sense of this, open a browser and search the term "streetscape," then select "images." Somewhere, there may be a street that looks like this: grass treated with chemicals to imitate the color of a Granny Smith apple, orange-red bricks about the same shade as the dyed cedar-bark mulch in the planting beds, pale shadows falling across asphalt barely darker than the bleached concrete, skies and foliage brighter and more saturated than real, a kind of augmented blandness made all the more suspect by the odd layering of a slightly "loose" gestural sketched line drawing that never actually diverges more than a slim pretense to either side of an absolutely rigorous optical perspective line.

In practice, digitally rendering even a crude approximation of such a "sketch filter" over the underlying geometry of a model of any serious size at the kinds of frame rates that users would need to successfully navigate on an average computer is still not practical. The last "Shrek" feature took 20 million hours to render on the most powerful and best-optimized hardware then available, and has a running time of 93 min at 24 frames per second (fps), well below the 60 fps expected by gamers. PC and console games, as mentioned earlier, typically call for an absolute minimum of actual geometry, with lighting effects pre-rendered into the texture maps, rather than cast by interactions between lighting and the objects in the scene.

The set of architect's visual presentation semi-conventions offers the advantage of familiarity across the spectrum of the community we hope to address, but not that of efficiency at the level of graphics rendering. Digital simulation of colored pencil or watercolor effects is no easier to do convincingly than hair, fur, or wafting mist. Personal computers have come a long way in their graphics performance capabilities, but they haven't come that far.

In digital graphics, there is no such thing as a doodle, or a sketch. The most primitive and simplest form of graphic representation is the simplest to define, i.e., the most precise. Wobbling, smudging, over-shooting, uneven color distribution, must all be added on, and with exquisite attention to detail, of which every characteristic must ultimately be definable through code.

In a traditional architectural design workflow, the early design process was undertaken on rolls of tracing paper with pens and pencils, to provide for the fastest possible production of quick graphical notations. Part of the designer's expertise is in the ideas; part of it is in his or her ability to visualize the idea as if they were already inside it, moving through it under various conditions of light and purpose, at a human scale.

Computer-aided drafting provides for fast and precise production of construction drawings, i.e., the documents produced AFTER design decisions have been substantially made. The process of producing even a simplified digital rendering of a proposed design idea is slow and demanding work, with a keyboard and mouse or stylus for long hours. Doing lots of different ones and flipping back and forth

between them to evaluate or reconfigure takes much longer than the quick pencil notations on "trace," and it's a much less obvious thing to try to do.

Where the typical architecture or design school project models the professional realm, in which competitions and commissions operate with short deadlines, met by small teams of experts with carefully defined separation between assignments and expertise within them, a Betaville [user] would expect to be part of an open exchange of ideas expressed in 3D geometry that is ongoing, and in which everyone has the benefit of the base model but also of any aspect of any idea contributed up to that point. There is less need for any one idea to mature before it is shared, because there is more time and scope for the exchange of ideas to evolve consensually, between stakeholders attracted by the prospect of outcomes and others attracted by the social-creative process.

For a city depicted in Betaville to serve effectively as a collaborative medium for this networked ad-hoc variant of the exploratory and sketch stages of design, producing lots of concepts, choosing and recombining elements between them, to come up with a meaningful overall design in context, its representation must both attract and support specific modes of engagement: while digital authoring impedes the rapid exploration of alternatives in camera, it can greatly augment the full exploration of alternatives in public, and in context, over time. Insofar as the ultimate responsibility for the long-term health of that context belongs to citizens, Betaville is an early prototype of the kind of massively social-creative platform that responsibility calls for, to provide a viable long-term and broadly based framework for what might public and private investments might make real sense. As the possible new forms of places are layered over time with their multiple and mutable avatars in Betaville, those places can begin to develop richer identities of their own, as the material/immaterial culture of a lived experience of collective-collaborative form-iteration as one of the basic modes of local governance.

The representation of the base model, the city as it is now, must be recognizable and credible as a depiction of real places, from sightlines to basic qualities of scale and reference to the material realities of the corresponding locations: the eclectic variety of an old neighborhood's built forms should contrast with the spectacular regularity of a modernist office building façade in Betaville, as it does in New York.

The representation, though, must present as one which is amenable to change: not so perfectly made that one wouldn't think of making alterations as a matter of course. Over-crafting the image might not only make it counterintuitive to alter it, it might simply de-motivate by inadvertently intimidating potential contributors, who might fear that their efforts would always look clumsy in an otherwise professional-esque image.

The Google Earth approach, of heavily compressed photo images applied to drastically simplified shapes, though entirely consistent with the technical path of least resistance as far as real-time rendering is concerned, would not work well for our purposes: we needed to make it look (and be) reasonably straightforward for a diligent nonprofessional to build models of proposals that would blend well with the existing context.

To provide for this, and a reasonably coherent overall appearance in the base model, we experimented with various combinations of geometrical complexity and

materials, opting in the end to rely on a combination of geometry and color, rather than applied bitmap textures, to the extent possible.

After a bit of experimentation, we settled on what we thought was a reasonable, renderable, and approachable level-of-detail, augmented with a simplified naturalistic lighting scheme.

Lighting (default: a slightly warm main light from about 45° vertically, from the southwest, with a slightly blue fill light directly opposite). For advanced users, full manual control of ambient and specular lights, and the ability to switch the blue "skybox" to provide for approximations of different times of day or year.

The ability to simulate specific shadow angles for different times of day and year is actually a key component of the qualitative evaluation of proposals for major new construction. Adjacent stakeholders are typically keen to verify claims that a proposed project will not unduly deprive them of natural light, and the ability to assess proponents' assurances would be a very useful feature of any serious tool for iterative design or consideration of alternative settings and configurations. However, the rendering of shadows in the Betaville scene is processor-intensive, seriously compromising frame rates (and therefore the ability to navigate efficiently) within the scene, particularly for less powerful computers. Accordingly, we provided three levels of shadow-casting: as a default, shadows are switched off; a user can turn them on at will, either if they have the processing capability to handle them while navigating, or to see and evaluate shadow-casting from a static point of view; a full set of controls is available in a pop-up window to alter the color, intensity, and direction of each light.

Color palette: For all the variety of vintages of construction in New York City (our first major and most familiar use case), and the cacophony of signage, the range of colors is pretty consistent:

- The rich brown sandstone for which the "brownstone" style of pre-war townhouse is named, originally quarried in nearby New Jersey and Connecticut, in one of its more saturated reddish variants.
- The deep neutral charcoal grey of fresh or wet asphalt—new blacktop does not fit the stereotype of New York as pothole capital of the developed world, but there has been a lot of it in our experience of the city under the Bloomberg administration, and Betaville is after all oriented to the concept of this and other cities as "in Beta," i.e., under ongoing reconstruction. The perceptual advantage of a decently strong contrast between the roadbeds and adjacent concrete sidewalks when viewed from a distance was also useful.
- The neutral and pale grey of concrete sidewalks, infrastructure, and some of the buildings.
- Red and tan brick, accounting for much of the masonry other than stone. Again, we over-saturated the colors slightly.
- A warm pale Indiana limestone color—this is characteristic of many of the city's major public buildings, and common to landmarks like Rockefeller Center, the Empire State building, and Yankee stadium.
- Two general-purpose greens, roughly a grass green and a forest green, to handle lawns, plantings, and foliage.

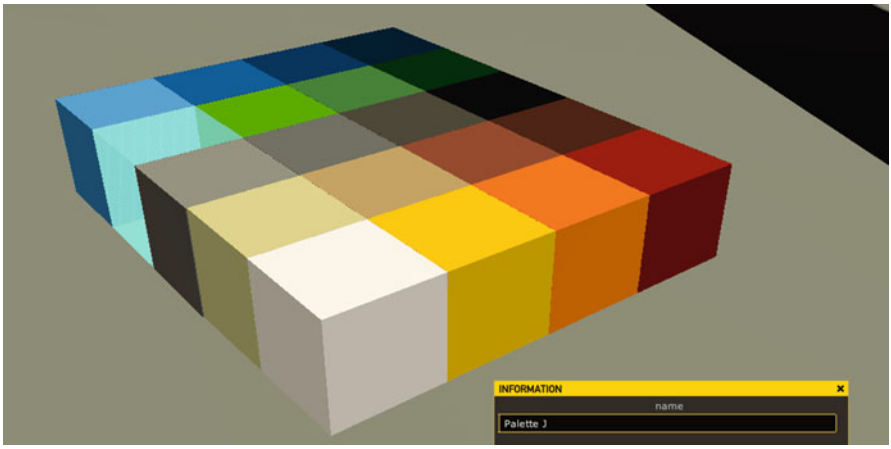

Fig. 4.8 The Betaville palette

One dark greyish blue for water, a paler and purer one for the sky and atmospheric "fog" effect.

A translucent pale grey-green with a slight ambient "glow" for glass.

This basic palette took some trial and error to work out. Different hues and values rendered quite differently in the modeling tools and Betaville, presumably due to varying implementations of the OpenGL graphics libraries between jMonkey and the 3D authoring applications we were working with: Autodesk Maya, Google (now Trimble) Sketchup, and Rhino.

By the time I had worked out the kinks, the "basic" color range was actually a mash-up of the observed typical colors of New York City, the generic vocabulary of architectural renderings… and the color range of nineteenth century Japanese Hanga woodblock prints, which I eventually realized had been in the back of my mind the whole time! This is the ultimate reference for the choice of the water blue, clearly a flattering alteration of the dull grey-green New York Harbor's surface presents in aerial photos, and therefore Google Earth. The two new strong greens, and a general slight exaggeration of saturation, were the major departures from the Japanese palette (Fig. 4.8).

Our intention was to provide the happiest possible medium of verisimilitude, broad appeal, and a key affordance in the rendering of the world itself: yes, this has to do with the real world as you know it, and yes, someone like you can discuss the proposals for change that are already in here, and yes, you can propose changes on your own initiative, using tools and skills that are already available to you or someone you know.

An affordance is a feature of a designed object that suggests what it does, and how to go about interacting with it to make it do that: just as a handle on a door offers the affordance of opening it, and a wide sidewalk offers the affordance of walking down it without crowding into your fellow pedestrians, a 3D model can look more or less definitive, and more or less amenable to change; it can be more or

less obvious where changes are proposed, and how to engage them. Insofar as the city being represented is composed mostly of elements that are intended to look permanent, making a recognizable virtual variant of them that highlights the plasticity of the world's components as well as its overall form is always going to be a tall order. We cannot yet claim to have perfected this idiom, only come to appreciate its potential value.

SimCity and Minecraft handle this quite simply, offering worlds that look like toy models or sets of building blocks, with an abundance of pre-made components whose interaction can be experimented with at any level of experience. The people who are used to looking at a scale-accurate model or map of a real city, and seeing it as changeable for the better (however any one of them may define better), fall into a narrow subset of the population: real estate developers, planners, politicians, architects, and engineers.

What kind of a virtual 3D avatar of your city or neighborhood would not only LOOK provisional to you but also do so in such a way as to incline you to get together in that "world" with your neighbors and any professionals you might need to support some practical urban problem solving along the way to considering improvements, rather than doing everything you can to overcome the insecurity implicit in an urban environment in which you are personally invested being clearly subject to change, within the complex dynamics of inevitable contextual evolution or disruption at every scale from the district to the planet?

This sounds unreasonable, and certainly flies in the face of the image of citizen engagement as resistance: Jacqueline Kennedy Onassis and Jane Jacobs are remembered more for their work to prevent large scale alterations like the demolition of historic structures or the construction of an expressway through a neighborhood.

Laura Kurgan, founder-director of the Spatial Information Design Lab at Columbia University, and a good enough friend to be straight with me about it, felt strongly that we had erred on the side of what she called "Developer Realism" in the graphic language of Betaville: too antiseptic for a community meeting, too narrowly conventional for the level of innovation we hoped to solicit from professional designers in the user mix. She wasn't advocating that we turn to the kind of esoteric semi-abstract and formally over-elaborate visual language that architects sometimes use for presentations to each other, only that we keep experimenting with the application's possibilities until we get it "just right."

David Lieberman, a veteran architect in private practice who teaches at the University of Toronto, approved of Betaville's simplified geometry and general spatial representation as clear but not over-precise visual information, but offered a different objection to Betaville's presentation of the city. Lieberman felt strongly that in conforming to the convention of placing the buildings as solid objects on the landscape, we failed to provide several conceptual affordances—the buildings themselves are more or less tall volumes of occupy-able space, with any number of degrees of publicness, from the atria of government buildings and shopping concourses to roof gardens and subway stations. A model purporting to show the transportation network in which the tunnels aren't just as prominently visible as the roads would be a falsification, in the same way.

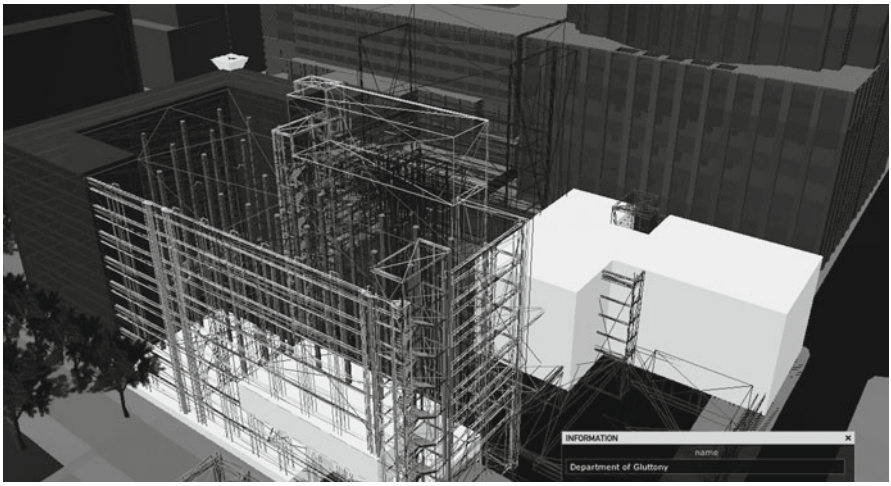

Fig. 4.9 Wireframe revealing building interior layout, block diagram of use types

For Lieberman, a properly functioning Betaville would simultaneously represent exterior and interior spaces, as well as infrastructure including structural features of the landscape itself, in order to cue and support a deeper level of design and planning than the disposition the surface of exterior public spaces, a too-narrow subset of a real urban environment and the rich mix of factors that should inform its evolution over time.

In fact, solving the visual language issues boiled down to the ability to render any or all of the meshes as wireframes or translucent (Fig. 4.9).

We set up the wireframe option as a menu button within a few days of the conversation. The business of producing a translucent base model can be handled in the modeling software as a matter of course. To verify this, I sent Lieberman a screenshot of one of the buildings for which we had a complete internal structure, with the whole thing simply rendered in a 50 % transparent material, providing an X-ray view of and through the shell of the building to slabs and columns and partitions, including a proposed underground amphitheater. “That’s more like it!”. Altering the model’s material to do this took all of 30 s. For a moment, I felt like the developer with the magic button: just press here to please a difficult customer! (Fig. 4.10).

The translucent rendering option is more than a facile special effect, though, if it actually offers users a usefully deeper understanding of the city itself, although rendering a lot of them in Betaville in real time is more than a basic personal computer can really handle just yet, certainly for a model as complex as New York City. If consumer hardware keeps getting more powerful, that may change; likewise, if a project comes to us that provides information about interior structure or other features to represent at the scale of a campus or transportation node, it might come in handy very soon. In due course, it may make sense to provide different rendering modes on the fly, for a range of sensibilities and/or representational priorities.

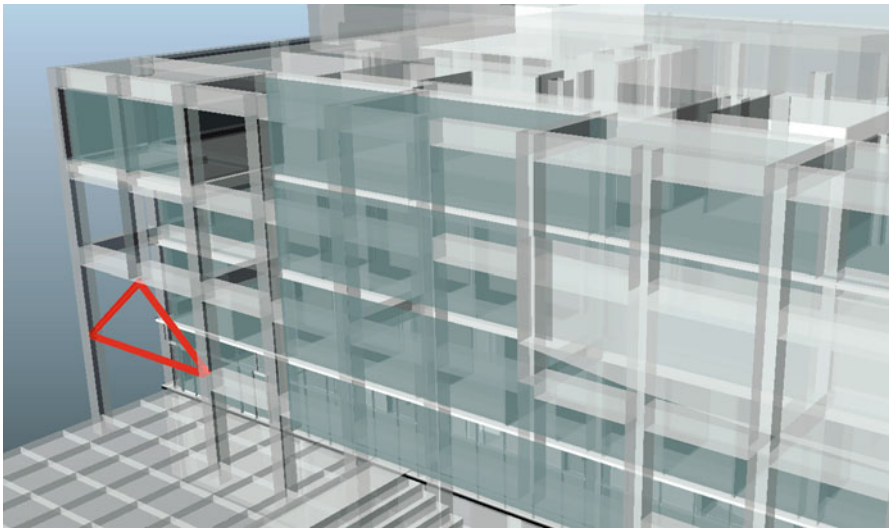

Fig. 4.10 Translucent building: architecture as spaces rather than objects?

Within the few years since Betaville's development got under way, there haven't been dramatic changes in the aggregate of software, hardware, and network performance levels. We have, however, made some headway in deriving the right kinds of effective performance from current technical capabilities.

For now, the visual language of the Betaville interface, considered separately from its technical functions and specific affordances, represents an analogous problem of identification: it should look as *familiar* as possible to the broadest possible range of potential users.

There have been unpredictable changes in rendering nuances along the way, as for instance when one of Apple's system updates happened to include new graphics card drivers that produced a distracting exaggeration of "z-fighting": crawling patterns of stripes and sawtooth edges anywhere two mesh surfaces were relatively close together. This had always been an issue where surfaces were VERY close together, which we had handled by building models with z-fighting in mind. The tolerance just happened to change a LOT one night. A very few thought it looked "cool," but maybe a little too cool. There was no analogous change in Windows, which henceforth renders a much more natural scene, particularly in the far distance.

We had three options: immediately convert the whole application to jME3, whose shader-based rendering would not be prone to the glitch; redesign the models and scene with stronger fog to make the far distance less legible, and it glitching less obvious, while mitigating with different alignments of water and shoreline meshes; or re-calibrate the whole setup to provide a more stylized image.

Unfortunately, we were already committed to deployments by this point, and our small team could hardly afford to rebuild from scratch, especially for the sake of a graphics card driver glitch that was likely to be transient, disappearing with the next system upgrade.

There were a whole host of issues associated with the upgrade to jME3. The menus, pop-up windows, and controls would all have to be rebuilt from scratch. jMonkey's switch from the FengGui windowing framework to NiftyGUI meant that the architecture of the interface would also have to change drastically—FengGUI was a bit tricky to skin (build with custom colors and graphic detailing to match the other interface elements), but it could render as a layer right over the scene very efficiently, in such a way that user with a high-resolution display could open several pop-up panels at once without noticeably affecting the framerate.

As we were considering whether this was the right time to make the move to jME3, I asked one of the programmers to put together a basic jME3 test scene, to see how well it would handle our nonstandard use, with way more geometry (upwards of three million vertices in the partial NYC base model!) and way less everything else than game engine developers plan for, and in particular to verify that the NiftyGUI framework would perform as well as FengGUI for our particular needs. jME3 handled the model alright, but NiftyGUI with ONE window open dropped the framerate from 79–80 to 7–11 fps, clearly nowhere near acceptable without a COMPLETE redesign and reengineering of Betaville, or major alterations to the windowing framework or the engine itself.

The approach favored by Skye Book, Betaville's lead developer, was to rebuild Betaville as a NetBeans application. NetBeans is an open-source Java integrated development environment (IDE), whose configurable "bento box" interface provides as a matter of course for separate windows within a resizable frame. Instead of using it to show a directory tree in a narrow column on the left, a large window displaying raw code on the right, and an output window below, we could build a version of Betaville that would use those same windows for our information panels, the world viewport, proposal/version menus, and so on, without requiring that the viewport carry the processing overhead of the various accessory windows any given user might want to have open at once (Figs. 4.11 and 4.12).

At a purely technical level, this solution made sense. At a user experience level, it presented a significant risk: if Betaville looked too much like a programming environment, it might attract developers but scare off a large segment of our intended user base, whose primary orientation would be to the application as a user-oriented and novice-friendly open and readily alterable virtual world.

Skye, meanwhile, suffered from the curse of every good developer: by the time the current version was up and running, he had thought through any number of issues to a new level, and badly wanted to reorganize the underlying logic and organization of how Betaville actually works, the application's architecture. He had also become active as one of the core jMonkey developers. From their point of view, Betaville was much less exciting as a use case because it was still running on jME2, which they had decided to move beyond in late 2008, right about the time we started working with it in earnest.

After quite a bit of discussion, we decided to explore a compromise: if we could build Betaville to run in a sufficiently well "skinned" NetBeans environment, with a graphical presentation of the IDE that would at least make the user experience feel more like a reasonably typical desktop application. There was one Look-And-Feel project that seemed to offer the right level of customization flexibility: Kirill

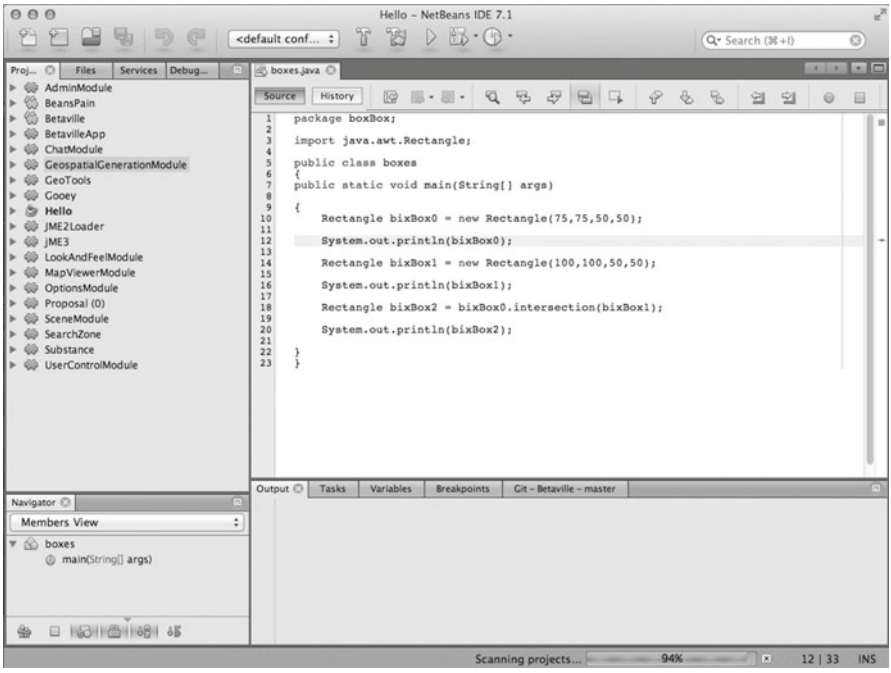

Fig. 4.11 NetBeans IDE layout, Betaville first-generation layout with open windows

Fig. 4.12 NetBeans IDE layout, Betaville first-generation layout with open windows

Fig. 4.13 The second-generation interface mock-up

Grouchnikov's Substance project. Ojas Gosar, Megh Vora, and Ibrahim Jumkhawala accordingly set to work with Skye to build out a prototype jME3 implementation of Betaville with a custom look-and-feel based on the work we had done to date, augmented by the NetBeans layout and some of the experience we had gathered through experimental in-house use, according to a detailed layout I put together in Photoshop (Fig. 4.13).

Over the course of a few months, we came to appreciate Grouchnikov's virtuosity as an interface designer-programmer, but also to understand that we were getting into an intractable development situation: the labyrinth of jME3 development environment, NetBeans, Swing, and the Substance Look-And-Feel framework was taking up a lot of hours, distracting us from more fundamental issues of core functionality, at a time when our deployments were starting to need more attention, and the gruesome administrative process of the school's integration with NYU, itself in the throes of various levels of internal reorganization, were starting to take their toll. By this point, Skye was a better-than-professional level programmer, but also an alumnus; the developer pool composed mostly of graduate students was a good gauge of what we might reasonably expect from a broader developer community in due course. If the in-house team was bogging down over it, so would any volunteer group we could reasonably expect to attract. Joel Wein, our guardian angel for optimization and software strategy, and most reliable source of referrals for top-notch computer science students to participate in the project, had left Poly for Google. He had left us confident of the stability and scalability of the codebase we had in hand.

As director of the digital media programs I had founded, I was facing my fifth department head, fifth provost, third chief of staff, and third capital project in 6 years, with no end in sight… Betaville was showing real promise as something

more than an academic laboratory experiment, and the future of Java as a write-once-run-anywhere language for desktop applications was not a clearly solid long-term investment by 2011.

As of this writing, Oracle's handling of Java 7 for the Mac OS (which accounts for a significant slice of our content/code developer and user bases and prospects) has cast further doubt on the wisdom of long-term investments in Java as the first level of infrastructure for the Betaville project. If tablets do indeed displace a significant proportion of personal computers in the next few years, the need to provide for iOS, Android, and Windows as a matter of course will significantly raise the barrier to entry for groups that want to address a broad community. In theory, html5 and WebGL could provide a single ubiquity-capable alternative through web browsers across platforms. In practice, it remained to be seen whether Apple will permit its mobile products' browsers to carry web-based applications, by-passing the App store's approval process and percentage.

The technical development strategy duly adapted. We would stick to the jME2 application we had in hand, reserving our coding resources for support, and for the development of new functionalities those deployments might need or suggest; where possible, we would build new tools as plug-ins, with an eye to future portability.

The user experience upshot, for the time being, is to stick with the generic/simplified model as we have it, providing for occasional experiments in models to be uploaded, and stay alert to opportunities to exploit whatever graphic rendering "glitches" may crop up that just happen to appeal to us or particular groups of users. The application works, after all!

The main base model of sections of New York City, is coming along nicely, to the point where we will soon need to break it out into separate sections, or undertake some technical optimization of the handling of level-of-detail. Three million vertices spread over thousands of separate meshes is a lot to ask, even if you are willing to sacrifice collision detection, physics, and avatars. Other models we have used for particular projects, or are setting out to build with third-party users, are being created with a clear understanding of model authoring-conversion-upload pipelines. Until we can auto-generate models by conflating whole-city GIS and topographical data, or come across an already-built set of geometry for a large metropolitan area, we can at least be sure that the existing Betaville platform and methodology will support several person-years' worth of models.

In regard to dealing with the evolving (well, more like convulsing) institutional context, stay tuned for the "deployments" section.

4.11 Proposals: The Framework and Its Variables

The first time someone launches the Betaville client application on their computer, after a dialog box or two to register, log in, and select from however many locations are accessible from the server, they see what looks to some simply like a virtual model or diorama, to others like a game, to yet others like an

Fig. 4.14 Screenshot with coordinate system panel open

open-standards-compliant 3D Geographic Information System (GIS) interface, a wiki, an online charrette. They are all exactly right. The base model's conformity to true scale can be verified at once by calling up an overlay generated by default from the OpenStreetMap database, or between points with a measuring tool widget available from the "city panel" dropdown menu. The precise geographic location of any point on the ground plane, or the user's point of view, can be displayed in another widget. Any information associated with any particular object in the model through a prior user's input, or external web links, or (for certain applications) real-time calls to third-party geodata can be viewed, as well as any chat posts about the object, and the Betaville user profile for the person who uploaded the model. At a district-to-regional scale, coordinates can be rendered as Universal Transverse Mercator (UTM) or latitude/longitude. At a building scale, the space is defined in meters (Fig. 4.14).

Betaville's upload wizard will currently accept models in the Collada open 3D (version 1.4) file format, with or without photo textures. All of the base model elements and proposals are converted to jMonkey's native .jme format as part of the upload process. Blender3D, Sketchup, and AutoDesk Maya all support the Collada format natively. Other 3D authoring tools may require an export plug-in, or export in another format to a third-party application for conversion.

What this means in practice is that models from most of the applications in daily use, and others that can be had at no charge, will produce models that can be

Fig. 4.15 Interior detail of proposed academic building for UNI Haiti in Betaville, showing roof truss structure

uploaded to Betaville. Novices and students have ready no-cost access to everything they might need to build for Betaville. Professional artists, architects, and engineers can contribute without having to reconstruct the models they already build as a matter of course from scratch, or engage in complicated alterations to their familiar workflow. There is an abundance of free online tutorials in the use of all of them, to support informal self-training. There is also a deep pool of free models available online for everything from trees and shrubs to geodesic structures, to use for modeling practice or spare parts. The initial upload wizard provides for an accuracy of placement within 1 m and orientation within 1 degree of rotation; a second widget in the city panel menu will reliably do better, within 0.03 m on the *x*, *y*, and *z* axes, and rotation within 0.01°. That 0.03 m being just over an inch, it won't provide for the accuracy of construction drawings, but will certainly support a pretty detailed 3D "sketch" (Figs. 4.15 and 4.16).

Proposals can be placed as a single object, or as any number of sub-components. In the base model, a building's shell can be selected and "wireframed" at the click of a button, to reveal floor slabs, structural columns, the partition layout of individual floors, infrastructure, emergency exit routes, or schematic blocks showing the distribution of uses. Objects from the scale of Flushing Meadows/Corona Park down to a keyboard or electrical outlet can be modeled and uploaded, as required.

The Betaville environment is multiplayer, asynchronous. What this means is that every participant comes to the world as a static model. while other participants may be commenting or adding proposals at the same time, any one user will only find markers for proposals that were already posted when they logged on, and their proposals will only be available to other participants who log on after they comment or upload. As the base model is only directly altered to the extent of having more

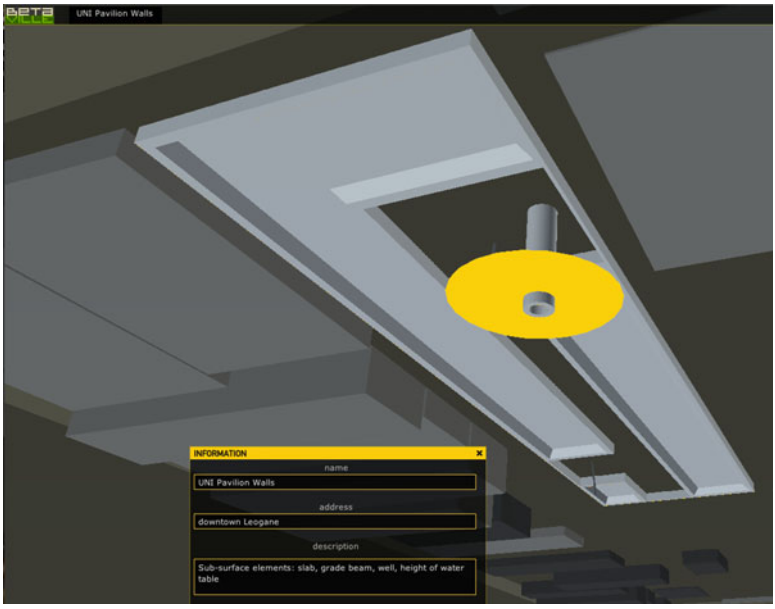

Fig. 4.16 Below-grade detail of proposed academic pavilion for UNI Haiti in Betaville, showing slab, grade beam, well and water table

markers over time, the loss of synchrony is minimal, and the advantage in terms of the ability to retrieve comments made at specific times about specific features of the base model or proposals provides robust integrity to the value of the environment as something like a 3D visioning wiki, and a transcript for later review to assess levels of use, controversy, or development of a concept through time.

There is, at present, no provision for a subgroup of participants to develop a proposal that is not accessible to any other participant. Betaville is, in that sense, a purely public space, with one proviso: the last choice to make in using the upload widget is whether other users may or may not upload variants or alternatives as versions of that proposal, either to the extent of ANY other user, or a group selected by the original proponent.

The proposal upload process also provides for adding a description/rationale up to 750 words, the full text of which can be accessed through the associated website, an external link, and of course posting to the object's in-world linked chat window (Fig. 4.17).

There is also an option to "remove obstacles": If a proposal actually calls for the removal of an existing structure to make way for the proposal, it is possible to designate those obstacles, and they will not be displayed when the proposal is shown.

If a proposal calls for excavation, this has to be arranged with the Betaville administrator, to provide a removable section in the terrain, as in the case of a concept for dropping the floor of the auditorium of an academic building in MetroTech to provide for sitting steps that can serve for events as an amphitheater and open-air screening venue (Fig. 4.18).

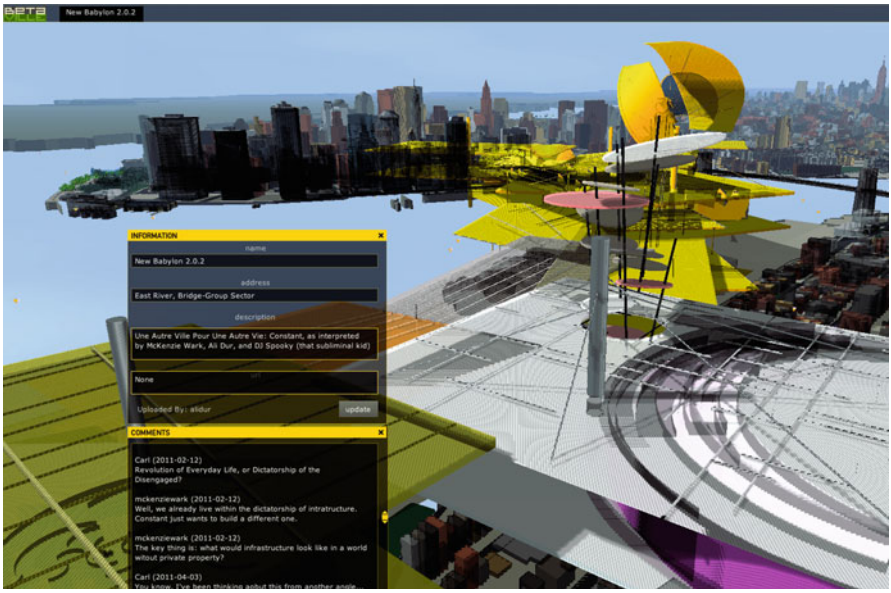

Fig. 4.17 Proposal selected, Info panel open: New Babylon with Manhattan in the distance

Fig. 4.18 The center for innovation that might have been

I actually built this in the context of discussions about the possibility for more intensive public use of a space typically empty after business hours, the development of a new Media R & D center in the building, and a more general conceptual discussion about approaches to greater engagement of the local community by the institution, leading by an unexpected route to one of our early successful deployments of Betaville in Brooklyn.

Chapter 5
Deployments

5.1 The Mother Deployment: Brooklyn–Bremen

The first deployment scenario for the Betaville project was in fact the establishment of the distributed development team between Brooklyn and Bremen: design and build out of the project plan, software architecture, interaction design, and sample base models of urban districts, in tandem with the development of "demonstration use cases," i.e., simulated use cases.

This last item was crucial in two ways: insofar as we were building for a novel class of collaborations, we would need to provide demonstration projects using Betaville relatively early in the development cycle to be able to attract groups of very early adopters to help flesh-out real-world deployment requirements before too much of the software infrastructure was set; just as importantly, we wanted to have a set of test users embedded in the design–development team from the outset, which was practical thanks to the involvement of students and faculty across the art–design–engineering spectrum and the participation of external/volunteer architects, artists, and designers.

The format of the development process was designed to leverage every available internal mechanism on both sides and to facilitate communication/support between the two, the Brooklyn Experimental Media Center in Brooklyn and the Media2Culture Institute in Bremen:

The work packages were broken out into components that could be developed as coursework or thesis projects in informatics, media design, and 3D model design; in Brooklyn, a separate weekly session was established for project meetings including participating faculty, students, and external participants or visiting experts with related interests. The most sustained external engagements were from Susan Gladstone, a planner seconded to the project by Levien & Co., architect David Turnbull, architectural modelers Levis Reyes and Edgar Ramirez, Downtown Brooklyn Partnership (DBP) president Joseph Chan, Dr. Norman Jacknis of Cisco system's Internet Business Solutions Group/Public Sector, and Municipal Art Society (MAS) President Vin Cipolla.

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Student participation was further supported in Brooklyn through the assignment of graduate and research assistantships at various levels, particularly to supplement coding capacity in Brooklyn, and the student exchange program.

Workshops and symposia organized in Bremen around the project were dovetailed with collaborative in-person workshops and block seminars, and joint conference presentations were augmented along the way as informal opportunities for project meetings between faculties.

The format was extraordinarily productive: within a year, we had a prototype for the web server and client applications that was robust enough to use internally and for public demonstrations; within 2 years, we were able to make effective use of the "beta" of Betaville in courses offered at a middle school (Louis Armstrong), a University (Columbia), and to begin to evolve the project beyond its initial specification. In Bremen, the mobile application was up and running, and an EU-wide network of potential partners was coming together.

Betaville had matured into its own modest "neotechnic ecosystem": the interdisciplinary research project relied on, and stimulated, a web of vital collaborations between students and faculty at every level, in a rich exchange with a variety of external expertise and communities. A practical use case was always ready to hand for a software developer or artist to provide a set of realistic requirements and feedback and from which to ask for something useful to their own work in exchange. There was a full enough spectrum of needs and capabilities built into the platform for it to productively serve and be served within the academic sphere, while offering a precious set of openings to not only the community as it was but as it might be.

The interdisciplinary integration and provision for valuable contributions from varied levels of expertise were two dimensions of the web, but a third turned out to be equally significant: providing for a full range of modes of contribution from direct problem-solving to speculative experiment.

One aspect of the complementarity between the Brooklyn and Bremen groups was their working cultures. While it had been set up in an engineering school, the Brooklyn program was designed fundamentally as a creative art and design program, more typically associated with an art college or university than a Polytechnic, but with a subspecialty in offering much deeper engagement of technology than would be feasible in a conventional art–design institution. The BxmC was, in fact, housed within the department of Humanities and Social Sciences, and our idea of "experimental media" had at least as much to do with the psychedelic media installation work of Nam June Paik and the music–architecture crossovers of Iannis Xenakis as it did with technological innovation. The Bremen group had related interests, but from within the institutional culture of a very high-quality computer science school for which "media informatics" was a software engineering specialty.

In practice, however, there was no direct correlation between the disciplinary category of a participant at any level and their appetite for a particular degree of specificity in task assignment. An engineer might come to the project demanding (and needing) a specific work brief with narrowly defined deliverables, or hungry for any degree of room for creative exploration, or itching to rethink the problem, or to make "virtual sculpture." Several of the best graphic/interaction designers were

technically computer science students. The project's ability to provide not only for different skills but different ratios of problem-solving to free invention opened up new levels of motivation and achievement.

I had set out to build academic programs from which no artist or designer or project director could graduate without regular experience of creative and technical professionals actively and willingly collaborating on the understanding that they will have to have "the hang of each other's realities" to do their own best work. Through Betaville, we achieved something better than cooperation, between two conventionally alienated yet interdependent communities—not just dabbling in each other's specialties, but developing mutually. If we could pull it off with artists and engineers, Betaville as a participatory cyber-layer of the New Soft City cultural infrastructure and discourse wasn't just a dream.

One example of this kind of spontaneous upgrade: Levis Reyes, our Dominican lead modeler for the base models, was also our lead "very early adopter" as a very adventurous designer. While the quality of his craftsmanship was exactly what would be expected from a City Tech Architectural Technology alumnus, the fertility of his imagination was something you would only know to look for if you had a bit more experience of their program.

Joschka Zimdars was one of our German exchange students: happy to contribute to the codebase, but equally happy to design a new mixed-use development over the top of the Bremen "Hochstrasse" expressway, based on a mash-up of the Ponte Vecchio in Rome and the HUB Mall at the university of Alberta. They were at the meeting in 2010 where the issue of how to provide an interface for navigation between Betaville "sites" came up.

The functional problem was how to provide users with the ability to navigate freely but on purpose between different locations in Betaville. A user might want to teleport from the Cadman Plaza in Brooklyn to the Rembertiring in Bremen to understand a reference in one of the chats, without having to log out or "fly" from one to the other with the keyboard navigation controls. Alternatively, a user might want to come to Betaville's interface first through some form of "Big BetaPlanet Browser" that could provide quick access to anywhere on the globe, showing the full range and distribution of Betavilles. The browser interface would be dynamic, updating every time a new Betaville comes online. "Wormhole garage" portals could be placed in particular locations in Betaville to provide direct access between specific sister sites or back to the Big Browser.

The idea for the portal-wormhole as garage actually came from the idea of connecting the models of our respective host institutions: the garage in Brooklyn where the Polytechnic president parked his Chrysler 300 would connect to one of the meter parking spots in the lot behind the Hochschule Bremen off Flughafenallee. Levis and Joschka agreed to work on the problem of developing a sample of what the wormhole browser might look like based on how it might work. They came to the following project meeting looking as nervous as Arne and Robert had when they came to tell me that our best engine choice was written in Java….

To provide for a global distribution of locations from a geodata set, they used the "hot spots" of volcanic activity along the fault lines between the Earth's tectonic

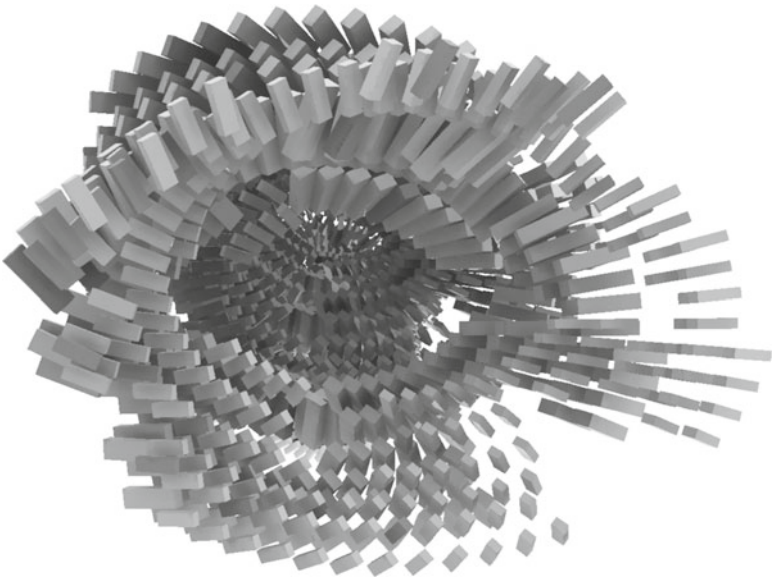

Fig. 5.1 The Wormhole Paradox global navigation concept (courtesy Levis Reyes)

plates, according to a stretched variant of the Universal Transverse Mercator projection on which Betaville's coordinate system is based. Then, consistent with the discussion we had had about overcoming any Eurocentric east–west or north–south implicit hierarchies, they torqued it about its axis and provided for free rotation of the assembly. The mock-ups were built using the scripting functions in Maya, passing the geolocations through a cylindrical projection to auto-build a visualization of the global browser we might need someday (Fig. 5.1).

Formally, this corresponds closely with the generative logic of much parametric architectural design work; logically, it uses a generic set of geodata to simulate a global distribution of access points. Conceptually, it opens up the possibility of a synthesis of two orders of dynamic mapping: to provide site navigation within the Betaville environment for a user to access a particular location and to provide real-time information about the global distribution of sites, a kind of worldwide public "information sculpture."

5.2 New York City

5.2.1 Downtown Brooklyn Commons

In the spring of 2009, the Betaville platform had yet to develop beyond a set of mock-ups in PowerPoint and a crude prototype. Barbara "Bobbi" Kates-Garnick had been engaged by NYU-Poly to promote a school-wide initiative in "urban

systems," to develop internal momentum and external partnerships, in the hope that they would mutually reinforce each other to the point of substantial effectiveness… Bobbi, having heard about Betaville, asked me to show it to Joe Chan of the DBP and Mike Weiss of the MetroTech Business Improvement District (BID).

The DBP is primarily a coalition of area business interests with some representation from the local academic and political sectors. The Polytechnic is central to the district in more ways than one: MetroTech, a complex of government, academic, and business occupants, was originally conceived as a strategy to rehabilitate the district in the 1970s by George Bugliarello, then president of the school. MetroTech's maturation as a more fully urban district, and a social as well as economic engine, now raises exactly the kinds of conceptual and qualitative questions Betaville was built for.

One of the images in the presentation showed a hypothetical set of upgrades to the NYU-Poly Dibner building (Fig. 4.18), a four-story work of slightly odd mid-1980s architectural design including the school's auditorium, library, and the departments of electrical and computer engineering and computer science. The image showed a large amphitheater of shallow sitting steps carved out of the plaza, down to an open stage under the existing auditorium, whose floor had been removed to provide for a proper double-height space, enough summertime seating to make it possible to hold convocation on the premises, and a large LED mesh movie screen to allow the space to function as an open-air movie theater… the scheme was a hypothetical concept, predicated on the desire to better integrate the academic and public functions of the space, and along the way provide a better approach to the adjacent Wunsch building, a historical landmark dwarfed by adjacent office towers.

Joe, whom I knew at that point only as a personable stranger in a well-cut suit, got excited. "That's like the Pompidou!" he said. "We could have our own Spanish Steps…." Joe, as it turns out, is an urban planner of a particular kind: strongly oriented to urban design quality in his thinking and open/ambitious in his approach. Joe proposed that we run an ideas competition in Betaville, addressing the need for ways to connect downtown Brooklyn's disparate and disconnected patchwork of open green spaces, working with the cognizant programs of area colleges: Architectural Technology at City Tech, Urban Planning at the Pratt Institute, Urban Design at the City College of New York, and Integrated Digital Media at NYU-Poly. This eventually manifested as the "Downtown Brooklyn Commons" project, whose exhibition at Brooklyn Borough Hall has led to something potentially much more ambitious and concrete than a design study….

The initial premise, that all of the schools would design and build IN Betaville, was looking like a bad bet by November. The other schools, with plenty enough on their hands, had not gotten back to me with the kind of alacrity that would suggest a readiness to get up to speed with the mechanics of Betaville and then actually develop some serious "future-making" concepts within the available time frame, a single semester. Accordingly, I offered to undertake a Betaville-based process at BxmC with our crew of students, which was by then well-oiled as a design and modeling group, and to present our work with it as one of however many approaches might come together with the neighboring architecture and planning schools: CCNY, Pratt, and City Tech.

This was a semiformal "ideas" project, and downtown Brooklyn includes a very broad range of constituencies, with an equally rich mix of goals and expectations: the very successful and fashionable redeveloped DUMBO (Down Under the Manhattan Bridge Overpass) district on the waterfront; the MetroTech corporate/academic/government campus originally envisioned by George Bugliarello in the 1970s and then built out by Forest City Rattner; the African-American Fulton Mall shopping district; Brooklyn Heights; the Brooklyn downtown core, then undergoing very rapid redevelopment; Cadman Plaza Park; and an eclectic mix of independent schools, public housing, interspersed with the disconnected hodgepodge of open spaces that Joe Chan found so frustrating. If we went out into the community too aggressively to solicit full participation, there was a real possibility of inflaming latent tensions between these communities, ultimately at the expense of any more formal or purposive process that might come later. Whatever research or consultation we might do would have to be discreet.

The DBP's specific request was to address what they called "Downtown Brooklyn Commons," a reimagination of the area of and around Cadman Plaza, a block-wide park stretching about half a mile from the foot of the Brooklyn Bridge to the rear of Borough Hall (roughly, the green areas shown in Fig. 5.2). On a map, it looks like a pleasant treed concourse, smaller and more formal than Central Park. From the perspective of a pedestrian, however, it's a bit of a no man's land, isolated on both sides and split along its length by wide arterial roads with fast-moving traffic. For all the thousands who walk the bridge itself, very few continue on to downtown.

Informally, I got in touch with a few people to get some background information: Deborah Schwartz, President of the Brooklyn Historical Society; Tom van den Bout, an architect who had worked on some of the early variants of Brooklyn Bridge Park and had served as president of the Brooklyn Heights Association; Susan Gladstone, a planner with Levien & Co. who knew the district well; and Elisabeth Ernish, the Parks liaison at Borough Hall.

We might not be in a position to develop a fully participatory implementation of Betaville's purpose, but it didn't make sense to dispense with one or to simulate it. What we might be able to do, though, was seed one by offering a broad range of concepts, in the hope of providing a stimulus to more (and more creative) consideration of the possibilities.

By this point, we had very active participation in concept model design from Levis Reyes and Edgar Ramirez, City Tech architecture Tech alumni, and some sense of the park's current uses as a sports field for nearby schools, home to monuments and war memorials, the green market, not quite resolved adjacencies between pedestrian and bicycle traffic across the bridge, history as an industrial and transit hub….

One of Betaville's key features came to the fore: the ability to display in rapid succession or various combinations, any level of alteration from placing a sculpture to reshaping an entire district, including virtual "restoration": showing where things had been in the past, or even what might have been proposed but never built. The ability to propose lots of different things provided for an efficient and motivationally effective design protocol for volunteer designers: rather than spending a lot of time together in meetings negotiating at the outset, the creators could put their energy into a personal vision. At the very least, it would provide them with an

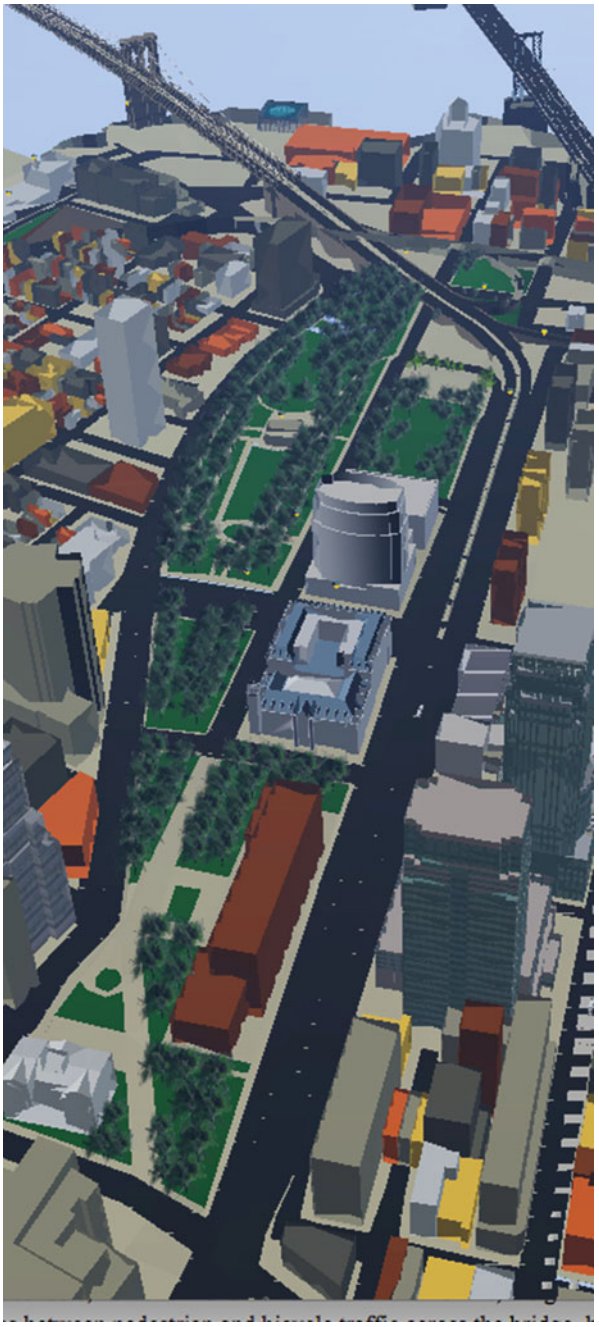

Fig. 5.2 Downtown Brooklyn, showing the Brooklyn Bridge at *top*, Cadman Plaza, and Borough Hall *bottom left*

Fig. 5.3 Pace Museum pedestrian network

opportunity to build up a portfolio. At best, it might form the core of the kind of deeper debate about the big ideas that most architects really live for….

At that time, the Manhattan "High Line" was in the news: an unused elevated train track running through the Chelsea district, whose historically industrial buildings were being converted and in-filled with art galleries and luxury residential towers, had been converted to an elevated linear park/promenade. We also had historical photos of Cadman Plaza in the early thirties: a maze of factory and warehouse buildings, with a spectacular horseshoe-shaped elevated train hub in the middle of it! Levis and Edgar designed entire new networks of elevated walkways to bridge over the commuter roads, essentially "high grid" concepts dipping into the park and neighborhood streets, leaping back into the air over the arterial roads (Fig. 5.3).

Within the framework of the Downtown Brooklyn Commons project, there was no reason not to engage this level of urban design science fiction in the mix, as a kind of middle term between the spectacular ambition that had built icons like the Brooklyn Bridge and the practical realities of tight public-sector budgets and the fact that the Partnership was ultimately more interested in the feasible. We didn't need to know how modest we could "bracket" our range of offerings from way smaller to way bigger than anyone expected.

At the Small End: A proposal for educational park furniture to support the school uses—for instance, a pair of abaci next to the playing field. They could be used as a scoreboard for games, a demonstration tool by a teacher or parent conversant with their use as pre-digital calculators, a lap counter for a jogger.

Public Art: The Hello World proposal to replace pieces of the sports field's artificial turf with a contrasting shade of green. For a few thousand dollars, we could make a public art installation that could be seen from outer space, or at least Google Earth.

The Big Wishbone: To demonstrate a broader notion about reintegrating the place-making and infrastructural purposes of what had once been called "public works," typically balkanized in current practice as urban design or public art overlays by artists and architects onto infrastructure conceived and built by engineers, I put together a proposal for what we called the Whitman Bikeway: a spectacular flying bikeway that would take off from the end of the Brooklyn Bridge's bikeway, and split into two corkscrew-shaped tunnels beyond the bridge's motor traffic off-ramps into the park on one side, and DUMBO on the other. The whole assembly would be clad in a large text, a three-dimensional poem riffing on a line from Walt Whitman's "Song of the Open Road." The Brooklyn Bridge itself is both an iconic destination and a practical engineering solution to the problem of moving people and goods across the river. Why shouldn't there be a bike lane improvement that would both resolve traffic conflicts between cyclists and drivers, and be an attraction, and a contemporary art conversation with a local historical icon of the arts (Whitman)?

Historical: Thanks to Deborah Schwartz at the Historical Society, we had access to renderings and plans for Dodger Stadium, a spectacular modernist concept proposed in 1950 by Norman bel Geddes for the site. We offered the bel Geddes in four variants: as originally sited, with the surrounding landscape and street re-routing, roof off; the same, roof on; the whole project moved to the Brooklyn end of the Manhattan Bridge, a currently hazardous and hideous mess of off-ramps, overpasses, and dangerous compromises between local streets and regional highways… and a big sign on the side facing the bridge: "Welcome Home Dodgers Love Marty." The concept was essentially to bring the Dodgers back to Brooklyn and to leverage the construction of a new stadium to provide for a "healing" of the transportation grid and urban fabric around it. At the time, conflicts between the neighborhood and developer for a new stadium at the Atlantic Yards were on the boil, and the owner of the Dodgers in LA was having financial trouble that might create an opportunity to repatriate the team, whose sale in the 1950s is still rued and resented by fans. The proposal was playful, but at some level also a signal to the community that there might be big ideas out there that would actually work for everybody. The bikeway concept might be out-of-the-box, but ultimately *at least* as viable as the status quo (Figs. 5.4 and 5.5).

Somewhere in the middle of the range between educational park fixtures and flying wishbone bikeway sculptures, we proposed a renovation and repurposing of a small building in the park (Fig. 5.6).

About a hundred yards from the stairs down from the bridge into DUMBO, there was a small two-story building in the park, surrounded by trees. From the bridge side, the building seemed to be some kind of park utility/office arrangement: typically a pickup truck or a golf cart in front. On the building itself, old signage indicating that it had once offered public restrooms; above, a row of tall windows indicating some kind of meeting hall inside. From the Borough Hall side, the building presents as a tombstone: a sheer wall of granite, engraved in remembrance of Brooklyn's war dead.

We proposed that this building be upgraded, turning its parking lot into a café terrace, reactivating the washrooms, and adding a new function: the reception area for a new blended-reality open-air museum and kunsthalle. For the first time, there would be an available rest stop for tourists coming off the bridge, which would also act as a gateway to the rest of the district: not only might it now be possible to rest and refresh

Fig. 5.4 The Whitman Bikeway

Fig. 5.5 Detail of the Whitman Bikeway

there but also to download a guided audio tour app for one's mobile phone, an augmented reality one keyed to story projects about names on the memorial walls, or another through which to see historical forms of the area, or future plans, virtual sculptures, science fiction… we called it the Open Museum (Fig. 5.7).

A few interesting things happened. Marty Markowitz, the borough president, was able to say for the record that he thought the Whitman Bikeway was a good

Fig. 5.6 The Cadman Plaza Memorial building

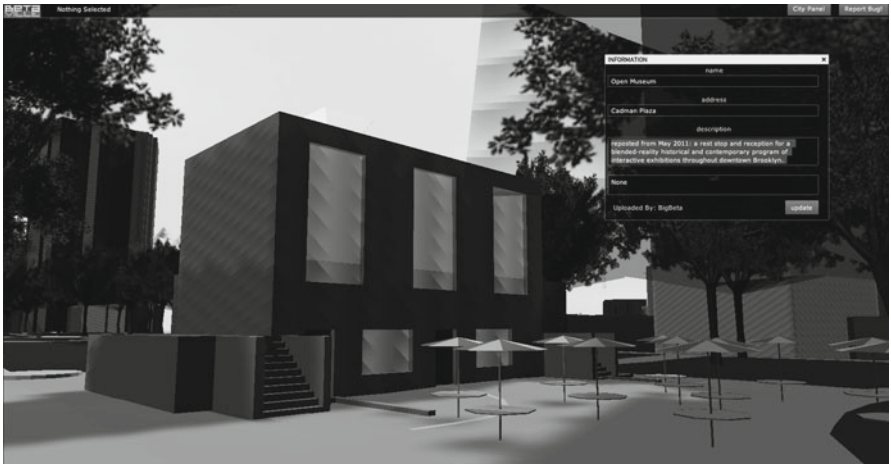

Fig. 5.7 The Open Museum concept for Cadman Plaza's Memorial building

idea… in his opposition to a bike lane elsewhere, he had acquired a reputation as an anti-cyclist, so this reaction was a pleasant surprise. Elizabeth Ernish, the parks liaison, was a working mother with school-age kids; when she saw the educational park furniture concept as a relevant–realistic–appropriate response to the site, the conversation opened up right away, leading to a readiness to discuss the Open Museum concept as a serious proposition. Tucker Reed, who was there on behalf of Two Trees, the developer of most of DUMBO, fidgeted impatiently through much of my presentation of the larger more speculative concepts, but when we got to the Open Museum one, he lit up: "I want this. What do we have to do? Come to my office next week." Steve Levin, the city councilor for the area, mentioned that he

had been in search of a fuller rationale for some capital improvements to the building, but also that the Open Museum's program could be a great way to propel his own hopes for an arts district just beyond Borough Hall that would eventually connect to the BAM district further along Fulton. Deborah Schwartz offered to meet with me to work out what it would cost to put the Open Museum together.

Of course, part of the Open Museum's program might well be to run an open and participatory collaborative "future-making" social media project, in which people could see concepts like my Whitman Bikeway, Levis' network of pedestrian boulevards with parametrically designed intersections, or a hundred approaches to reconfiguring the intersection of Jay, Nassau, the Manhattan Bridge, and the Brooklyn–Queens expressway.

This was a perfect irony. If I had been prepared to build and run that Open Museum, it seemed to have the necessary support. If I hadn't just spent 2 years putting together an innovative multimedia capital project for the school, only to have it pulled out from under me to leverage a hostile takeover of pieces of the digital media programs by another department, I probably would have gone for it, as an extension of the school and programs into the community, a "deeply social media" space. Students could directly engage the development of new software tools and build both base models and proposals for every scale and scope of ambition of potential for local change.

Marty had already called about the Dodgers, by the way. They weren't prepared to split a media market with the Yankees and Mets. Ah well.

We didn't actually bring back the Dodgers, and we didn't actually build a new media cultural center in the park, but we did verify that Betaville's ability to provide for a more open conceptual/first-phase design process and support nontraditional participation in ideation, and its built-in ability to present an interactive visualization of iterations–variants–alternatives in a familiar context model, could all contribute to more congenial AND more adventurous discussions, perhaps all the way to built outcomes.

In retrospect, the most direct functional contribution of Betaville to this effort was in providing a vehicle for a variety of schematic sub-propositions as openings to an informal discussion of the mix of possibilities. The ease with which an idea could be manifested, the relative simplicity of its rendering offering the affordance of initiating—rather than concluding—a design process, and the explicit invitation to further development through the interface, all pointed to the potential for further development, which each agent felt free to imagine forward.

5.2.2 Municipal Art Society

In the fall of 2009, I presented the Betaville platform to Susan Freedman at the Public Art Fund in New York City early in the development process, on three intertwined rationales: insofar as Betaville operated in a grey area between social sculpture/software art and a process tool for possible alternative curatorial and/or public

engagement scenarios, the Public Art Fund, which had been curating temporary public projects in the city since 1975, seemed an obvious choice of partner; secondly, the art community (and especially its technology sub-scenes) seemed the most reasonable place to seek out early adopters and exceptionally competent individual and group "test pilots"; and third, the potential for innovation in public art curation: Betaville could enable new and more broadly inclusive calls for proposals, adjudication practices, and even for direct engagement of artists with local communities in the later stages of the development of a particular project.

In the back of my mind, there was also the matter of due diligence… for all the stereotypes of artists as an avant-garde of free thinkers and radicals, I knew well that in practice, the esoteric language of contemporary art and the many layers of institutional insulation between "art" and "public" as I had come to know them over the years would provide some assurance that we wouldn't inadvertently do real harm to vulnerable populations in the high-stakes arenas of education and urban development before we were ready, particularly in the areas that are most typically targeted for "renewal." The Public Art Fund's program of temporary installations seemed to me to be an ideal experimental framework: explicit about its experimental approach to urban environments and ephemeral.

Susan stopped me mid-sentence: "Hold it right there, I'm calling Vin!" Moments later, Vin Cipolla appeared, and I explained Betaville "from the top"… Vin had recently been engaged to take over the leadership of the MAS, a venerable New York advocacy group with a strong commitment to Jane Jacobs' vision of local community self-determination and Jacqueline Kennedy Onassis' commitment to the preservation and development of New York's important buildings and civic spaces. He also turned out to have a background in tech venture capital and a deep interest in tools and practices for creative collaboration… in the years since, Vin and the MAS have not only helped the project reach much more effectively into its target communities, but to do so with the full benefit of the MAS network's experience, ultimately a better set of checks and balances than "contemporary art."

On that occasion, and in the years since, Susan Freedman has been enthusiastically supportive of the Betaville project as a general-purpose participatory platform, albeit with one reservation: the Public Art Fund itself did not take up the "public art by public means" concept Betaville had been at least in part engineered to enable, not did the Temporary Art Unit of the Department of Transportation, to whom I also proposed it while working with them to set up Real City, a projection installation for the colonnade of the Manhattan Bridge. There is a model of Real City in Betaville, a virtual historical artifact of the piece as built (Fig. 5.8):

Currently, a working group of architects, artists, and engineers has come together under the aegis of the Gotham Innovation Greenhouse to develop a set of concepts for the area of Manhattan generally called "southwest Midtown," roughly bounded by the Hudson River to the west, Penn Station to the East, and 23rd and 42nd streets to the South and North. Over the next few months, we will prepare the base model of the area and seed it with a variety of provocative proposal models, analogous to the spread of ideas offered for the Downtown Brooklyn Commons project, but going deeper into the historical, district-wide, and systemic issues facing the area as

Fig. 5.8 Real City Installation screenshot

the future of Penn Station, Madison Square Garden, the Hudson Yards, and the waterfront call for more open, and better integrated, consideration than they have gotten by conventional means to date. The MAS has pledged to do its utmost to help us with a campaign to promote the availability of the model for further public engagement in the fall, when it's ready; the area has been one of contentious debate at least since the original Penn Station was torn down in 1962.

If we can bring out the same kind of curiosity and ambition that characterized the Downtown Brooklyn Commons project in this larger context, one of the city's most dynamic districts may yet offer some of its best-resolved development paths.

5.2.3 The College Art Association

In January of 2011, we gave a panel presentation about Betaville at the 100th Anniversary College Art Association conference, which happened to be held in New York. McKenzie (Ken)Wark contributed a talk about New Babylon. Ali Dur, an architect from Istanbul, built a virtual replica of one section of one of the New Babylon studies for Paris and uploaded it to the New York City Betaville—a gigantic loose scattering of struts and slabs spanning the East River between Chinatown and DUMBO. Of the few actually enclosed sections, the largest was provided with a set of widely spaced point-source sound loops by Paul D. Miller, aka That Subliminal Kid. Rather than a city square, Wark's "New New Babylon" had a disco. Most of the available photographic documentation of the original New Babylon are

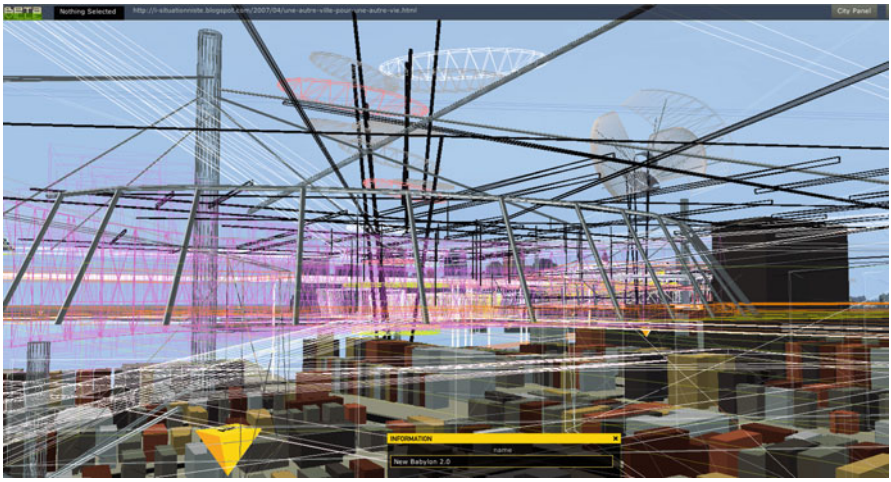

Fig. 5.9 Wireframe detail of New New Babylon (Ali Dur, McKenzie Wark, Paul D. Miller, Constant)

in black and white… most of New New Babylon's elements are candy-colored (Figs. 4.17 and 5.9).

Ali went on to create an animation from the model, a sequence of tracking and panning shots through a seemingly endless dreamscape of color accompanied by a mix of Spooky's loops, a kind of "digital drift" exactly consistent with the situationist concept of moving through the city as a "dérive"… and since, to head up the Istanbul node of the Open Line Studio, about which more in Chap. 7.

We had some opportunity to upload the models in advance. It was the first time I had seen any of the New Babylon designs in a context that gave me a real sense of the sheer scale of the idea. I somewhat sarcastically suggested to Ken that I would feel free to sleep in, without fear of missing the Revolution of Everyday Life, insofar as there was little chance that anybody would actually ever come up with the capital to actually build even a fraction of the section we could see dancing across the East River. He replied that it wasn't any bigger or crazier than what is there now, only consistent with an entirely different order of economic and symbolic relations.

New New Babylon persists as a proposal in Betaville, an idea Ken Wark pointed out was no bigger or crazier than notebook computers or the Brooklyn–Queens Expressway used to be, ready at any moment to be productively misunderstood as a current future-making proposal, rather than an art-historical curiosity (Fig. 5.9).

5.2.4 The Festival of Ideas for the New City

On May 6–8 of 2011, the New Museum held a "Festival of Ideas for the New City": a long weekend of special programs and events at and around the museum, with

Fig. 5.10 The Betaville kiosk at White Box, May–September 2011

varied kinds and degrees of participation from arts and community groups in the vicinity. I was invited by the nearby White Box Gallery to set up a Betaville kiosk in their storefront space as White Box's participation in the festival….

White Box works in the grand tradition of artist-run spaces: from 1 month to the next, you might find a doghouse design competition, a new installation by Michael Snow, several tons of sand, or Betaville.

The New Museum's move to the Bowery from SOHO, and its construction of a contemporary architectural landmark building cheek-by-jowl with the Salvation Army and secondhand industrial kitchen suppliers, represented a significant moment in the evolution of the Bowery and the Lower East Side from an immigrant/working class/bohemian quarter to a luxury district. As an anchor occupant of the new Bowery, and a cultural institution with local community responsibilities, the New Museum set out to convene the full range of local stakeholders in its neighborhood.

For what eventually became a run of 3 months, an attendant would work on models and tinker with their placement in Betaville, concentrating on the vicinity: Lower East Side and Chinatown, approaching the Manhattan end of the Manhattan Bridge. One of the kiosk's three screens faced the attendant, another the street, and the third the visitor. I tended the kiosk myself for much of the run, as an informal approach to gauging responses and—hopefully—making Betaville some new friends.

The first beneficiary of Betaville's design support functions was the kiosk itself. Jee Won Kim, a Korean-American architect with an office nearby who served on the White Box board of directors, had started to design an elaborate setup calling for laser-cutting large panels of MDF. We got together, trade a few quick models, and settled on a very simple arrangement made by customizing an inexpensive painter's scaffold to hold the monitor brackets and the computer (Fig. 5.10).

Meanwhile, Craig Brown had come to the Digital Media program. He was a 3D interaction designer with a background in virtual architecture at UCLA. Betaville made immediate sense to him. One of his student projects had been a design study for the area opposite one end of the Ponte Milvio in Rome, and he immediately recognized in the Manhattan Bridge's strange configuration a variant of the same play of what he called "tectonic forces": a historical interface between bridge and neighborhood that had been pushed and squeezed over time by the needs of motor traffic, whose current form expressed more than it resolved new patterns of occupation and circulation. We adapted and expanded the concept for the Manhattan Bridge, bringing in some of what I had learned in Toronto about traffic calming, and on location through the process of setting up a public projection piece, Real City, for the bridge's monumental colonnade earlier that year.

The Manhattan approach to the Manhattan Bridge is a strange and chaotic piece of the urban fabric: a miniature variation on St. Peter's gate sits on an artificial hilltop at an odd angle to the surrounding street grid, isolated within a cobblestone plaza that looks like it was meant for pedestrians, but bisected by fast-moving car and truck traffic that rushes alternately in or out, depending on the time of day. Large orange plastic pylons are moved by hand every 12 h on that roadway and the adjacent section of Canal Street east of the Bowery. The roadway on the bridge itself is optimized for almost highway speeds, while the intersecting sidewalks work at a crazy mix of scales, from the busy shop fronts of nineteenth-century tenements and warehouses that characterize the old Chinatown to the north and widely spaced tall towers to the south along the Bowery. One highway-style ramp runs up to the upper deck Brooklyn-bound from the south, while another runs into the end of Chrystie and the Sara Delano Roosevelt Park, overlooking a bike lane with a wide parapet overlooking the old informal vegetable market hugging the bridge's abutment.

In tandem with the design project per se, a couple of Taiwanese students in the Digital Media program undertook a documentary video project about the market, its merchants, and its customers. This was a classic case of an informal immigrant situation, in which many of the people most likely to be affected by bright ideas about upgrading the market's infrastructure do not speak much English, may well not want to attract attention to themselves (or their immigration status, or regulatory agencies, or well-intentioned agents of transformation generally). Chinese themselves, and obviously students to boot, were able to elicit at least a modicum of local input.

Over time, the new form evolved as the "Ponte Mirabile," incorporating various forms of attenuation of the "straight shot" motorway to something that might provide for a slowing of cars and trucks before they run into the pedestrian crossings and the neighborhood, and a minimal sheltering of the market area, calibrated to improve it sensitively: not so expensive that it would gentrify the market out of existence as a vital provider of cheap fruits and vegetables to low-income residents, or so drastically altering the conformation of the street that it might compromise the delicate balance of truck parking, pedestrian circulation, and stall space that add up to an informal urban "node" (Fig. 5.11).

Betaville on the Bowery, as an initial foray into the emerging institutional genre of art–architecture–urban design crossover programming (the BMW Guggenheim "Lab," the Museum of Modern Art's Rising Currents project), provided a useful

Fig. 5.11 Ponte Mirabile concept for the Manhattan Bridge Colonnade and Plaza (after Craig E. Brown)

opportunity to gauge the variety of kinds and levels of engagement that might be latent in the district, and the local–global art networks in which White Box and the New Museum participate in very different ways. Of the incredible variety of responses at White Box from curators, artists, and audience members, one in particular developed through the curiosity and enthusiasm of White box's board member, Jee Won Kim.

Jee Won responded strongly to the potential for alternatives to competition in architectural design processes. He had worked in south Korea on the Busan International Architectural competitions, as well as any number of collaborations with international artists, and of course architectural competitions. The possibility of new hybrid protocols, through which designers might more deeply engage end users but also through which they might find better ways to use the competition process itself beyond the design–bid–build process, a winner-take-all workflow in which the efforts of all but one of the competing teams are effectively lost was more than attractive to him.

We tried a few things, from putting on an "architectural food fight" to which we invited a mix of artists, architects, and real estate and planning experts for an informal brainstorming-dinner party to a back-and-forth design "conversation" in Betaville about a speculative concept for the Brooklyn Waterfront Park, then in the early stages of building out along the disused industrial piers running along the shoreline south beyond DUMBO, opposite Brooklyn Heights and a long stretch of the Brooklyn–Queens expressway. Inspired partly by the recent "Rising Currents" project at the Museum of Modern Art/PS1 in which several teams had proposed new large-scale alterations to the harbor, and partly by the radical "Liberty Piers" and "New Babylon" demonstration projects in Betaville, we experimented over the course of several months with what Jee Won called the AquaFarm: a mile-long

elevated lattice of intensive agriculture that could operate in a sustainable cycle with fish farm pods in the water and a set of mixed-use pier buildings extending the local street grid and open space over the highway. Most of the surface of the existing piers would remain open as well, sheltered by the AquaFarm's superstructure above. Of the artists he contacted about contributing to hypothetical public art installation/integration concepts, the veteran German intermedia artist Hans Breder went the furthest. The Betaville AquaFarm concept now includes a triptych of very large outdoor video panels emerging from the water just beyond the shoreline. An interactive display of the proposal will be included in his upcoming retrospective in Düsseldorf. As a follow-up with White Box, we helped Catalina Rojas upload a model of a proposed Rain Garden design by Frances Levine for their building on Broome Street.

Through the Gotham Innovation Greenhouse, the AquaFarm has led to another initiative, the Open Line Studio, about which more in the "outcomes" section of this book.

Jee Won Kim's generosity (from the outset) and curiosity (clearly insatiable) have also provided for a sustained engagement with the practical requirements of working with Betaville in an architecture office: a principal trained at the Cooper Union [before or after computers?] working with a combination of mostly younger associates and interns with highly developed skills as 3D modelers but within very specific software environments and workflows.

As the firm's principal, Jee Won doesn't do much of his own drafting, let alone 3D model construction. His studio works most typically with AutoCAD and Rhino, with occasional use of 3D Studio MAX, and very occasional use of Sketchup and the Google 3D warehouse for stock elements like furniture. Of the four, only the latest version of 3D Studio Max and Sketchup will export the required .dae files "out of the box." Our creative collaboration, close as it has become in 2 years since we first met through the White Box project, still requires that I personally handle the file conversion and uploads.

Establishing a new model pipeline is always a headache. As a researcher in and engineering school with semi-captive participation by students, to whom the particular requirements of the Betaville modeling pipeline are a daily reality, it seems like the most obvious and simple task. Often, I find myself tinkering with models as a welcome refuge from more demanding work, like this manuscript. For others, however, preparing a model that will upload properly, and to the desired effect, can be a frustrating and disorienting challenge.

Jason Lee, the architect at Jee Won Kim who handles most of the more complex modeling and rendering work for the firm, prepared the AquaFarm models for Betaville. As a more recent graduate from the Pratt Institute in Brooklyn, he studied under a mix of senior faculty with little personal experience of digital tools in the actual design process and junior faculty who taught the technical courses and/or studios where students were expected to work with digital tools. For Lee, the most glaring challenge/impediment to designing for Betaville was the constraint on file size. He reported that a typical complete building design without full construction detailing is on the order of 250 MB. Insofar as the usual presentation formats are

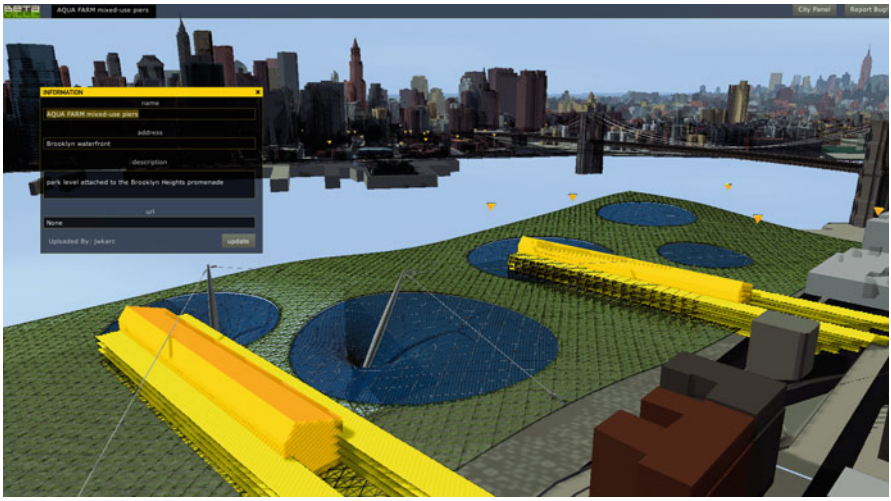

Fig. 5.12 Jee Won Kim "AquaFarm" concept for Brooklyn Waterfront, including pier elements from the Betaville College Art Association project and a large floating video triptych by Hans Breder, as exhibited in *Hans Breder/Kollisionsfelder* Dortmunder U, 2013

rendered as high-resolution prints or short animations output as pre-rendered video, either of which allows for long rendering times, Betaville's restriction to something more like 5 MB calls for a very different approach to the construction of the model itself, with a density of information appropriate to concept sketches. The practice of presenting such sketches in an open forum, using tools primarily associated in architectural practice with construction drawings or convincing renderings to support formal proposals or approvals, remains counterintuitive.

With a bit of informal support, however, Jee Won and some of his creative collaborators were prepared to explore Betaville's potential as an environment for thought–visualization experiments and to do so partly by taking up and developing elements from ideas already in Betaville (the Pineapple Pier elements of the College Art Association piece) and elsewhere, in accordance with the original vision of Betaville in use (Fig. 5.12).

As I write, three interns from the architecture program at Inje University are building out a base model for the New York City Open Line Studio site, so that they can help their colleagues in Korea become sufficiently fluent with the model pipeline to be able to share that fluency with their classmates and faculty participate fully and effectively in the Busan Open Line contingent in the fall of 2013.

Jee Won Kim and Byeong-Joon Kang have been willing to deal with the near-term workflow complexities demanded by the addition of Betaville to their toolkit for a specific reason, not specifically technical but for which the Betaville platform offers new levels of affordance: new hybrid design practices beyond what is practical, or even conceivable, within current design competition frameworks: a large number of firms submit preliminary concepts or simply their qualifications in response to a program brief and a deadline, on the basis of which a small number of

firms work up finished schemes, from which an adjudication panel selects a single one. The prospect of being able to provide for collaboration between finalists, or for substantial distributed design development of schemes as part of the competition process, or part swapping between schemes or teams, is of particular interest if the client site is remote from many of the competing design proponents (such as Busan, in south Korea, where Kim and Kang worked together to run the international competitions that led to the construction of Vienna-based Coop Himmelb(l)au's design for the Busan Cinema Center), or for small firms inclined and committed to creative collaboration across fields or long distances.

It remains to be seen at this point whether the functional capabilities of the technology itself, or the conceptual development its specification proposes, is the most productive aspect of Betaville in this case. We have agreed to find out the hard way, through the Architecture Faculty of Inje University's direct collaboration on the Betaville-based Open Line Studio project in 2014–2015.

5.2.5 New York Hall of Science (ReGeneration): Tomorrow 2.0

Curators Steve Dietz and Amanda Parkes, working with the New York Hall of Science, called in the spring of 2011 for proposals for artworks that would engage any combination of local social, environmental, and ecological issues in a the multimedia exhibition *ReGeneration* at the New York Hall of Science, which occupies one of the buildings put up for the 1964 World's Fair in Flushing Meadows/Corona Park, Queens.

The Hall of Science, under the direction of Margaret Honey and Eric Siegel, had taken an interest in synthesizing art, technology, and science as an integrative part of its program. From their program statement:

Despite growing scientific and cultural consensus about the importance of sustainability there remains significant uncertainty about everything from the actual meaning of the term to overarching solutions. Technology and behavioral changes including energy production, agriculture, recycling and pollution reduction are all on the table as we work to understand and address the challenge of sustainability. From a scientific point of view, systems that generate energy are exothermic; systems that require external sources of energy to function are endothermic. Analogously, New York City can be described as an exothermic system that thrives upon the infusion of energy in the form of immigration—of both people and ideas and knowledge.

> In ReGeneration, 10 artists and artist groups will engage with Queens (the most ethnically diverse county in the United States) to explore how its enormous cultural vitality is both sustained and sustaining. The goal of ReGeneration is not to create or propose systemic solutions to every conceivable problem. Rather, through the intersection of art, science, and technology, artists will explore and celebrate particular indicators and examples of cultural vitality. These engagements can ultimately be adapted to other environments, enabling a network of local practices that helps sustain a regional or larger cultural vitality. (Curatorial statement, *ReGeneration* New York Hall of Science)

Joe Fattorini, one of my master of science students, had already started working in high schools with Betaville, and one client school in Manhattan, the Dwight School, had already gotten into the business of building out a set of the World's Fair buildings from 1964, as a preliminary exercise to prepare them to create a locally relevant set of curriculum enrichment assets. Together, we proposed Tomorrow 2.0.

Two other schools came on board: the Urban Assembly Gateway High School in Hell's Kitchen and the Louis Armstrong Middle School in Queens, near the Hall of Science.

Louis Armstrong Middle School

The Polytechnic Institute of New York University has operated the David Packard Center for K-12 Education since 1996. In the early fall of 2011, I approached its director, Ben Esner, in the hope that he could connect us with a partner school in the vicinity of the Hall of Science, to broaden the base of participating students, and hopefully have the project well under way, with at least a representative sampling of projects in Betaville by the time the show opened in October.

Ben thought about it for a minute and offered to set something up with the Louis Armstrong Middle School. A few weeks later, we met with a group at the school: Bill Fahey, the principal; Ronnie Aroesty and Olena Horcajo from Junior Energy, an NGO promoting energy issue awareness in schools; Joshua Blum, the school's Science coordinator; and Kate Thomason, the teacher recruited internally to work with us.

They laid out a strategy that would fit the project while helping them meet some outstanding goals. The New York State education system is currently driven by a rigorous set of standards and testing, intended to raise achievement levels and the general quality of the system. The effort is substantial and urgently needed, but leaves little flexibility in the regular curriculum for experimentation. After-school enrichment programs, on the other hand, do provide opportunities to innovate at the school level. LAMS already had a substantial set of after-school enrichment programs for students with special needs or requiring extra help to meet state standards, but little to offer as yet for their highest-achieving students, who might seek greater challenges or opportunities to stand out as applicants to the most desirable high schools, for which competition is intense.

Accordingly, we agreed to build a semester-long program of two 2-hour sessions per week to provide long enough working sessions for the students to be able to really dig in; Kate, for whom NYU-Poly provided a small stipend, would supervise the class itself in the computer lab, while I would lead and support the technical and conceptual development of the projects. The projects would focus on Energy as a theme for the group supported by Josh Blum at the school and Junior Energy for external resources. Students would apply to participate with a short essay about their interest in some aspect of the substance of Tomorrow 2.0.

Fig. 5.13 Student proposal for the next world's fair—they walked like beasts: in the future, robots drinking fossil fuel and farting greenhouse gases will be so exotic

We got underway at the beginning of the spring semester. After a brief introduction to the operation of Sketchup and Betaville, supplemented by the Google 3D warehouse for pre-built parts, the discussion and work were all about the history of Flushing Meadows and the World's Fairs, climate change, finding information about things like the volume of a ton of CO_2 or how many square kilometers of solar panels it would take to power New York City, global distributions of native species of traditional food species eaten in the culturally diverse vicinity, methane from pigs as a renewable fuel source, how to derive potable water from runoff at the stadium… and how most effectively to visualize these concepts as pavilions or exhibits for the NEXT world's fair (Fig. 5.13).

During the course of the project, we had visits from Junior Energy, the NYC Department of Education's Technology Officer, and a local television station. The LAMS students were promoted on New York One as "person of the week" *and* "person of the month."

Part of the program's format was to have the students also act as "explainers" at the exhibition itself. I had hoped to have an intensive engagement with the museum's floor staff, to make sure that visitors could have a "guided tour" as much as possible, to make the most of the platform as a vehicle for internal enrichment for their contingent of student volunteers, and to minimize the risk of visitors coming to Betaville crashed, wandered off, or simply a little too enigmatic for the average 90s museum guest attention span. We weren't able to work this out for the whole run, but Joe and the students did work together for special sessions, which provided another level of engagement for the students, the museum, and its audience.

Urban Assembly Gateway

Richard Kahan attended the first MAS Summit for the Future of New York City in October of 2010, at which Betaville was unveiled as a working research prototype: a presentation, but also six demo stations set up in the reception area, for demonstrations through the entire schedule. Richard had established the Urban Assembly in partnership with the NYC education department, a new network of Career Training Education high schools, and was on the lookout for new approaches to education about and with digital media… Richard saw tremendous potential for Betaville as an enrichment platform for the Urban Assembly schools, dedicated to academic and ultimately professional advancement for students from underserved communities throughout the city.

Through the lens of that kind of mandate, Betaville presents a compelling combination of possibilities. Civic engagement is a crucial order of student empowerment, as is the prospect of being able to provide students with experience of the web and 3D modeling as tools for changing the world, as well as a bridge between the glamor of entertainment media and skills with an ultra-customizable piece of software connected through GIS and Java programming to STEM fields at the college level. The Urban Assembly Gateway school, then being planned to open in 2011 in Hell's Kitchen, would specialize in technology, under the three broad headings of Information Technology, Health IT, and Web/Animation, offered the best fit.

By the fall of 2012, Betaville was up and running in the newest school in the network, the Urban Assembly Gateway [curriculum streams]. I had proposed its use as a common platform for programming and "digital media" (3D modeling/animation and game design), as well as a facilities/planning tool for the school itself, and a medium for broadening the digital media curriculum to include urban design and service components… I thought that was radical enough. Between one meeting and the next, they were talking about adopting Betaville as a platform for teaching geometry! The Louis Armstrong students had already proven the program's feasibility and effectiveness.

The process and its outcomes were radically different. The project was offered internally as a 3D modeling/game development "club." By the time students got to the first session, they mostly seemed to expect an entertainment-oriented and recreational format. The 1-hour sessions, whose setup was complicated by the need to juggle rooms and obtain laptops in carts, made for a frustrating workflow. As often as not, students were just getting down to serious work when the janitor came in, fretting about the late hour.

Over the course of the semester, the group boiled down to two very small groups: a couple of students with ambitions in creative fields who got serious about making something for Tomorrow 2.0; another small group, informally teaching each other Blender 3D and starting to argue about the outlines of their own indie game project; and quite a few more eager to socialize and play but just as eager to avoid doing anything that might be construed as work. The lack of a supervising teacher with keys and authority to enforce a semblance of discipline played to the weaknesses of the weaker students. The best of them, with occasional complaints, were already showing signs of unstoppability.

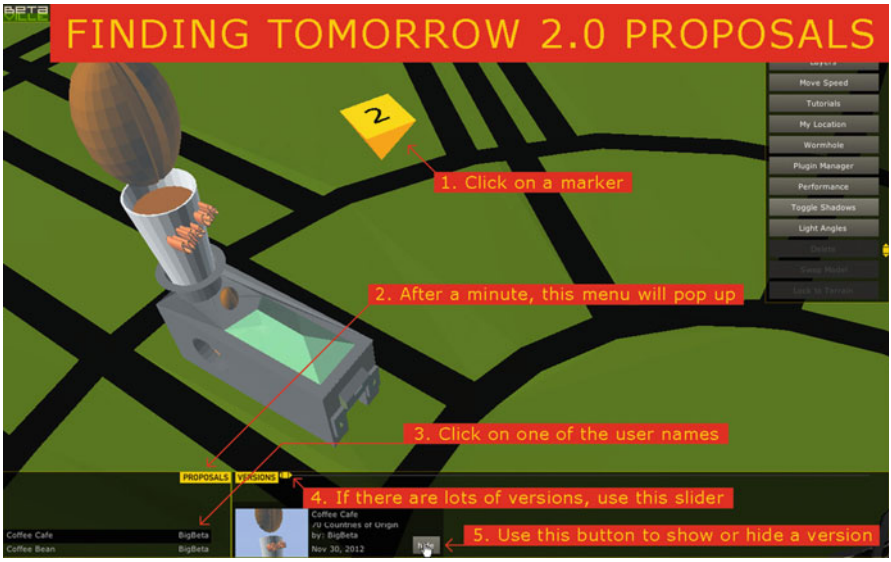

Fig. 5.14 Info poster, *ReGeneration*, New York Hall of Science, featuring UAG student project: the "Coffee Cafe" operated both to serve coffee and to teach visitors about the global economy and ecology of coffee production and consumption

To be clear on a very important point, the difference between the experiences and results from the two schools has nothing at all to do with the relative general quality of the institutions or their staff or teachers. It was entirely a matter of the differences between the project formats, in terms of the expectations set up at the outset. The Louis Armstrong approach, including a strong definition of subject and goals supported by "enrichment of the enrichment" along the way by guest experts in the subject domain and the construction of the activity as academic rather than social/recreational, was crucial for these age groups in a late-afternoon extracurricular framework with small time windows of access to computers. I still serve on the urban Assembly Gateway's advisory board and look forward to an opportunity to offer them a more mature implementation when the time is right.

Meanwhile, the show at the Hall of Science proceeded. We added "travel posters" around the Betaville Smartboard display to show prospective users some of what they might find if they went for a virtual tour, tinkered with its configuration and settings, and put up a set of instructional panels to facilitate unguided tours. By the time the show came down in January, Tomorrow 2.0 was running smoothly. Mike Cosaboom, the Hall of Science's project manager for the ReGenerations show, approached me as we were taking down the equipment at the end of the run to let me know that seeing the Louis Armstrong "explainers" in action on the last day—their excitement about the underlying issues, their pride in their projects, and their desire to engage visitors in Tomorrow 2.0—had brought home to him both what we had set out to do and the possibilities. I was particularly pleased to hear this, because he had worked so hard to help us make it happen (Fig. 5.14).

In this case, the Betaville platform served first and foremost to demonstrate the potential for a new open channel between local institutions (the schools and the Hall of Science) and their specific urban context, flushing Meadows/Corona Park, leveraging local history and geography to develop new ideas for the future there, and by extension in other locations with related potential. The combination of a readily accessible authoring environment (Sketchup) and the context model provided in Betaville, with Betaville's ability to annotate and display those concepts in physical public venues like the Hall of Science as a window to its broader availability online, suggests the generalizability of such projects as a first engagement by students of ongoing engagement of the built environment as indefinitely reimaginable, both qualitatively and functionally.

5.3 Bremen, Germany

Running through the middle of Bremen, there is an arterial commuter road that might remind a New Yorker of the Brooklyn–Queens Expressway. As it passes in front of the train station and its large, open plaza/bus and trolley transfer point, the Hochstrasse stands elevated on stilts, casting a deep shadow between the buildings, a gloomy nether land between the plaza and the low-rent mid-rise buildings on the other side, leading down to the old city and the river. One end of this Hochstrasse (weirdly, just the contrary of a traditional "high street" of shops and pedestrians) passes out into an area of small houses and splits in two separate high-speed one-way multilane pass-throughs, isolating a large patch of treed parkland that was once also streets, houses, and the rather substantial Rembertikirche, a gothic church that didn't quite make it through World War II. This harsh effect, of what looks like a park except for the ring of high-speed traffic that cuts it off from the neighborhood, is quite similar to the strange situation of Cadman plaza, one of the key "broken links" in Joe Chan's vision for an integrated network of pedestrian spaces in downtown Brooklyn.

One of the motivating factors from the Brooklyn team's point of view was actually collegial: to bring Betaville home to the Bremen team, making their part in the technical development more present and concrete, less "a world away," and also to return some value to Bremen for its investment. Of all the Betaville "sites," this was the one with the strongest engineering capacity on-site, especially if the architects and/or civil engineers at the Hochschule could be brought into the project.

This was also the venue with the most developed public art project concept ready to implement as part of the program: Jürgen Am Thor's "Rememberti," a virtual reconstruction of the absent church and neighborhood, including a remapping of one of the streets now erased by the commuter roads and the park itself.

Within a conceptual framework of citizen developers and "direct software development," how might we assess the practical value of building the tools right in the middle of the use case?

With a temporary summer site lab in the park, at least one segment of the development process becomes a social sculpture of another kind: the neighbors might gravitate to the park to find out more and find themselves trading ideas for the tools, the process, and the city in situ.

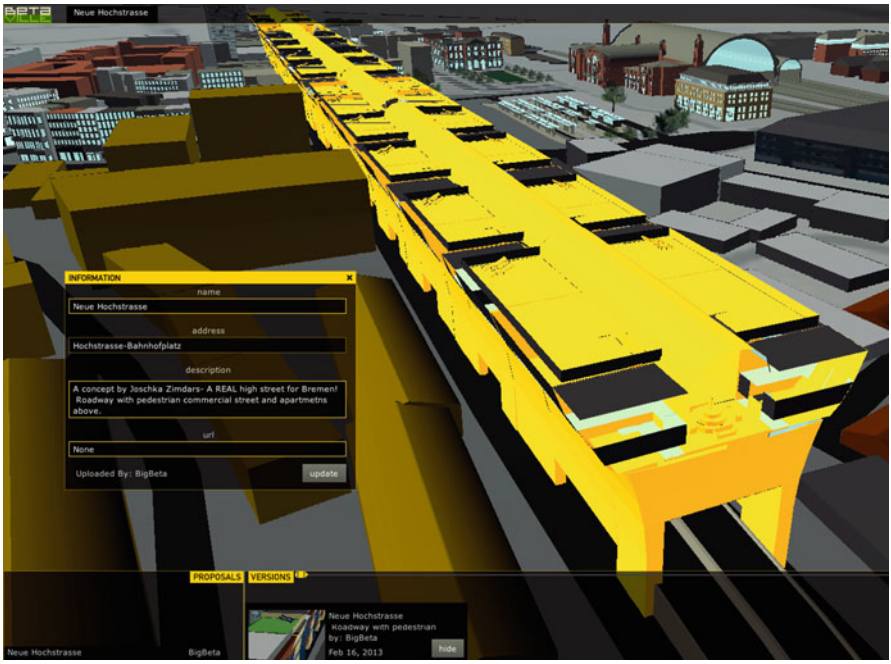

Fig. 5.15 Proposal for redevelopment of the Hochstrasse elevated highway through downtown as a "high street" based on the Ponte Vecchio in Rome and the HUB Mall at the University of Alberta, by Bremen student Joschka Zimdars

While it was relatively easy for Bremen to recruit top students to participate in the Betaville project to fulfill their program requirement for a semester abroad, the Brooklyn students who had no such statutory requirement were much harder to motivate to add the cost of flights to the already onerous cost of tuition and living expenses in New York, from which the exchange did not relieve them. We eventually set up short-form "block seminar" courses, in which I would teach an intensive workshop in either the summer or winter intersessions. In this way, were able to provide a viable format for the reciprocal student exchange (Fig. 5.15).

Within these logistical limits, the inter-institutional collaboration went well, in the ways we had intended: the ongoing development of Betaville's software infrastructure provided any number of opportunities for programmers to build specific components for a working system, according to their skill level and curiosity, in a broad-spectrum group project that both required and stimulated exchange of ideas about the purpose and methodology of the overall project, and an exceptional level of engagement between students at different levels, or working on different aspects of the work. Students were present, and often active, in discussion and debate between participating faculty about the Betaville's purpose, progress, and strategy. The broad range of work called for by the effort to build and populate the Betaville software infrastructure and demonstration projects for Brooklyn and Bremen provided lots of opportunities for students to experiment outside their specialty, as well

as contribute their well-developed expertise in particular sub-domains: Skye Book, as lead developer, was able to develop his leadership skills as a developer in both the research project and the open-source jMonkey community, providing invaluable support to our first round of users, and students and faculty across the collaboration. Cemre Güngör, one of our MS students, undertook a similar role vis-a-vis interaction design; several of the Bremen students, including especially Peter Schulz, Karl Bode, and Jonas Panten, turned out to be very good UI designers as well as software developers, and in due course built their Master's thesis projects on components of Betaville; some of the Media informatics students from Bremen turned out to be good model builders and urban concept developers (Joschka Zimdars and Behrad Biglarpour in particular).

Martin Koplin was able to establish an EU-wide network of academic partnerships, the "ThinkBETA" consortium, to consider variants of the Betaville methodology for creative/research work in Sweden, Lithuania, Poland, Roumania, Germany, and Denmark.

Between the time when Betaville became a verifiably viable technology in late 2010 and the time I left NYU-Poly in the spring of 2012, we presented the Betaville project in any number of academic and nonacademic settings: The MAS's Summit for the Future of New York City in 2010, ISEA 2010 in Dortmund and 2011 in Istanbul, the College Art Association in 2011, the Digital Government Society in 2011, the Goethe Institut in 2012, technical conferences in Riga and Bremen in 2012, the Personal Democracy Forum in 2012, and the Energy Datapalooza hosted by the CTO of the USA in Washington.

The eclectic character of this list reflects the odd mix of quarters from which interest in Betaville, and initiatives like it, has come: experimental media art, open data/digital governance advocacy, urbanism, and education.

Betaville's no-cost availability for the project was crucial in providing a vehicle for the initiative, as was its ready extensibility: the fact that we could adapt it to a semipublic touch-screen interface on short notice, and its provision of the same context model in the school, in the museum, and online were critical in making the conceptual program a practical reality; this suggests a new approach to educational software and to the value of open tools as public spaces. The possibility of providing both for a protected environment consistent with the obligations of an educational institution AND two-way communication between the classroom and the surrounding community as a field for creative experimentation is worth noting, as curricula and technology strategies evolve in this sector. As local open geodata resources multiply and mature, their value for public engagement can be modeled and disseminated as part of the formal education of young New Soft Citizens.

5.4 Washington DC: The Energy Datapalooza/Tomorrow 3.0

Betaville's initial provision for conforming to open GIS standards to provide for ease of adaptation of geodata, and for Betaville to provide an interface for such data as a useful function of base models, inadvertently anticipated the tremendous

increase in practical interest in open data from the related—but not as yet well integrated—domains of government, big data, participatory e-governance, research, and creative-to-social software platforms.

The Datapalooza initiative was a use case we had not planned, but we happened to be ready for when it came up.

As CTO of the federal department of health and human services, Todd Park set out in 2010 to combine big data and crowdsourcing to simultaneously better exploit the large databases maintained by the agency as part of its mandate and to leverage the openness of the data as an engine of economic and technological development. The promotion of open data could complement in-house information resources like healthcare.gov by providing raw data to any number of mobile or web-based applications built by private developers.

When I attended the Personal Democracy Forum as a panelist in early June 2012, Park gave one of several keynotes, speaking by then as the Chief Technology Officer of the United States. He told the story of the Health Datapalooza there mostly as a matter of providing a new avenue of service delivery and innovation leveraging public data beyond what the agency could reasonably have been expected to do on its own. In other quarters, he has been quoted with more emphasis on the value of open availability of public health data as raw material for private initiatives. HealthData.gov provides a catalog of available public databases; HealthCare.gov a directory of public and private healthcare providers, and an overview of the White House data-to-venture pipeline.

Park announced the upcoming Energy Datapalooza as a follow-up on the successful HHS initiative at the Personal Democracy Forum. A few days later, I was invited to attend through one of the Datapalooza organizers based in Austin, who had heard about Betaville through the research grapevine there. The format was simple: a workshop at Google's offices in New York in early July 9th at which groups of "innovators" from the public, private, and academic sectors would come up with or select ideas for applications leveraging available open databases and then get together to build them out as working prototypes to be submitted a few days in advance of the Datapalooza itself, a showcase presentation in the Eisenhower building in Washington.

The brief was to propose either a new application or a significant upgrade to an existing application, within the time interval of 90 days, including a presentation or short video to introduce the project.

What I proposed to the White House was an upgrade to Betaville, addressing its potential as a public energy information/education platform, in two ways: a set of energy fact 3D model visualizations and a new functionality: click on a building in Betaville and see its energy-related property data pulled directly from an open database in real time.

The first set was no more or less than a professional-level version of the program for the Tomorrow 2.0 project at the Hall of Science: a scale model of a ton of CO_2 at 25° C at sea level, its equivalent in trees, enough vehicles to emit the same in a given distance of travel, and so forth (Fig. 5.16a, b).

The second set was originally proposed to demonstrate a web interface for the "building performance database" mentioned as the kind of resource that the

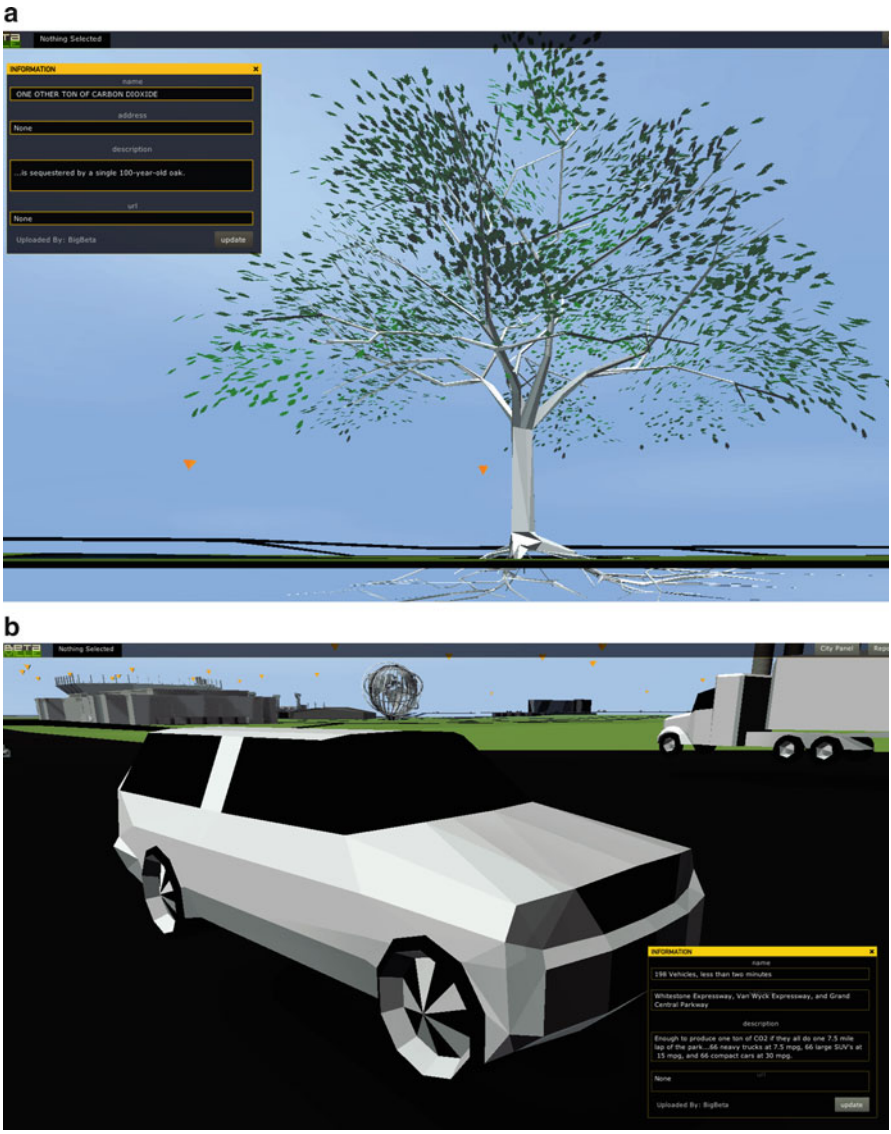

Fig. 5.16 (**a**) One ton of CO_2, in the form of a single Northern Red Oak 100 years old. Note that in Betaville, unlike Google Earth, trees have roots! (**b**) One ton of CO_2 in the form of 198 typical vehicles doing one lap around the highways encircling Flushing Meadows/Corona Park, a 7.5 mile circuit: 66 Volkswagen Beetles, 66 large SUV's, and 66 heavy trucks

Department of Energy intended to provide. The "sample" database provided by the DOE, however, was not usable for this kind of thing: a table of query results from the actual database, in tabular form: column 1, the numerical ID of the row; column 2, a number of square feet; column three, a number of kilowatt-hours; column four, the

integer 2010. This set was for a partial list of buildings in Gainesville FL. Another could be had for Dayton OH, but again without any way of geo-referencing the data, or identifying a particular building's use classification except by inference.

Meanwhile, the city of New York had put up the NYC Open Data portal, with an incredible variety and depth of raw information including everything from census and emergency call statistics to .shp files and, of all things, energy consumption data per building, even to the extent of identifying buildings whose boilers are still burning #6 "dirty diesel" fuel.

After a bit of back-and-forth with Ian Kalin at the Energy Data Initiative, we agreed to use the existing Betaville model of New York City and build an extension for Betaville so that model could be used as an open energy data information browser. We might not be using the federal information resource directly, but we might be providing a proof-of-concept for federal officials to use as a guide. If nobody got sued or murdered over this in New York, it might be OK after all!

By the time this was settled, we had lost 60 of the 90 days allowed for development. A mad flurry of emails ensued between myself, Skye, André König (a brilliant undergrad from Bremen on his semester abroad, taking my 3D design class at the Gallatin School), and David Frackman, a veteran Java programmer, Digital Media alumnus, and sympathizer.

One set of data would be pulled from our GeoServer, another live from the city, which would be practical if we could bypass certain inefficiencies of the city's Socrata API.

By this point, Skye was putting some very long hours at Technicolor, David had a contract deadline looming fro Pro Publica, and I was researching-and-banging-out the 3D models for the static visualizations for the demo, which just happened to fill out the virtual exhibits for Tomorrow 2.0 at the Hall of Science, due to open 2 weeks later.

Skye kept on top of the somewhat unstable GeoServer while André and David and I traded panic messages, assurances, and solutions. There was a working demo on my laptop several hours before my 4:00 AM train down to DC, where the demo ran flawlessly, using my cell phone as a modem, in a room full of more people with security clearances than artists usually meet in a lifetime. By the time ReGeneration opened 6 weeks later, the static components were part of the show. Down in Washington, there was now a technical demonstration of publicly available human-readable information about the energy performance and consumption of individual buildings and their surrounding districts, which people working in one agency could use to show the people working in other agencies that this kind of thing was not only buildable now, but that it could be done without precipitating a crisis.

Everything had leveraged everything else—the Datapalooza demo built on the Hall of Science's creative program, which used the Datapalooza, which gave us a deadline to build out the feature of Betaville that hadn't been even possible in New York City in 2008, because the API's and workable terms of use hadn't been in place at the time: the base model of a city could be used to directly access public data in real time, to inform and support full citizen engagement of deliberation about matters of public interest, EXACTLY as predicted so confidently by David Gelernter (Gelernter 1993:107): "Raw data pours into a Mirror World…" (Fig. 5.17).

Fig. 5.17 The Datapalooza info panel, pulling live open NYC geodata

Of course, Betaville wasn't just built as a virtual mirror of an actual world, but as a massively collaborative creative medium, the "missing public creative space" in your New Soft City, a native environment in which many futures can coexist, mix, and evolve over time. In this city, the avant-garde can be everyone, especially if the software infrastructure is readily extensible as new goals and needs emerge.

This would NOT have been possible in a situation where functionalities and uses were narrowly circumscribed by a commercial client-provider contract based on specific capabilities defined through a formal bidding process. The scope of the project did not extend to a study of whether Betaville's usefulness for ReGeneration and the Datapalooza actually *depended* on its status as an informal and hypothetical open space. It may turn out that the codebase, like the alternative scenarios in the model, are most valuable as experimental media, or the infrastructure for collective experimentation, rather than as formally public utilities like roads and water treatment plants.

Chapter 6
Software Infrastructure

6.1 Platform Choice

In 2008, when we set out to build Betaville, the original concept of Java as "Write Once, Run Anywhere" was still viable and seemed an obvious approach for a small development team with big ideas. As tablets and other mobile devices drive more and more citizens to require that developers use a range of specific programming languages, Software Development Kits (SDK's), and publishing pipelines for any plan to build real-time interactive 3D applications to reach a level of access that can properly be called "public," it will become that much more important for small teams with big ideas to work well across departments, organizations, and sectors. As the technology underlying Augmented Reality applications gets more robust, the value of on-site experience in viewing proposed changes and participating in discussion on location will become even more valuable in an ecosystem for which we expect the longer sessions spent building models with third-party applications on desktop and laptop computers will call for a larger and more diverse developer community. For the near term, however, the initial allocation between New York (desktop Java client and PHP/MySQL web services) and Bremen (Android mobile) still provides as much performance and access as we can handle.

Between the two groups in Brooklyn and Bremen, we were able to build out complementary working "beta" versions of a desktop client that would run on the Mac, Windows, and Linux and an Android mobile Augmented Reality client with an entirely separate back end.

Using the Collada open 3D format as a transfer file format, we have been able to provide for at least the technical requirements of integration with modeling workflows associated with the cognizant design and engineering professions, as well as open-source and consumer-level authoring software.

jMonkey has taken good care of us, both as a developer community and as a technology. Its fully open codebase, general high performance, excellent documentation, and active developer community engagement have not only fulfilled Mark Powell's hope for a good-quality all-purpose Java 3D graphics engine but made

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Betaville a practical possibility up to this point, and provide for its extensibility in the medium term. We have yet to exploit jMonkey's amenability to physics and agent-based simulation or to provide the kind of in-world 3D modeling tools (even parametric or algorithmic ones) that would make Betaville fully usable as a real-time design collaboration tool, but the development environment is built to support these kinds of ideas in the lab and in the field.

Beyond the middle term, much will depend on the evolution of patterns of hardware adoption and on two key software issues that will hopefully settle out in the next couple of years: the viability of java itself and the penetration of alternatives.

The latter half of 2012 was eventful for Java: for those of us working on Macs, the transition from Apple to Oracle as providers of the runtime environment has not been encouraging; the first upgrade to Java 7 foisted a "developer release" on end users, notably disabling webstart applications like Betaville. Downgrading back to Java 6 is a very messy business, exactly the kind of thing that might scare off a curious novice, or an entire roomful of them at the Goethe-Institut in Montreal on December 3, even if they weren't following the news reports about serious security holes. There is too much enterprise work built on Java for these issues to persist for long, of course, and the "long term" for a development environment may well be less than 5 years anyway. We are holding our breath, though, and keeping an eye on the horizon.

Now, imagine a city half of whose infrastructure (the digital half of the New Soft City) is subject to change without notice or which is written in a language and runs in an operating environment whose performance is subject to the engagement, good will, and reliability of a single commercial entity.

Josh Slack, the second developer to join Mark Powell in building jME 1 and 2, is still actively developing his Ardor 3D variant, but also working with fellow jMonkey alumnus Rikard Herlitz to develop the Goo html5/WebGL engine. Apple's iOS can handle it, but the company has yet to open the capability beyond their iAd advertising program.

Will Oracle get its act together or hand Java off to a motivated and open-oriented third party? Will html5 and WebGL be able, *and permitted*, to provide for a single platform that can reach the full range of citizen hardware? Must/can Betaville's developer community scale to a point where it can support multiple platforms?

For now (5 years after the beginning of the construction of the Betaville environment), Java/jMonkey has been a very good choice. In due course, we will use again the strategy I described at the outset of asking multiple people to find a platform that would meet a well-defined set of requirements rather than using whatever we might happen to be accustomed to.

In the long run, maintaining independence from any particular controlling interest, whether in regard to terms of use for raw data, effective accessibility of software to users and third-party developers, or technical deployability, may be a new order of governance challenge specific to New Soft Citizenship.

At the point at which raw data, programming languages, operating systems, and visualization/simulation/design software assume the functions of public *infrastructure*, their status as intellectual property and commercial services may need to change. Is a government agency EVER an end user?

Whether copyright and patent law can really deal with this, now or in the future, is beyond the scope of the Betaville project. What we did set out to test was the possibility of providing a software infrastructure, Betaville, for a new set of working relationships between the agents and stakeholders, within the limits of open-source software development as a provisional approximation of the public domain.

6.2 Division of Labor

Betaville's requirements are by definition extreme in terms of the variety of domains it operates in: software engineering, interaction design, urban design, architecture, game development, conceptual art, pedagogy, and public consultation.

We did not test Joel Wein's warnings about the risk and inefficiency of trying to build every component of the Betaville suite as a joint transatlantic effort, except by following his advice to break up the software level into two relatively autonomous tracks: web client and server in Brooklyn and mobile and touch table/kiosk in Bremen.

Within the Brooklyn team, Joel's role was actually even more specific: he gave strategy advice at the beginning, but didn't actively participate in day-to-day development, except by referring excellent graduate students form computer science to the project, for whom it offered a welcome bit of variety in their course of study. At crucial points, therefore, he was able to provide a critical level of software quality assurance, by supervising a full vetting of the prototype with fresh eyes.

For all that Betaville's core function is to provide for new forms of creative collaboration to displace harangues and criticism, we kept in mind that some elements of the development process must remain adversarial to work, and quality assurance is one of them. Joel assigned three sharp graduate students the task of optimizing the Betaville prototype in the spring of 2011, as Betaville was starting to look like a serious proposition, and at risk of needing to scale on short notice in the field. Ibrahim Jumkhalwala, Megh Vora, and Ojas Gosar set out to show us where Betaville's codebase was inefficient, and how to optimize it, using the methods and tools in which they had developed a professional level of proficiency in their coursework under his supervision. They went at it with the enthusiasm of ambitious and bright young professionals eager to please a distinguished professional (Joel, not me), and sure of the necessity and power of their skills….Joel gave them plenty of time to find the bugs and offers fixes. In the end, they spent all of that time looking for faults, because they didn't find any. They gave their report as timidly as Arne von Ohsen had presented jMonkey, an impossible answer: the code was already as optimal as they could test for.

I remember looking over at Skye, who had primary responsibility for wrangling code and coders on the project: a master of science student in the school's idea of an art department, in front of an Akamai research fellow and his thesis advisor (me). He exhaled for probably the first time in 5 min, and the three computer science students got down to the business of helping us build Betaville to the next level of impossibility.

In fact, much of that code had been contributed by undergraduate and graduate students from Bremen through the student exchange over the previous five semesters and three intersessions, and they had had full access to their classmates and supervising faculty along the way.

Among the students, we provided for clear definition of responsibilities, but NOT for assignments firmly attached to a particular student's formal expertise: a digital media student who wanted to prove himself or herself as a coder could take a crack at it; a computer science student from Bremen who wanted to build base models or interface mock-ups or imaginary architecture was free to do so, until they got good at it or gave up. This provided a good balance of opportunity and coherence to the process. Whether they excelled or floundered in some new role they had hankered for, participants would make better collaborators out of the experience. In view of Betaville's purpose, any opportunity to provide for self-determination and curiosity as primary motivators was a basic requirement.

Within each particular subspecialty on a project, we endeavored to provide for an open-source protocol on disagreements: anyone who thought they had a better idea was free to try to prove it. I had designed the digital media programs on the specific premise that competent innovation inevitably calls for collaboration between designers, programmers, and organizers and that the students' experience should therefore as well.

The one exception to this rule was in dealing with "project management," which served us mostly as a way to deflect conflict by assigning software mapping or workflow analysis to people who sincerely believed it would be relevant to a project of this very modest scale. On several occasions, we found ourselves with more people inclined to overall project design and management than Betaville could really use, so the focus there was a speculative one: if the project were to scale to a point where such roles or tools might be necessary, how would we prepare? Would software architecture visualization tools become necessary, and which ones could we use well?

Accordingly, three project participants (Matt Becker, a professional web developer and Betaville volunteer, with Rahul Rao and Ashwin Ramesh, Brooklyn digital media MS students) built out a "map" of Betaville using Visual Paradigm. They did a thorough job of it, but the product turned out not to be as useful as regular navigation through the code itself using the "project explorer" window of the Eclipse Java IDE. Subsequently, Ashwin and Ramesh concentrated on the more immediately practical requirements for building out the first base model and working with Cemre on a set of mock-ups for a second iteration of the interaction design.

The division of work between Brooklyn and Bremen ultimately worked out, and worked well, as originally planned. We were careful to make the most of our two axes of compatibility: deep community of purpose and clear complementarity of expertise.

The relative abundance of person power among the students, and the wide spacing of our commitments to third parties in BxmC and M2C's respective networks, made it easy to support each other rather than compete. The ability of the project to provide a platform and use case for individual experiments like software mapping or a voting system was part of its value within the academic partnership.

It may be that new parametric paradigms will eventually change this, as either the ornamental-algorithmic design practices associated with Maya and Grasshopper or the physical-simulation parametric approach on which Gehry Technologies' Digital Project is based percolates down from specialty firms to the mainstream of professional practice and training.

6.3 Vertical and Horizontal Integration in Practice

If anything, the congeniality and productivity of the BxmC/M2C collaboration may have been a little too perfect. The attractiveness of Betaville as a compelling art–design–engineering project with a noble purpose and credible prospects of real-world deployment, coupled with the relative flexibility of the respective programs, brought us multiyear engagement from many of the best students on both sides. Several of the Bremen students, initially involved with Betaville through their semester abroad in Brooklyn, went on to work on it for their undergraduate or graduate thesis and/or as independent study. This helped to offset the frustrating effect of research assistants leaving the project just as they become useful, the bane of many a senior researcher. The multiyear student engagements provided for better work from individuals but also better continuity between cohorts.

The positive motivational dynamics of the project relative to the more typical student experience—creating for an arbitrary, artificial, or simply fictitious scenario with work that would surely be discarded no matter how good it was—brought out the best in many of our most promising students and in other for whom we had not had such high hopes at the outset.

From my point of view as a faculty member, the experience of fully synthesizing, rather than juggling, teaching and creative/research work was a transformational upgrade: rather than having to shut student out to get work done, I had to recruit and support them; insofar as their work was ultimately my work, I had a stake in their interest and success way beyond looking good to ratemyprofessors.com or the department chair.

The mix of experience and proficiency levels across disciplines can be powerful in new ways. It can work well not only at the doctoral and master's levels but down to the undergraduate level as well, providing a framework and motivation for self- and peer-level motivation. Broadening the scope beyond Humboldt's disciplinary boundaries to do serious work in digital media applications is feasible and can be effective beyond current standards and expectations.

In fact, the mix of skills and skill levels on the project has been of value in another way, by providing, at least in miniature, an analogy to the broader community. From the perspective of any one set of expertise, there's always someone at the table who doesn't make the same assumptions about what's to be expected, what is obvious, or what is possible.

From within the academic context, this was a tremendously successful process. For faculty and students alike, it provided a happy medium between formal and

informal approaches to the education–research continuum and a welcome enrichment. The support of the Rockefeller Foundation in New York, and of the BMBF (Bundesministerium für Bildung und Forschung) in Germany, vindicated and encouraged our work, and publications and conference presentations were coming together nicely.

The weakness of this perfect garden in terms of Betaville's larger purpose was that it did not motivate us to more aggressively engage third parties in the broader community. The regular overhead of administering M2C and the digital media program in Bremen is substantial, and the bureaucratic complexity of managing the growing digital media programs at Brooklyn in the context of several layers of internal reorganization at the Polytechnic itself and NYU generally was getting out of hand. By the fall of 2011, the idea of getting into the fray of real-world urban art-to-policy controversies seemed on most days like more than we could really promise without some serious updating of the overarching strategy.

Within its semi-enclosed ecosystem, however, Betaville was proving out well in terms of its first-level goals: a very broad interdisciplinary international group of faculty and students was successfully building out a set of software tools well beyond the expected capacity of such a small and loose team; the web server and client applications, the ancillary web services, and the mobile client were increasingly powerful, and increasingly robust, in precisely the ways we had claimed were possible in 2008.

The Betaville platform proves out the technical components of David Gelernter's rash promise of 1992: mirror worlds are indeed buildable.

Betaville already upgrades his claim and substantiates that escalation: mirror worlds can be built that provide not only for information sharing and public discourse, they can also provide a shared space for creative engagement of possible futures for a public work, whether it might be a sculpture, a media installation, a bridge, a park, or the transformation of an entire city district.

Betaville also updates Douglas Engelbart's vision of "Augmenting Human Intellect" in light of subsequent evolutions in the availability of public information as real-time machine-readable data, saturation of networks and computer access, and the informal dissemination of new levels of skill in the broader community. Tools and communication networks beyond the bright hopes he expressed in 1968 are now readily available to "consumers" on a mass scale. The odds, therefore, which new partnerships will form to extend the reach and power of initiatives like the Betaville project on a typical day, have greatly improved.

6.4 Social Effectiveness in the Field: Community Engagement

Among the sampling of projects described in the "Deployments" section, there might have been others: a charrette hosted by the Municipal Art Society (2011) about a waterfront site on the east side of Manhattan, just below the United Nations complex; the Corona Plaza art–urban design seminar (2012) developed as a

collaboration between art and urban planning faculty at Queens College and curators at the Queens Museum of Art; and the "Architecture of Agonism" workshop at the Walker Art Center (2012), Minneapolis.

In these three cases, the enthusiasm of initial contact did not translate fully into implementations. The most extreme case was the East River charrette, for which students Elvira Kalviste and Ken Li had just finished detailing the required section of coastline and buildings when Ronda Wist, who was organizing the charrette, confessed that she had not understood a word of what Vin and I had been saying about using Betaville, and let me know that they would proceed according to their usual tools and set schedule. Attending the charrette as one among many participants around tables covered with aerial maps, felt pens, and post-it notes, I was reminded that while the conventional charrette format may not be much good for eliciting great big new ideas, it can certainly work well in expliciting and cementing a consensus as one of the last stages of confirmation of a coherent plan of action whose essentials are already in place. The East River charrette was just such an occasion, packed into a single day, and Betaville wouldn't have been useful.

The Queens group, like the other schools that had participated in the Downtown Brooklyn Commons, was already ambitious for a single-semester format without having to provide for Betaville's learning curve; while we had been able to successfully introduce the platform late in a single course for a fourth-year planning seminar the previous fall, that situation had also included the full engagement of the instructor in Betaville's development over several months prior. Fifteen students with well-resolved concept plans, even lacking drawing skills, could be briefed on the technical requirements and upload well-documented models within a couple of weeks.

The Architecture of Agonism workshop seemed at first like another instance of inappropriate application of a long-form Betaville strategy to a short-form charrette format: the conceptual scope was ambitious—local artists, activists, and planners seeking to open up a broader debate about the redevelopment of the Hennepin Avenue district, a long and somewhat controversial stretch caught between the old red light district, a lively strip of theaters, the redeveloped high-rise downtown, and quite a bit of open ground that had once been the city's high street. The workshop was intended to elicit some reasonably radical and creative alternatives to counterweigh the expected real estate development in the area, but the very short charrette format that would have been a great kickoff to a broadly inclusive long-term process couldn't in and of itself deliver more than a mutual introduction about the underlying issues….Carl DiSalvo, who had seeded the "Agonism" idea for the workshop with his Adversarial Design (DiSalvo 2012), and Steve Dietz, one of the curators of the ReGenerations show in Queens, will certainly be ready to go further when conditions are right. In the meantime, the Betaville model will be ready and waiting, and we got to meet a few of the local stakeholders who are likely to drive a sustained effort. This will, when it happens, include the full range of Betaville's applicabilities, from public artworks to new networks of new forms of public space.

These three almost-engagements, in different ways, will have been useful in helping us define and provide the practical requirements for a sustained and full engagement of Betaville in the kind of long-term asynchronous and distributed creative process of ideation and development it is built for.

6.5 Functional Effectiveness in the Field: Alternative Outcomes

6.5.1 Uni Haiti

In late 2009, I was approached by Evens Anozine, a Haitian entrepreneur in New York, about applying Betaville's potential to his hometown of Léogâne. He hoped to help his cousin Philippe Beaulière build a new computer lab for the Ecole La Rédemption there, and he had teamed up with Jim Luce, who was planning to build out a leadership program to help the school's students prepare for and obtain university educations abroad, in exchange for a commitment to mentor orphans in an extended family care program, and to return with their eventual degrees to help rebuild the country.

By the time we got down to Haiti in May of the following year, the challenge had ballooned: most of the city's buildings were in ruins, and between 10 and 20 % of the population had been killed or displaced. The school building was still standing, but the walls of the room we had planned to use had fallen off.

In the three-and-a-half years since, we have built out a Betaville of the area around the school, including proposals for new infill buildings to provide for a new university campus in the city, and variants of the computer lab at La Rédemption according to different funding scenarios. The simplicity and portability of various levels of concept sketch have made it possible for a couple of busy architects in New York City to communicate effectively with Philippe, the necessary local experts, and with a team of volunteer sanitation engineers in Colorado. The power of the visualizations to provide for robust planning, design, and fund-raising without a substantial operating overhead where they are badly needed, where the design challenge has to include the complete lack of urban infrastructure, and unique security and health issues, would have been a good enough reason to build Betaville in the first place, as a medium of engagement at the most basic level of need for a slow and steady maturation of understanding and vision between educators and builders in Haiti, philanthropists and designers in New York City, and some incredibly thorough volunteer engineers in Colorado. The model of virtual collaboration based on incremental design evolution by a global network of committed experts, in ongoing dialogue with end users, is now practical. Even in the western hemisphere's poorest country, Betaville can already work (Fig. 6.1).

6.5.2 The Centre for City Ecology, Toronto

In the spring and summer of 2011, the Centre for City Ecology convened a round table and two evenings of talks about digital mapping. Through them, I got to meet John Danahy, director of the Centre for Landscape Research at the University of Toronto. A pioneer in the effective use of GIS data for education (decade-by-decade

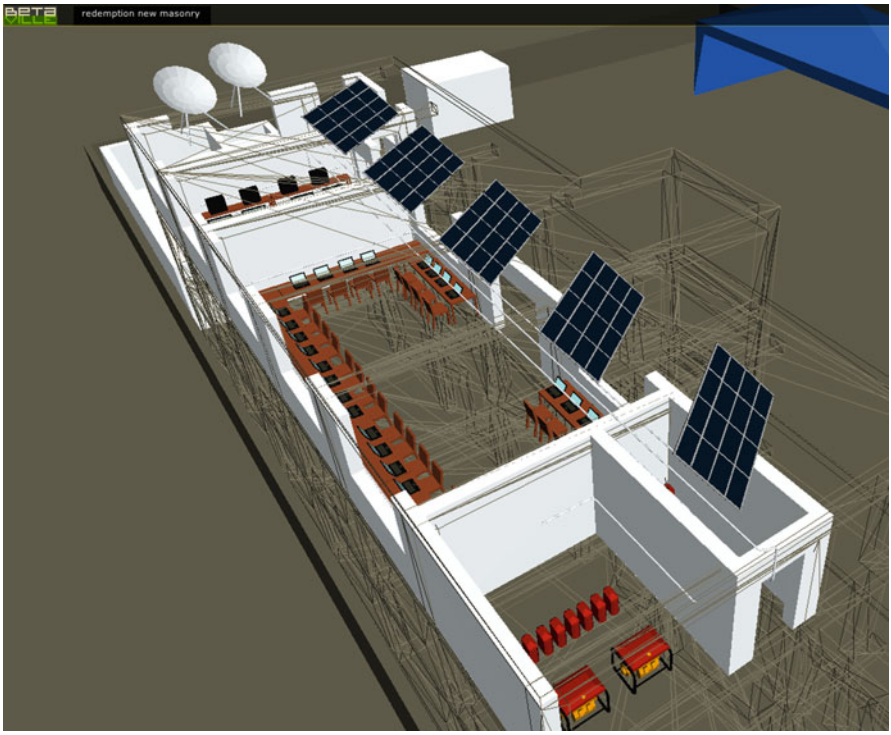

Fig. 6.1 Computer lab concept, Ecole La Rédemption, Léogâne, Haiti

mapping of the Garrison Creek area), advocacy (sightline and shadowing studies for the federal and provincial capital districts), and community-based planning (the Lakeview project), John was used to uphill climbs. The City of Toronto's GIS service is set up with a cost-recovery mandate and therefore treats city data as a fee-for-service "product," with attendant restrictions on use and sharing. Between the round table and the public talks, John met with a group of councilors including Adam Vaughan, who had participated in the round table.

John and I hoped to develop a participatory design study for the area from the U of T campus down to the waterfront in Toronto, using Betaville and PolyTRIM in collaboration with the CCE. This was amounted roughly to the boundaries of Adam's district, and we knew him to be supportive, a good opportunity therefore to make our general and specific cases for the city to adopt a more open data policy. Over the phone, John and I laid out our "ladder of open geodata":

Plan A: Wide open data. On the rationale, that public information is a basic public good, the raw material of three interrelated engines of development: one, integrative research and analysis to inform and support sound planning and policy development, for which data collection from scratch is simply impractical, as no research group will ever be big enough to do the scale and variety of field observations that would be required, and yet the tools for systemic analysis are widely

available; two, innovation in the marketplace at every scale from individual inventor–developers to the large firms for whom the current terms of GIS data licensing do already offer effective access, if and when they care to make use of it; three, to fully support the kind of broad engagement, participation, and background knowledge among citizens that networked personal computers can support. Whether this might be construed as informal workforce development or development of the electorate's competence to participate in the public sphere might be a matter of the ideological orientation of a particular politician, but it seemed to us a win–win from either end of the spectrum.

Plan B: Open noncommercial access. Minimally, we would ask for unrestricted access for noncommercial uses of the city's geodata. This would make it practical for us to derive value from the data in the public interest as a pilot project or proof-of-concept, without calling into question the terms of engagement or financing of the GIS data bureau itself. At the point at which we could show transformative value in our use of the data, that might be an issue, but in the meantime, we would at least not be effectively "priced out" of a data-driven public-interest initiative by the current cost structure and terms of use.

Plan C: Rogue mapping. Through the process of building out the Betaville platform, I could back up a credible "threat" to simply bypass the city's geodata resources, at least for a limited scope of work in downtown Toronto: between the University of Toronto's architecture and planning faculties, Ryerson University's Institute Without Boundaries and Game Design programs, and the network of planning/design/advocacy groups in the area to which we had access through the Centre for City Ecology and my contacts from my days there as a neighborhood association president, plus some judicious adaptation of global resources like the OpenStreetMap database, we could actually assemble a working group to build its own open-source geodata resources for Toronto's central downtown area. I could show the model and the technology, built by students for New York and Bremen, if they needed convincing.

Plan C would not be a preferred option from anyone's point of view. Our interest in the city's GIS service is as a robust, current, and comprehensive library of raw data, and the same data public agencies are rightly required to maintain in support of public service provision and planning. We want to use the data as background information and as the raw material for disciplined and eventually useful new future-making projects, not duplicate the elaboration and upkeep of the databases themselves.

Undermining the underlying mandate and funding rationale for the bureau itself would be one risk factor. In a climate of public-sector deficits, we would not want to risk making something as fundamental as the maintenance of public records look unnecessary or freely available. The checks, balances, and professional discipline of a formal public service agency are indispensable.

By the same token, the fee-for-service model of open data provision is a deeper concern: the potential for commercial exploitation of public data may or may not pan out as a stable and sufficient revenue stream for any given public agency in a particular jurisdiction; in ones where a particular segment becomes an indispensable "client" for information services, they could gain a backdoor controlling

interest in the work of a service bureau subsidized and legitimated by the public purse and (even unintentionally) distort the supply of data to the public service and research sectors over time.

In the spring of 2012, I gave a webinar for the Urban Systems Collaborative organized by OpenPlans' Frank Hebbert, under the title "RFC % [Request for Comment/Infinity]: Towards Sustainably Open Data." The "RFC∞" in the proposition was a pun on Steve Crocker's "RFC 1" of 1967, the open call for responses to an idea that in due course turned out to be the Internet, and the precedent for a network-based protocol for iterative development of concepts through a whole network of peers.

My proposal was for a mixed economy of open data collection and provision in which citizens, along the same lines as the better-known "citizen science" projects, could submit updates and corrections for approval to a bureau mandated (and properly funded) to verify and curate submissions. This would supplement the agency's ability to keep data current and help over time to build it a base of grassroots political support for a steady base funding level, not to mention a wholesome level of visibility. With this model, an expectation of open public access to the data would be clearly reasonable, appropriate, and feasible. Academic researchers and NGO's could contribute in a likewise reciprocal manner. A fully mixed economy or ecosystem of open data with the broadest possible participation in its development and upkeep might not only make it more practical for beleaguered bureaus to keep databases current, it could be in and of itself an "engine of participation," supporting an informal civic network of volunteer expertise as part of a more general open governance ecosystem.

Meanwhile, back in Toronto, the immediate needs of our proposed work for downtown Toronto could make do with plan B: not a great long-term solution, and one without any direct value to the dataset provision ecosystem, but at least we could have viable access for the project itself and potentially an outcome that would help explain and justify a formal open data policy with a viable operational plan down the road.

Plan A was what I call a "Big Gimme," possibly the core systemic weakness of open data as a big idea and policy proposition at any level of government or governance. When the concept of Geographic Information Systems was originally put together in 1960, its model was of a single geographic database capable of graphical output in the form of on-demand cartography: as new field observations are added to the underlying datasets, the maps can be updated without reprinting and redistribution of paper maps, etc. The burden of collecting individual data points remained in place: somebody with a degree would have to go out there and make observations in person for any update of the database to be called for. The advent of automated real-time data collection, and the diversification of sources of data from a plethora of sensors embedded in physical systems, logs of device usage, and network traffic statistics and content, the massive scaling in use of new forms of system modeling from Building Information Models as facility management tools, "smart" buildings, and the dissemination of "big data" capabilities beyond physical science and engineering domains into daily commerce, social sciences, and even art applications, calls forth a new set of mandates and needs for system designs that are robust and sustainable not only in strictly technical terms but as information ecosystems.

In retrospect, plan B was our legitimate claim; the response was positive, and we are working to put together the Toronto node of the Open Line Studio project to make the most of the city's particular treasures (like the CLR and CCE) for a broad-spectrum international design development initiative, one of whose areas of experiment will be precisely to help define and advance the adoption of open data policies and systems that will be properly and effectively open over the long term.

6.6 The Impact Is Mutual: How the First 4 Years Have Redefined Betaville

As of this writing, it has been about 2 years since the Betaville platform was presented as a robust research prototype at the first Summit for the Future of New York City. Some more years will pass before any formal Betaville-supported projects or processes break ground, but some of the likely terms of engagement, and strategies to deal with them, amount to "political outcomes" in the other direction: Betaville's deployment strategies, organizational framework, and conceptual orientation have evolved considerably as a result of the political forces that have borne on its first deployments.

6.6.1 Downtown Brooklyn Commons Revisited

Through the spring of 2012, I followed up with the Downtown Brooklyn Partnership about the possibility of Betaville's application to their follow-up from the Downtown Brooklyn Commons initiative. Joe Chan was gone, but his successor was Tucker Reed, the Two Trees representative who had been so excited about the Open Museum concept.

Their scope had scaled up dramatically, to the development of a master plan for the "Brooklyn Tech Triangle," whose corners would be DUMBO to the northwest, with its busy network of tech start-ups and design firms; the Brooklyn Navy Yard to the northeast, which is redeveloping under the aegis of its own development corporation as an industrial park with a new-technology focus; and the MetroTech district to the south.

We talked about teaming up for it: Betaville could provide a design and process infrastructure and a public communication vehicle for the process. Tucker was frank, however, about the limits of his interest in open participation. The main thrust of the initiative would be to develop a plan to be implemented expeditiously; any drawn-out community-based visioning process must be "sandboxed" as speculative or advisory. A mobile variant of Betaville as a locative promotional guide to the district, promoting new developments, events, and attractions, would be great.

By this point, NYU (my employer) was a major stakeholder in the development of the area: not only the owner of the NYU-Poly campus but also of a very large

office building, it was to take over from the Metropolitan Transit Authority, for which its plans were a bit hazy. The prospect of finding myself and my collaborators (including students) caught between a business group and the university's commercial arm was much more than I was ready to risk. The leave of absence notwithstanding, I was expected at a bottomless series of meetings about carving up the digital media programs (or not), moving to new facilities twice within 4 years…the university was becoming an impediment to following through on the potential of Betaville or much else but a career as a mid-level bureaucrat in a large firm in the throes of too many levels of internal reorganization.

In the interim, Tucker has engaged the services of one of the best architecture and urban design firms in the city: WXY Studio. I have passed onto them some of the work we did for the Downtown Brooklyn Commons, with an invitation to use it freely, essentially as open-source design concepts.

6.6.2 Betaville in the Wild

Whether the Polytechnic Institute of New York University eventually recovers from its long years of decline and present turmoil, or some other school emerges as the epicenter of an integrative and dynamic "neotechnic" within the NYU conglomerate, nobody can predict with confidence. I wouldn't be surprised to find that it turns out to be the Gallatin School of Individualized Study, with its robust framework for interdisciplinary collaboration within the system and a mandate to build out "Global Design." In the interim, the engineering of Betaville's maturation as a viable public infrastructure and social medium must rely on a different "development environment," able to work directly with the right individual collaborators wherever they happen to be working: at Cooper Union, City Hall, Cisco, CUNY, Robert Greenberg Associates, the Office de Consultation Publique in Montreal, the Hochschule Bremen, or the architecture faculty of ITU in Istanbul. There are some great people at NYU Polytechnic, for that matter.

Chapter 7
Future Roadmaps

7.1 New Topics in Research: Creative, Social, Technological

7.1.1 Creative

The migration of the Betaville project's main "trunk" (the web-based server and client) out of the academic domain into the broader not-for-profit sector implies a change in its orientation from a research project per se to somewhere along a continuum from experimental social software artwork to first-order participation in public discourse, a public space in the New Soft City.

The Open Line Studio project will bring together a globally distributed set of five interdisciplinary groups to undertake five speculative design projects for urban waterfront sites. In each city, the lead will bring together whatever combination of willing participants they can recruit to address their chosen site in terms of their own issues, goals, and capabilities. Betaville will provide a common infrastructure for information, visualization, and discussion/development of specific places and proposals; each group will supplement Betaville using whichever combination of tools serves them best.

The tentative list of city sites is as follows: Hudson River Park, New York, USA; Griffintown, Montreal, CA; Busan, the Golden Horn, Istanbul, TK; Siracusa, IT; and Bremen, DE.

Over the course of 1–2 years, the local groups will develop integrative possible future variants of the sites as they now exist, with regular access to each other's work in progress and team-to-community participants.

The physical premise, of an urban waterfront site, derives from a common feature of the two originating cities, shared with the home bases of friends Betaville has made along the way, but also reflects something like a design pattern for settlements: the meeting of land and water.

The inspiration comes from a moment in Istanbul with Ali Dur and Arzu Erdem. They had invited me to dinner at a restaurant overlooking the river, as we discussed the possibility of a Betaville collaboration. I described the postwar transformation

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of the Manhattan waterfront as one of expressways having been built along the shoreline as the historical use of the river for transportation, the water's edge for trade and distribution, and the industrial and worker housing uses further inland subsided. In New York, the subsequent effort to rehabilitate the waterfront as open public space seemed to be leading to the inadvertent development of parks as narrow strips isolated from the community by the highways, a serious degradation of the parks' functions as local civic spaces. I was just starting to politely say something about how Istanbul, senior to New York as a waterfront city, must surely be in an entirely different situation…. Arzu smiled, and we all turned to look at the Bosphorus. The light had fallen, and the river's edge glowed yellow-gold with the streetlamps, and red and white with a million headlights and taillights as they crawled to and fro along the Asian and European shorelines, like so many blood cells in the arteries of a living body. That body, however, was incompletely evolved: what living creature carries its principal circulatory vessels against its skin?

The idea for the Open Line Studio developed more fully in the summer of 2012, before "superstorm" Sandy dramatically altered the local public conversation about New York City's longer-term future as part of a bioregion and as an intensive human settlement with over 500 miles of ocean and river coastline.

Montreal, Toronto, Busan, and Bremen offer a mix-of-mixes of civic cultures, challenges, skills, and creative cultural capital. Over the course of about 2 years, we plan to facilitate a proof of concept at the level of open participation at the local level but also for an ultra-distributed network of engagement: just as we have been able to bring the expertise of sanitation engineers in Colorado to a school in Haiti, and a work of software art to an architect in New York City who is now using it to collaborate with an artist in Düsseldorf, and use that to reimagine strip of vacant land on the north coast of Sicily, the Open Line Studio will also demonstrate the practical feasibility and effectiveness of a new order and scale of networked creative process, for which the infrastructure is already in place and the necessary tools are readily available.

As these projects proceed, driven by a diverse group of committed creative professionals, the question of the models' visual language can be discussed and experimented with. Some of this will be a matter of extending the graphical capabilities of the application, much of it a matter of the articulation of the models built with other tools.

The first iteration of a digital graphic form is rendered precisely. Doodles that look finished will tend to stay that way all too often, especially if they are being churned out in parametrically nuanced hundreds by automated simulation-design software. Software that mimics the incidental graphic details of pre-digital tools like pencils, airbrushes, or watercolors will hopefully always look fake, because they will always BE fake. One subproject of the Betaville project will continue to be the development of graphic presentation and interaction design strategies that don't look finished or fake. As the tools continue to evolve, and more and more of us grow up without any experience of pre-digital or un-digital graphics, a semi-vernacular form may yet emerge that can at least provide for a shared sketching space that artists, architects, engineers, and the neighbors can all identify with and through which they can share the right kinds and levels of information. Betaville aims to provide a congenial space of experiment-sharing for this.

7.1.2 Social

Incrementally and organically, the cores of the Open Line Studio groups are being set up by some of the artists, advocates, and engineers who have been attracted to the project by its initial promise and successes.

One way or another, Betaville must move beyond the domain of the formal education–research domain to be fully viable as a public space:

- To be fully intelligible as public
- To be intelligible and congenial as a medium for experimentation rather than an experiment itself
- To participate more directly in the play of ideas, motivations, and practical constraints of public discourse and action
- To accrue and support the necessary mix of developer citizens: software, ideas, knowledge, and motivation

7.1.3 Technological

The potential of the Betaville platform in its current state of development as a virtual laboratory and tool kit for uses including/synthesizing art, design, planning, and technology disciplines, or interdisciplinary collaborations at the curricular-to-research levels, persists as the class of use case for which we have been able to verify successful performance in use through the programs at Bremen, Brooklyn, and Queens.

For the foreseeable future, Betaville's underlying Java/jMonkey development environment provides a viable level of access as a desktop application; whether or not mobile devices significantly displace personal computers over the next few years, the complementary authoring tools for any user who might eventually hope to upload even a simple proposal will be desktop applications, from SketchUp to AutoCAD.

During the course of the foreseeable future, other futures will become foreseeable.

The provision of open data aggregation/visualization capabilities as a matter of course to provide smart base models of cities that can act as deep information to support informal learning and public discourse about alternative forms of urban environment in real places.

The building out of Betaville's latent capabilities as a simulation environment, as well as an interactive 3D perspective view of models built with external tools to exploit their existing generative and parametric capabilities.

Building out a variant specifically to integrate with current participatory planning and AEC collaboration tools, per John Frazer's still-speculative outline of an "evolutionary digital design process."

7.2 Betaville in the Mainstream: Communities, Operational Models, Variants

Academic Atelier: The first 4 years of Betaville's development took place within what I have called the "neotechnic" model: horizontal integration of disciplines across vertical integration of teaching, research, and (on a good day) service. This approach is "neotechnic" in recovering a praxis consistent with a polytechnic, in which the preparation for professional life includes direct participation in the institution as a consultant to industry and government. It is also consistent with an "atelier" model of teaching in the arts including architecture, within which students are more apprentices (undergraduate) and assistants (graduate) than they are passive (student) clients for instruction by experts who should either be teaching more by example or less. This model worked well for the Betaville project partly by the lucky association of a few very compatible people and two small programs in schools that could still trace their Polytechnic roots.

A sustained and genuine interdisciplinary collaborative framework may go against the grain and tradition of academic culture, but it is an incredibly powerful model, possibly even indispensable, for a whole class of social-to-cultural public software development projects.

Under the right institutional conditions, the neotechnic model can work well again or all the time. Insofar as software now constitutes the de facto medium of ideation, creation, distribution, and public discourse, the ability to reconfigure and transform it is fundamental to the full spectrum of "user" disciplines.

Consultancy: The atelier model of studio education for architects and artists dovetails to some extent with the practice of Polytechnics and Grandes Ecoles, in which faculty "research" is field work for the public and private sectors, which may or may not be novel. The obvious question arises, whether there might be a market for a "Red Hat" type of service-and-support consultancy to work with groups more able to procure Betavilles than to build their own in the short term. BAAS (Betaville-as-a-service) could turn out to be one of the rungs of a "new soft ladder of participation."

The Wild: Betaville's usability and extensibility will have matured when ad hoc groups build them on their own initiative, developing any number of variations for any combination of recreational, cultural, political, educational, and commercial purposes. The more Betavilles there are out there, the more effectively "open" anyone can be.

The Gotham Innovation Greenhouse: Betaville's next home is a new hybrid of think tank and design studio, the Gotham Innovation Greenhouse (GiG). GiG is designed to make the most of New York City's very rich mix of people and skills, by convening and supporting projects outside the framework of the respective "day jobs" of participants. Through an informal network, specific initiatives can proceed with minimal organizational overhead. GiG will operate as a 501(c)3 not-for-profit corporation, with a small board of directors.

7.3 Betaville as Bootstrap: Development of Social Capital in User Communities

Consistent with its erstwhile context, Betaville's success to date has been primarily within the domains of education and research, as an engine of ideation for hypothetical transformations of local built environments. Where we have been able to reach beyond speculative engagements, the potential (and need) for the development of "deep social media" to help develop the effective creative and problem-solving capacity of coalitions of experts and stakeholders has seemed to hold two interdependent areas of promise: more effective vehicles for the kind of broadly inclusive creative process that can make it practical for new investments in the physical built environment to fully serve their constituencies and "soft communities" whose mix of mutual social, technical, and creative stimulation can mature as informal peer-bootstrapping environments.

Our approach to the potential of Betaville itself as one of the many possible media for creative collaboration between agents with different levels of expertise within a variety of domains will remain incremental in terms of the scale of groups we convene and radical in terms of the level of innovation we hope to make possible within each group.

A Betaville project is a priori a creative collaboration, but one that operates on the understanding that the process of defining a desirable change to a built environment is one of many modes or forms of governance. It is with this in mind that we accept Innes and Booher's core claim for collaborative governance (Innes and Booher 2010) as applicable to Betaville:

"In collaborative governance the purpose of participation is to engage the public in joint learning and to build public capacity for problem-solving and adaptation. Collaborative governance is grounded in the belief that developing the most effective solutions requires informed public deliberation. The assumption is that many problems will require the public to at least support, if not play a part in, implementing solutions, and therefore that social learning is a crucial part of planning and public policy."

Schelling's 1859 dictum (Schelling 1959:223) that "die Musik in der Plastik ist die Architektur" (Architecture is Music in sculptural form), paraphrased since by others as "Architecture is Frozen Music," reaches a new level of obviousness in a world where the arts, design, sciences, and engineering are practiced with logically interrelated software tools on interconnected networks. Whether as creative social play, experimental art, or purposive design to address pressing issues in a present city, the process of creative collaboration as an alternative to established protocols for public consultation, deliberation, or contestation offers groups and communities the tools and networks they already have as a new kind of shared space for learning and skilling AS groups and communities.

7.4 From Street to STEM: Can Betavilles Help Attract and Prepare a New Generation?

Part of the success of the Tomorrow 2.0 project at the Louis Armstrong Middle School, the Brooklyn Experimental Media Center, and the Media2Culture Institute in Bremen was in providing two new orders of connection between domains to students: the first making an effective experiential connection between digital media per se (3D modeling, animation, game design, web design) and related fields in science, technology, and mathematics. The younger students, as they come to understand that engineers also work with 3D models, and computer science and engineering actually underpin the media to which they are so powerfully attracted, come to identify with a richer mix of professions, and in particular with the creative and social dimensions of STEM fields.

For the students and schools from that level all the way up to research, the explicit engagement of technology as both career/research path AND media of social and cultural transformation alters the "affordance mix" of the curriculum and research program: applied science fiction.

7.5 Generalizability: Potential New Use Case Types

MojoMonkey (Mark Powell) summarized his motivation in developing the first version of the jMonkey engine as a combination of curiosity and boredom. As both a gamer and developer, he expected better performance (and a better workflow) than he could get from Java3D in 2001, for the battle simulation and weather prediction applications he was working on professionally. The jMonkey project subsequently matured into a full-service open-source Software Development Kit for developing single and multiplayer games from first-person shooters (Flesh Snatcher) to real-time massively multiplayer role-play (Urban Galaxy)…and Betaville.

Betaville itself has so far worked out well as educational software (Tomorrow 2.0), a shared design environment for collaborative architecture and urban design planning projects from the wildly speculative (Liberty Piers) to actionably innovative (Downtown Brooklyn Commons) to utterly practical (the Haitian computer lab) and as a proof of concept for public data visualization (Energy Datapalooza); projects are in the works to deploy the platform in ways that can combine the data visualization capabilities with the open design environment in Montreal, Toronto, Istanbul, Busan, and New York.

In the Haiti scenario, the models provide for something like a 3D wiki of the design alternatives. Some of the other deployments add up to a situation more like the "New Soft Charrette" to provide for a greater range of concepts and a longer process of concept development online than in-person meetings could support. This is the "classic" mode of Betaville in use, as I had originally fantasized it as the president of the Niagara Neighborhood Association in Toronto.

Another class of use cases we have regularly discussed between New York and Bremen but not yet had an opportunity to build out is a range of post-competitive development environments for architecture and public art commissions: an open process for the identification of potential sites and deliberation about choices among them could be followed by an equally open proposal process—sketches of proposed projects could be uploaded to the city model, supported by externally linked documentation. A post-selection process could provide for refinement of siting and/or a deeper engagement between the artist and local community, where appropriate, to provide for well-developed relationships between artworks and their physical and social contexts. For architecture proposals, new possibilities emerge for cross-collaboration between finalists and stakeholders.

Community-based planning can come from anywhere. A real estate developer might elect to engage a local community adjacent to a promising site in advance of the development of detailed plan preparation, either to test the waters or to come to an understanding about hot-button issues and workable trade-offs, or to actively collaborate on a win–win scenario.

The same kind of work can be undertaken internally in a large organization: an ongoing "mirror facility" project, over time, can provide a useful forum for discussion of improvements to an existing arrangement or the layout of a new one.

A municipal government can build a Betaville of itself to serve a variety of goals, from attracting new investment to a planned district to pretesting the viability of a proposed new development or even pre-selling its components. A Betaville can also provide an invaluable planning tool in situations where long-term plans must be built out incrementally: when the big picture is always online, individual actionable items are much easier to plan well and to justify as public investments. Integrating robust simulation capabilities would provide for an additional level of value, providing for on-the-fly recalibration of the near-term component as the long-term goals evolve.

As Betaville can serve as a distributed studio environment for creative collaborations at every level of skill and scale, it lends itself in principle to online learning scenarios in art/design disciplines. As the domain of online education grows and diversifies, so can distance education "BetaMOOCs."

A Think Studio: A think tank does research on the basis of which it produces strategy and policy recommendations; a studio develops concrete and specific designs. Even the Betaville we already have in hand offers a distributed/open structure and low overhead 24/7, capable of bringing together the qualitative dimensions of street-level perspective in the same visual environment as an aerial/area view, including conditions or systems below grade and inside buildings, within a software environment that can support data visualization, record discussion and iteration trails of every version of every idea, link any component to anywhere else online, and invite direct review or contributions of new ideas from holders of professional expertise and informal knowledge.

Betaville itself is an adaptive system. If things go according to plan, it may be unrecognizable within a few years.

Chapter 8
Conclusion

Betaville has demonstrated several levels of possibility as a *soft infrastructure*:

For collaborative participation in future-making—not improving on digital design processes at the individual sketch level, but by providing for open-source-style concept and consensus development over the network over extended periods of time. No one will resolve all the issues with a single instruction set to a piece of authoring software, or perfect the design at a single desk, but there's no value in having them try, because the slow and broad sharing of incomplete ideas among many collaborators is itself so valuable, and because in due course it can, as it must, drive the ongoing transformation of built environments.

Soft infrastructure as the network of organizations, institutions, relationships, and habits, like the pre-digital soft cities of Raban and the situationists—Betavilles can be built, rebuilt, and inhabited as "elective social spaces" whose geometry is amenable to immediate yet consensual reconfiguration as soon as the relations for which it acts as the symbolic setting and affordance set change. New New Babylon is buildable, NOW.

Soft infrastructure like the New Soft City: connected, dynamic, mutant, and resilient by morphing rather than simply bending and snapping back. Betaville offers a new class of public space, in and with which experimentation is appropriate beyond the ethical limits of experimenting on real cities. Betaville is more public than Central Park not only because you can get there from anywhere right now but because you can ALWAYS get there. After a while, if enough Betavilles develop similar properties, those properties can be "ported" to the next version of a physical city, rather than finding out the "hard" way, again.

Betaville provides for a new genre of public art for New Soft Cities everywhere: massively participatory social sculpture.

To a complex evolution and cross-mutation of creative and research work with physical simulation and algorithmic composition, design based on general physical principles, Betaville answers with a social soft-terraforming medium operating between the "magic circle" of massively multiplayer recreational applications, the extension of mirror worlds as public information and discourse environments to

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Fig. 8.1 Hello World public art proposal (artificial turf), Brooklyn

collaborative design tools, capable of supporting inefficient but massively large and sustained collaborative imagination-to-design workflows or playflows.

This amounts to a radical reconception of the publicness of public art, now possible in the softest possible level of the architecture of New Soft Cities, their virtual personae: the work is not only passively public in a traditional way (it's in a place people can go to at will and look at it) but actively public in a dynamic new way; the process of the work's development is permanently open and available for new ideas and forms, as new and soft as anyone cares to make it, from anywhere; radically more plastic than the physical city, it is a medium in which visions of future public things and places can be experimented with and those experiments can mature into concepts and consensus over the time available, which is effectively infinite.

Direct interest in the Betaville project has led to some great working relationships, and new deployments are already in the works worldwide, but we can only explore so many of the potential areas of exploitation and further development for Betaville ourselves, within the Gotham Innovation Greenhouse in New York and the M2C Institute in Bremen. Accordingly, the code is available online under a FreeBSD license, which makes ultimate future forms of the Betaville platform and its uses intentionally and desirably unpredictable.

Every living city is "in beta." Let's play (Fig. 8.1).

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