Introduction

How do designers shape the world around us? Many different answers to this question have appeared in the pages of *Design Issues*. Designers are involved in the creation of signs, symbols, individual artifacts, and coordinated sets of products and services that configure both the environments we inhabit and the experiences we have. The editors of this journal seek to bring to the design community articles that deepen our understanding of design. We are interested also in discussions that enhance our appreciation for ever-expanding areas of design activity and that stimulate us to consider design in new ways. This special issue edited by Richard Buchanan on "Design and Organizational Change" falls into this later category and continues the journal's practice of devoting entire issues to themes of particular importance. That designers work for or with organizations is a familiar concept. That design can have an impact upon organizations and that design thinking can shape organizational behavior in productive ways is less well established within the literature devoted to design and design practice. The essays collected in this special issue pull together various perspectives on design and the life of organizations. The authors suggest new avenues for design practice and fresh topics for design research.

How should designers approach the challenge and opportunities inherent in the act of designing? "Brighton 05-06-07," a document included in this issue, suggests the concept of wellbeing should serve as a fundamental principle animating design efforts in the contemporary world. Composed by a small group of designers and design educators last June, the title "Brighton 05-06-07" acknowledges the time and the place of origin. But the argument advanced in "Brighton 05-06-07" is global rather than local in its significance. Its publication in these pages continues another of this journal's practices: publishing original documents addressing vital themes within the culture of design.

Bruce Brown
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Dennis Doordan
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Introduction: Design and Organizational Change

Richard Buchanan

In June 2004, the Stern School of Business at New York University hosted a small working conference on the theme of "Organization Design." The National Science Foundation sponsored the conference for the purpose of developing a scientific base for organization design, broadly defined as "explicit efforts to improve organizations." Like "Managing as Designing," the groundbreaking conference held at the Weatherhead School of Management at Case Western Reserve University in 2002, the NYU conference was part of the growing trend in business schools to investigate design—often under the term "innovation"—and its role in management and organizational change.[1] For designers who have begun to explore the impact of their work on organizations and organizational life, as well as the impact of organizations on their own work, the trend and the conferences are important. They further elevate the idea that organizations are products, as well as the idea that, like other products, organizations can be designed by intelligent forethought and appropriate action.

The idea that organizations are products of design is not entirely new. The rise of management and organization theory in the twentieth century is, in essence, the history of the rise of an important branch of design thinking, based on the broad goal of finding ways to improve organizations and their effectiveness. However, an explicit concept of design emerged only slowly in this area, and in isolation from the development of design in other applications. Herbert Simon's *Administrative Behavior* (1945) was the first major work to make design an explicit concept in management.[2] It focused on design as an activity of decision-making and advanced ideas about communication and information that revitalized the field of management and organization theory in many ways. Indeed, the ideas developed in this book also were the genesis of *The Sciences of the Artificial* and the concept of "design science," as Simon understood it. Subsequently, Jay R. Galbraith's *Organization Design*, a book that applied some of Herbert Simon's ideas about organizational design, offered a concrete method of "structural design" based on information and decision-making that continues to influence management practice. For the most part, however, the study of organizations focused on theory and empirical research. The idea of transferring research results into practical action was, as noted by Roger Dunbar, William Starbuck, and the other organizers

1 Richard J. Boland and Fred Collopy, *Managing as Designing* (Palo Alto, CA: Stanford University Press, 2004).

2 Herbert A. Simon, *Administrative Behavior: A Study of Decision-Making Processes in Administrative Organization* (New York: The Free Press, 1945).

of the NYU conference, implicit or merely "perfunctory addenda" in organizational theory. In short, academic discussion neglected the significance of design and the rich variety of design practices that could affect organizational life and lead to new organizational structures and processes.

The conferences "Managing as Designing" and "Organization Design" helped to open the way for serious academic consideration of the work of designers who focus on strategy, communication, information and decision-making, new product development, interaction and service design, vision creation through "strategic conversations," and other interventions in the life of organizations. The conferences recognized that organizational change could come about through the practical activities of design and, most important, that "design" should be explored more explicitly and from a broader range of perspectives than it had in the past. This is what makes these conferences watershed events not only for those in management and organization theory, but also for those working in other branches of design that now see their work as potentially leading to organizational change.

Since the 1990s, a small but growing number of designers and design consultancies have become competitive with management consulting firms in certain areas of work. More recently, some of the leading management consulting firms have begun to look at design as a tool that may be included within their own practices, with or without deep understanding of the nature of design. The enthusiasm of both movements is infectious. Indeed, design could offer a new way to understand and practice management, leading to more human-centered organizations.

Enthusiasm alone, however, will not be enough to sustain interest in design, particularly when the concept of design as a discipline of thinking and making is still widely misunderstood or poorly understood. There will have to be tangible benefits, and the benefits will have to be understood as a clear outcome of design thinking. This requires support from a new kind of design research, oriented directly toward the influence of design on organizational life. As part of this effort, there will have to be better understanding of the variety of approaches to design, grounded in sound theory and in the diversity of effective strategies and methods of design practice. The common form of design thinking that is evident in Jay Galbraith's work and in other less explicit forms of design that are presupposed or implicit in organization theory does not cover the wide range of approaches to design that are emerging in practice today.

As Edward A. Snyder, Dean of the Graduate School of Business at the University of Chicago, recently remarked: "Theory and practice go together. People who understand theory are more likely to understand practice—today and tomorrow." [3] Except for thought leaders in the field, this recognition has come only slowly in

3 Quoted in *Business Week* (October 23, 2006): 64.

traditional branches of design. However, it is entirely evident now as design moves into new domains of application. The intuitive sense of many in the design community that design thinking has potential value for organizational change will have to be supported through research conducted in a variety of disciplines including design, itself, and through explicit discussion of the relationship of theory and practice.

The organizers of the NYU conference wanted to bring together two kinds of ideas in order to advance research and overcome the division of theory and practice that often has characterized the study of organizations and efforts to improve them. They wanted ideas about "how organizations should look" (the nature of the product to be produced) and ideas about "processes for creating organizations with desirable properties" (the design practices that could produce those products).[4] The former ideas fit well within the scope of organization theory, which always has sought to understand the nature of organizations. The latter ideas correspond to design, in whatever form it may be conceived.

Furthermore, the organizers wanted to focus on "the organizational design implications of research finding," and foster "communication among the diverse approaches to design" represented in the meeting and in the broader design community. To this end, the conference brought together leading figures in organization theory from around the world, but also included thought leaders from organizational design and other fields of design whose work was felt to have potential significance—primarily those from architecture, industrial design, and interaction design.

Some of the papers from the "Organization Design" conference were developed and published in one of our sister journals, *Organization Science,* in a special issue on "Organizational Design."[5] This is consistent with the goal of strengthening the scientific basis for organizational design by comprehensive studies of organizational form and specific design methods and techniques—typically quantitative studies, but some qualitative studies, as well. However, another goal is served by focusing attention on some of the *ideas* and *methods*—the *practices*—of designers who have attempted to change organizations. This is the purpose of the current special issue of *Design Issues,* which continues the theme advanced in "Managing as Designing" and "Organization Design," but with a different perspective than that of the development of organizational theory. The goal of this special issue, "Design and Organizational Change," is to emphasize design as a professional practice that is consciously moving into the domain of organizational design and organizational change, drawing from areas of design practice that are more closely identified with design as it is commonly understood in the design community, including architecture, industrial design, information design, and interaction design. As organizational theory and

4 Roger Dunbar, William Starbuck, et al. "Call for Presenters, Recorders, and Participants, Conference on Organization Design, New York University, June 4–6, 2004."

5 See *Organization Science* 17:2 (March–April 2006). Special issue: "Organizational Design."

management come closer to design, it is important for designers to consider how their work, sometimes in traditional areas and sometimes in new areas of application, can bring about organizational change. Thus, the articles in this issue explore design practices and the ideas or theory that support them. Some of the papers presented here were delivered at the "Organization Design" conference, but other papers are included which develop the theme in ways that are related to the original conferences, but are representative of some of the other efforts of designers to affect organizational life.

The first article is "Managing as Designing: Lessons for Organization Leaders from the Design Practice of Frank O. Gehry," written by Richard Boland, Fred Collopy, Kalle Lyytinen, and Youngjin Yoo. In June 2002, Boland and Collopy organized the "Managing as Designing" conference that initiated wider academic interest in the possibilities of new design thinking in the practice of management. In this article, they continue to explore the theme of "design attitude" illustrated in the design and architectural practices of Frank Gehry. One of the key features of this article is important for understanding the development of design theory. The authors point out that in Herbert Simon's theory of decision making, there are three elements: intelligence, design, and choice. They argue that subsequent use of Simon's ideas in management reduced the three elements to a single element: choice. This distorted the understanding of Simon, and led management studies away from the role of design thinking in Simon's work. They maintain that the return to design in organizational studies is a return to a proper balance, with greater attention to design thinking.

To develop this idea, the authors define design attitude as "a thorough going expectation that each project is a new opportunity to create something remarkable and to do it in a way that has never been done before." They note how this attitude spreads among all of those who participate in Gehry's design projects, and they observe how important language—the language of the project—is in spreading this attitude. The article identifies characteristic features of design—for example, visualization, and model making—that distinguish design from the ordinary practices of managers. Boland, Collopy, and their colleagues have the perspective of clients and management researchers, yet they succeed in presenting design in a compelling way that is strikingly relevant to management practices and, at the same time, throws light on the nature of design.

The next article takes a design practice that has received significant attention over the past ten years, and turns it in a new direction. Sabine Junginger's "Product Development as a Vehicle for Organizational Change" investigates the possibility that product development—usually regarded as the way an organization adapts to the external environment of the marketplace—may lead to organizational change within an enterprise. The novel approach

taken in this article is supported by a careful discussion of the nature of product development, and then by an investigation of the ways that product development may be used by managers to bring about organizational change.

Case studies play an important role in professional fields such as law, business, and medicine, but their proper role in design education and design research has received relatively little attention. Compared to other fields, there are few case studies in design, and many project descriptions merely pass as case studies, without an understanding of the nature of a case study, its purpose, or structure. In a Reflection, Maggie Breslin and Richard Buchanan discuss the potential of the case study method of research and teaching for design. They suggest that the field of design and design education is ready for a serious development of the case study method as a bridge or transition from theory to practice—and back again to the strengthening of theory.

This brief essay is followed by a series of articles that employ variations of the case study method. Each one identifies and explores a phenomenon in design and organizational change, describes an example of new design practice, demonstrates significant connections in organizational life, and prepares the ground for further investigation. In a sense, all of the articles are exploratory case studies, focusing attention on aspects of theory and design practice that deserve further investigation. In "ZIBA Design and the FedEx Project," Maggie Breslin, a designer and researcher at the Mayo Clinic, demonstrates the use of the case study method in an account of ZIBA Design's work with FedEx, exploring the issue of "fourth-order design," a characterization of design work at the level of environments, human systems, and organizational change. Breslin shows how the case study in design may relate theory and practice, as well as illuminate research issues in the use of design to bring about organizational change.

Organizational change often is viewed in the context of for-profit organizations, but it can also be socially significant when applied to nonprofit institutions. We already have seen this in the context of educational institutions—for example, the impact of Gehry's architectural practice on the Weatherhead School. It also is worth noting that the NYU "Organization Design" conference used, as an exemplary case, NASA's Next Generation Launch Technology program, with ten representatives from NASA as participants in the discussions. The use of design thinking in the development and improvement of governmental agencies is an emerging area of opportunity for designers.

The scale of this opportunity is evident in the next article, "Design in the Australian Taxation Office," by John Body, former Second Commissioner in the ATO, and now principal of his own design firm. Body provides a detailed account of how design thinking is being brought to bear on the problem of the administration of

taxation in the Australian context. He explains how design offered a way of converting strategy into action, with the goal of making the taxation system clearer, easier to use, less expensive, and more personalized—all serving the broader purpose of increasing trust and compliance among citizens. Body details the concepts and tools of design employed by the Taxation Office, and then describes the management effort that brought design to life in the organization. He also discusses the participation of designers in the project, including Jim Faris and design researcher Darrel Rhea, principal of Cheskin Research. His account is from the perspective of the third year of what is estimated to be a ten-year effort to build a design capability within this important government institution—an effort that is being observed by other governmental agencies within Australia and elsewhere in the world.

The next article also is about the Australian Tax Office, but from a different perspective and with a different problem in mind. In "Information for Strategic Thinking: Health of the System Reports," Julian Jenkins explains a strategy for supporting strategic thinking in organizations. This article harkens back to the first article by Boland and colleagues, with the central theme of *intelligence*—in this case, information—*design*, and *choice*. It also offers a subtle return to one of the central themes of the work of Horst W. J. Rittel: information, argumentation, and the "issue-based information system" known as IBIS. Jenkins makes no reference to Simon or Rittel, but rhetorical thinking is clearly a central feature and part of the theoretical framework of this article. The design challenge involves not only a change in the structure of information reporting, but also a change in behaviors that orient managers toward strategic issues that often are obscured in traditional information reports. This approach is significant because it shifts the concept of reporting from the mere accumulation of data to the use of data within purposeful argumentation. In effect, it places strategic argumentation at the center of management work and at a key place within organizational life.

One of the features of these articles—a feature that makes them useful for teaching as well as consideration from the perspective of professional design practice—is the combination of a theoretical framework and practical design work. The theory in each case is embedded in the case writing, sometimes requiring conversation with the text to bring it fully to light. But the problems and practices of the designers also are presented in enough detail to see how theory and practice work together in the concrete circumstances of practice.

This pattern also is evident in the final article, "High-Reliability Organizations: Changing the Culture of Care in Two Medical Units," by Daved van Stralen, M.D. This is not a typical article on a typical design problem and solution. Indeed, professional designers played no role in designing and developing the two medical care facilities that are discussed by Dr. van Stralen. Yet the article

presents a set of design issues and design ideas that are exceptionally relevant to new forms of design practice—for example, design that involves human interaction, substantive forms of "service design," and complex human systems. Furthermore, the article demonstrates the "design attitude" that Boland and his colleagues discussed in "Managing as Designing." This article is a fitting conclusion to a special issue on design and organizational change, because it demonstrates how participants in a system may design their own practices and environment.

The term "High Reliability Organization" (HRO) refers to a human system that must be exceptionally reliable in an environment of high risk, uncertainty, and potential catastrophe. A common definition is that an HRO is "an organization that consistently avoids catastrophe in an environment where accidents can be expected because of many risk factors and the complexity of operation they involve." Karl Weick and Kathleen Sutcliffe provide these examples of HROs: nuclear power generation plants, naval aircraft carriers, chemical production plants, offshore drilling rigs, air traffic control systems, incident command teams (response teams for natural or human-made catastrophes such as hurricanes and hazardous material spills), wild land firefighting crews, hospital ER and Intensive Care units, and investment banks.

Research in this important area is developing quickly, with potential insights that may affect the design of other types of organizations. However, van Stralen's article presents the design and development of a pediatric intensive care unit and a pediatric nursing home. His account demonstrates how personal experience in a related, but different environment, along with several key theories, can be brought into practice through effective leadership and design thinking. This article originally was presented at the NYU conference on "Organization Design," and it is presented here in a slightly revised form.

In the context of *Design Issues,* van Stralen's article is an example not only of the use of theory in practice, but of practice as a kind of design activity embedded in a complex human system. Though Dr. van Stralen uses the term "design" quite sparingly in his account, the reader will recognize some of the most challenging paradoxes and issues faced by designers when they attempt to bring about cultural change within an organization. For example, there is the paradoxical situation of the leader who must facilitate change, but must also ensure the distribution of agency among many participants, in effect giving up significant authority to others. Then there is the issue of complex, chaotic systems that, by their nature, come close to catastrophe, yet must be sustainable and sustained in the face of high risks and uncertainty. And there are essential issues of social interaction that must be understood and navigated. Dr. van Stralen clearly understands and explores the idea of social interaction and its central place in bringing about organizational change through

conversation and participatory design. Furthermore, his article illustrates how a cultural system can become self-designing—designing itself from the inside, without explicit intervention by professional designers. While van Stralen does not refer explicitly to the concepts and principles of interaction design or fourth-order organizational design, he shows how a design attitude, intuitive design practices, and human-centered design values can bring about effective organizational change. This is reflective practice in action.

The articles selected for this special issue all are examples of "fourth- order" design: the design of organizations, environments, and systems that serve the diverse purposes of human beings. They represent different approaches to the problem of organizational change, and they all employ an expanded concept of human interaction that is elevated from individual interactions to collective interaction in complex environments. However, they also demonstrate that the new, expanded forms of design practice do not abandon the traditional concerns of form-giving and making that have defined design in the past. It is the concept of form that has grown more supple and complex, embracing the social and environmental context of design. Without the integrity of form-giving and making that lies at the core of design, what can the designer do that is not already within the sphere of other disciplines? Together, these articles represent a new area of design practice and design research that will grow in importance as the value of design is recognized.

Managing as Designing: Lessons for Organization Leaders from the Design Practice of Frank O. Gehry

Richard J. Boland, Jr., Fred Collopy, Kalle Lyytinen, and Youngjin Yoo

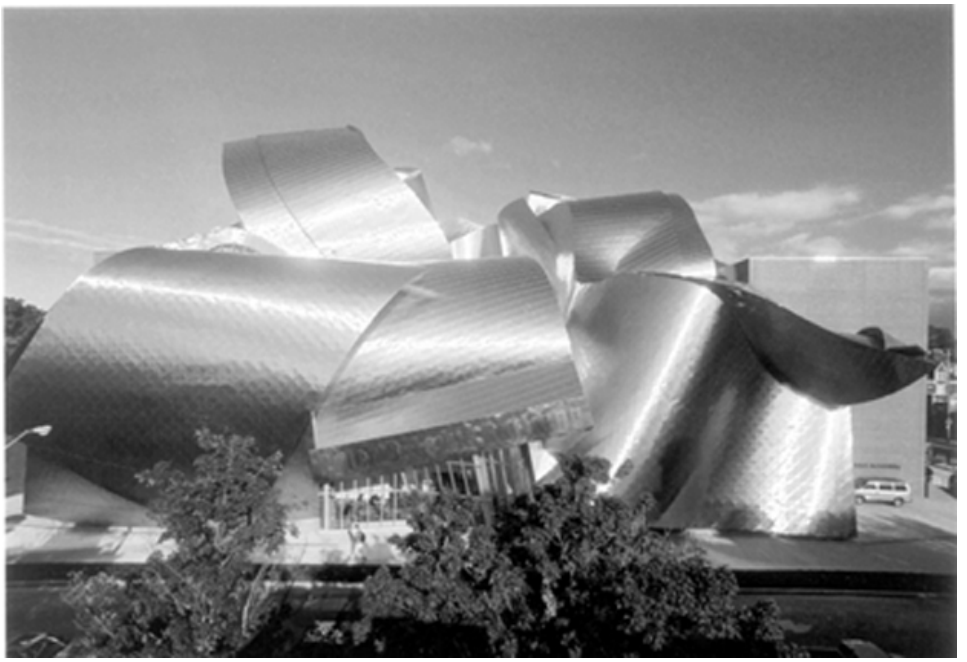


Figure 1
The Peter B. Lewis Building.
Photos by Robert A. Muller.

In the summer of 2002, our school moved into its new home, the Peter B. Lewis Building, designed by Frank O. Gehry. (Figure 1) We are faculty members at the Weatherhead School who have become involved in studying Gehry's unique design practices and their implications for managing and organization design. We had an interest in design and its importance for management before encountering Frank Gehry,[1] but our involvement with him took that interest to a new level of commitment.

Learning from Frank Gehry

Interacting with Frank Gehry and his colleagues reinforced our belief in the importance of design as a mode of cognition and as an organizational practice. It also inspired us to explore the ways in which design could inform management by convening a workshop in June, 2002 on "Managing as Designing" (www.design.case.edu). The

1 See References on page 25.

workshop, which was funded by the National Science Foundation (#0132757), brought together designers, managers, and organizational scholars to discuss how knowledge of design could benefit the practice of management. Some of the more engaging results of that workshop were published in 2004.[2]

We also organized a formal study of Frank Gehry's design practice to trace the innovations in architecture, engineering, and construction associated with his unique building projects, especially those related to his use of three-dimensional digital representations in design. Our study, also funded by the National Science Foundation (#0208963), is now in its third year, and reveals that a wake of innovation follows from the construction of Gehry's designs, including innovations in crafts, fabrication, engineering, technology use, project management, and organization strategies. Here, we will highlight some of the lessons for management and organizational leaders that we have gained from participating in the Lewis Building project, the managing as designing workshop, and our ongoing study of Frank Gehry's design practice.

Animating our interest in bringing together design and management is dissatisfaction with the way that design, as a *noun,* seems to overshadow design as a *verb* in the popular press, as well as in the practice of modern management. This results in an emphasis on design as a completed and whole *thing,* instead of design as a becoming and unfolding *process*. In the popular press, it means that design is treated as referring to style or fashion. In management discourse, it means that design is treated as referring to a finished product, or an established way of doing things in an organization. Either way, the power of design as a verb—as a way of defining problems and projects, and of acting responsibly to seek betterment in the world—is lost. We are committed to bringing the verb form of design to life in management thought, because design is so central to the actual process of managing. Successful managers and successful organizations are ones that engage in design as if it mattered—they actively design and redesign products, processes, and services in order to create new markets and to succeed in existing ones. Entrepreneurs are wonderful examples of the designing managers—giving form to valuable new products and services, and sometimes creating whole new industries. But all organizations, even the most well-established, depend on capable designing on the part of management for their continued survival and success.

It has been almost forty years since Nobel Laureate Herbert Simon declared the centrality of designing to managers, yet management scholars continue to ignore his sage arguments. In 1969, Simon, wrote *The Sciences of the Artificial,* one of the finest examples of what we call the design attitude for managers. Now in its third edition, it called for a new curriculum for management education based on the manager's role as designer. He saw management as a profession whose training should be like that in the applied sciences, such as

2 R. J. Boland, and F. Collopy, *Managing as Designing* (Palo Alto, CA: Stanford University Press, 2004).

engineers or architects, rather than the natural sciences because the manager's professional responsibility is not to discover laws of the universe, but to act responsibly in the world to transform existing situations into more preferred ones. Simon held that, like the engineer or the architect, the manager is a form-giver who shapes social organizations and economic processes to create value. As he stated in the preface to the second edition:

> Engineering, medicine, business, architecture, and painting are concerned not with the necessary but with the contingent—not how things are but how they might be—in short, with design.[3]

In his *New Science of Management Decision,* Simon equated managing with decision-making, and argued that there are three essential aspects of decision-making: intelligence, design, and choice.[4] He further argued that these three elements are inescapably intertwined, and that the new science of decision should attend to each. Yet, quite quickly, the institutionalized study of management decision-making reduced these three into a single aspect, that of choice. Decision-making, which Simon saw as a multifaceted, noble calling for managers, is now seen as making a choice from among the alternatives that are presented to them.[5] We see dramatic evidence of this reduction in the scope of management decision-making even at the highest levels of the U.S. Government. As a example, it was asserted by national leaders that the President of the United States had no decisions to make with respect to an August 6, 2001, intelligence memo warning of an al-Qaeda attack, and included references to New York, airplane hijackings, and the World Trade Center, because it did not include "actionable intelligence," meaning a choice of actions to take. Although Simon expected the responsible manager to engage in decision-making through a robust and recursive process of collecting and interpreting evidence, designing possible courses of action, and testing multiple ideas, today's leaders are resolutely passive, waiting for "actionable" items to be presented to them. Sadder still, the media and the American public accept this state of affairs. In keeping with the overly noun-based uses of design, organization leaders today are mere responders to situations presented to them, as opposed to active makers of a future worthy of us as human beings.[6]

Giving serious attention to Simon's call for recognizing the importance of designing to management is long overdue. Thus, we emphasize that design in its verbal form is a critical yet overlooked skill for any successful leader or organization. A design attitude, with its expectation to shape a better world, is a neglected but centrally important cognitive mode that should be nurtured in management practice and education. This paper summarizes some lessons on designing for management derived from our observations of Frank Gehry and his associates over the last six years. Even though we are transplanting these observations from the working practice of a

3 H. A. Simon, *The Sciences of the Artificial* (Cambridge, MA: MIT Press, 3rd edition, 1996), xii.

4 H. A. Simon, *New Science of Management Decision* (Reading, PA: Prentice Hall, 1977).

5 J. G. March, "Bounded Rationality, Ambiguity and the Engineering of Choice," *Bell Journal of Economics* 9 (1978): 587–608.

6 R. J. Boland, "Control Causality and Information System Requirements," *Accounting, Organizations and Society* 4: 4 (1979): 259–272.

renowned architect in the context of his building projects to the work of managers in other types of organizations and projects, we believe these observations can inform a new and empowering mind-set for the management of our public and private institutions.

We first discuss the notion of a design attitude and its relevance for management and organizational leaders. We then review the importance that Frank Gehry and his associates place on an awareness of vocabulary, and the benefits that a critical awareness of vocabulary could bring to organization design. The word "functional," as described by Gehry, is used as an example of how a reflective awareness of language in design can redirect management attention in beneficial ways. We then review the powerful lessons for management in Frank Gehry's use of multiple models in his design practice; in the tension between his conscious efforts to sustain a liquid state in the face of pressures to crystallize his designs; and in his ability to embrace constraints and use them to energize design innovations. We end by comparing and contrasting the lessons from Frank Gehry with those learned from the study of software designers in organizational settings; highlighting the importance of meta-design in enabling managers and organizational leaders to benefit from these lessons in their own organizational design practices.

A Design Attitude

There is a very distinct attitude that pervades the work in Gehry's studio: we call it a "design attitude." By design attitude, we mean a thorough, ongoing expectation that each project is a new opportunity to create something remarkable, and to do it in a way that has never been done before. They respect the conditions (beliefs, expectations, practices, policies, etc.) that they find in a new project situation, but they anticipate that these conditions could be other than they are, and they strive to change them for the better. In addition, Gehry believes there is a great need to create real architecture.

> Why then is there so much mediocrity in our landscape? Why then doesn't the world at large realize it? I'd say 98.5% of buildings are mediocre—I call them *buildings* because I wouldn't even list most of them as architecture.[7]

This design attitude is not restricted to his firm, but is evident in almost all of the individuals and organizations that become involved in his projects. From the president of contracting firms to the craftsmen who fabricate the buildings, we saw a desire to do things better than before—a design urge that compelled them to question and search for new methods, materials, and ways of organizing. A common phrase we heard from craftsmen and contractors alike in regard to some aspect of the work for which a conventional approach had been proposed was: "Well, you could do it that way, but why?"

7 F. O. Gehry in R. J. Boland and F. Collopy, *Managing as Designing* (Palo Alto, CA: Stanford University Press, 2004), 19–35.

We see the design urge as a powerful force for innovation and improvement that too often is overlooked or suppressed by managers and management education. Frank Gehry sets the stage with his reputation, bringing a high-profile image of creativity and invention to a project; but others who became involved already have the seed of a design urge in them, and it flowers with encouragement. In the world of management, most organizations, most products, most services and, ultimately, most socio-technical systems of any sort can be made better—not in the sense of quality or efficiency, but in the sense of being *functional*, as described by Gehry below. They can and should be other than they are, and a design attitude is the first step in being able to realize the possibilities for organizational betterment that lie within us.

Design Vocabulary

In addition to the design attitude, another rather fundamental difference between Frank Gehry's way of working and the world of management and organizational practice is his awareness of his own vocabulary. No doubt this is true of many great designers, but it is not so common with managers. We often heard Gehry and his associates refer to the vocabulary of a project, and question whether an element in consideration was in keeping with a project's vocabulary; or how the project vocabulary might be extended or played out. Since we think about vocabulary and language as something that changes rather slowly, we asked Frank Gehry if he saw a trajectory in his work. He said that he always tried to do something different, and that if he knew where a project was going before he started, he wouldn't do it. Then he added: "But you can never escape your vocabulary." There is a tension between the coherence a well-developed vocabulary can bring to a project (in methods, materials, processes, etc.) and the constraints it can impose on the desire to create new and more powerful designs. Without an awareness of one's vocabulary, this tension does not get to play itself out, and we anticipate that its absence would constrain innovation.

Being aware of the importance of language, and of the way that practices, routines, images, and other nonverbal elements are all part of one's vocabulary, is a level of reflexivity that we seldom, if ever, see in management—even in the most iconic of business leaders. We cannot help but wonder what changes could be wrought in the behavior of organizations, large or small, profit or nonprofit, if their leaders had such a reflective awareness of their language and its effect on their designs. At the very least, they might become aware of how the tools which they employ to justify their actions (cost-benefit analysis, discounted net present value, strategic analysis, profit and loss statements, etc.) are elements of their vocabulary that may or may not fit the situation they are engaging, and that carry a logic which could be at odds with their espoused objectives. The idea that they might then become aware of how they choose

a vocabulary for different responsibilities, and develop a sense of how to develop a better vocabulary as part of their responsibilities, is especially intriguing.

We believe that if designers could help managers gain a sense of their immersion in language and begin reflecting on the characteristics and qualities of that language, our world would be better off. It would be better off because a reflexive awareness of language opens up their possibilities for self-criticism, for considering how their will is shaping their behavior (beyond any causal forces in their environment), and for a more thorough consideration of the motivations and consequences of their actions.

Being Functional

In the "Managing as Designing" workshop, each participant was asked to propose a favorite design word as a seed for discussions. Frank Gehry chose the word "functional."

> Because traditionally, architects use the word functional and clients use the word functional when they look at a building and say, "This guy produced a very functional building." And it means to them that they can use it, that it works. But that doesn't say anything about how it brings emotionality to the table, and doesn't consider if it is human. Is it humanistic? Functional is boom! There it is, it's functional. Functional for me has a broader meaning than that. It means achieving a building that does all the things we want from our buildings. Building the Lewis Building and having it here right now and using it is functional, but that embodies all the processes, all the people, all the budgets, all of the building departments, and the whole history of architecture. All of those things come together over time and arrive at a conclusion that stands here.[8]

In their projects, he and his associates spend a significant amount of time exploring the desired function of a project with a client. This includes functional requirements for current and future programs, for cultural characteristics of the organization, for efficiency of operation, for being a good neighbor, for the context and scale of the environment, and for the feelings and emotional reactions to living in or visiting the structure. All of this takes time, and Gehry insists that his projects have adequate time for a full exploration of their required functionality. During our research, we have seen him walk away from potential projects if he felt there would not be sufficient time for developing the insights required for a truly functional design.

Frank Gehry was explicit in expressing his conviction that a lack of true functionality in today's organizations contributes to the sorry conditions in the corporate world.

8 Ibid., 33–34.

> The business world is suffering, and I think that a commitment to being functional in this broad sense is something that will pull us out of this terrible situation.[9]

We certainly agree, and we believe that development of a design attitude is a potent antidote for the lack of attention to true functionality in corporate America.

Models and Emotions

Another aspect of Frank Gehry's design practice is the use of multiple models in his designing; they serve as tools of thought and also evoke an emotional involvement from others participating in the process. He uses sketches and raw models in the early stages of designing in order to convey the emotion he is seeking in the design. By using multiple physical models with different scales, he and his associates seek to explore reactions to different facets of their approach to the design problem, since each model reveals different characteristics of the emerging design (Figure 2). Unlike modern management practices that divide the human experience of organizing into segmented areas of operation, and reduce them into abstract, de-contextualized, and partial representations, Frank Gehry's design practice centers on involving the totality of human experience. Multiple physical models, drawings, sketches, and 3-D computer models are all part of his efforts to evoke and respond to human experiences, both cognitive and emotional. In this way, his design approach allows for *multiple* voices to be heard, with each voice speaking to a different aspect of human experience.

Figure 2
Multiple models and scales.

Frank Gehry's practice of design as a verb resists the temptation to collapse these multiple voices into a single one, and allows them to speak in their unique ways about the functional requirements of the design problem. Design as a verb allows for playful interactions among different materials, models, ideas, and alternatives. It is this spirit of playfulness that brings the energy and emotion to individuals involved in the process. At the same time, Frank Gehry's design process seeks to realize the possibilities of an idealized dream. His

9 Ibid., 34.

equivocal and evocative sketches provide glimpses of the idealized dream he is searching for, and by not bridling multiple voices or playfulness, the design emerges by drawing emotional energy from them.

In contrast, ever since Taylorism at the dawn of the industrial age, modern management practices have sought to control uncertainty in their environments, and the ability to predict outcomes. As a result, modern, institutionalized management pursues a monotone voice rather than multiple ones. Instead of allowing multiple models to coexist and to play with them, management often seeks comfort by quickly reducing their choices. When Henry Ford said, "The customer can have any color he wants, so long as it's black," he collapsed the voices of his customers into a single, convenient one. Similarly, professional managers often resort to mimicking "best practices" of their industry as a preferred course of action, citing the management maxim, "Don't reinvent the wheel" even though reinventing the wheel might be precisely what a situation calls for. Time and again, instead of pursuing ideal solutions and dreams worth seeking, and encouraging their subordinates to do the same, managers quickly settle for solutions that are good enough, even though they may not be truly functional. As a result, we have grown accustomed to expecting management to act as if they are engaged in a purely rational, abstract exercise, without significant consequences for human beings. Today, in light of Enron and so many other large-scale corporate failures, managers and their organizations at best are being tolerated as a necessary evil, rather than being celebrated as a creative force that brings life force and emotion into our experiences.

Embracing design as a verb in management thinking includes, then, bringing emotional energy back into the center of managing. It means invoking the hopes and dreams of those who are involved. It means energizing individuals and inspiring them to dream new possibilities. It means searching for ways to create a more functional and satisfying world. We saw this search for betterment not only in Frank Gehry's building designs, but also in the way he manages his projects. Gehry and his associates form and manage teams in unique ways for each project by continually redesigning a "bricolage" of socio-technical spaces, bringing specialized actors and artifacts together in novel ways that respond to the particular conditions and requirements of each project. Despite the different goals and incentives of the many actors in a large construction project, we saw that many of the contractors and subcontractors who worked with Frank Gehry often pushed themselves above and beyond their normal effort level to accomplish the challenging task of building his designs. New tools had to be invented, new methods had be devised, and their technology and capabilities often were stretched—all in order to meet that challenge. Frank Gehry has enormous social capital because of his unique standing in the

public eye and the media. But instead of using it to center himself as the "star" of a project, he uses it to elevate others around him so that they can pursue their dreams and hopes as well. In a sense, he invites others into the design process as coinventors of ways to build such unusual structures.

There are emerging management theories and practices that can offer concrete possibilities to introduce design as a verb and positive emotional involvement into the process of management. One such practice is "appreciative inquiry."[10] Unlike other approaches to organization development that focus on the *gaps* to be closed and *problems* to be solved in a situation, appreciative inquiry seeks to tap into the reservoir of life and hope that lie ignored in organizations, and to unleash them as an emotional source for creating positive change. Instead of reducing human experiences into abstract and de-contextualized data points, appreciative inquiry gives voices to these concrete experiences, and orchestrates them in a positive, self-reinforcing cycle of inquiry into how members of the organization can seek higher human goals. Another example of positive emotional involvement is the *Theory of Transformational Leadership*.[11] Unlike traditional leadership theory that focuses on the transactional relationship between leaders and followers (performance and reward), transformational leadership theory seeks to identify the characters and processes that enable leaders to *transform* their followers. The focus of transformation leadership is not on the leaders, but on the followers who are enabled to achieve extraordinary things. Leaders achieve this transformational result by using their emotional, intellectual, moral, and social capital to mobilize their followers in accomplishing collective outcomes. In this way, transformational leaders are, like Gehry, designers who evoke emotional reactions from those around them in order to accomplish extraordinary tasks.

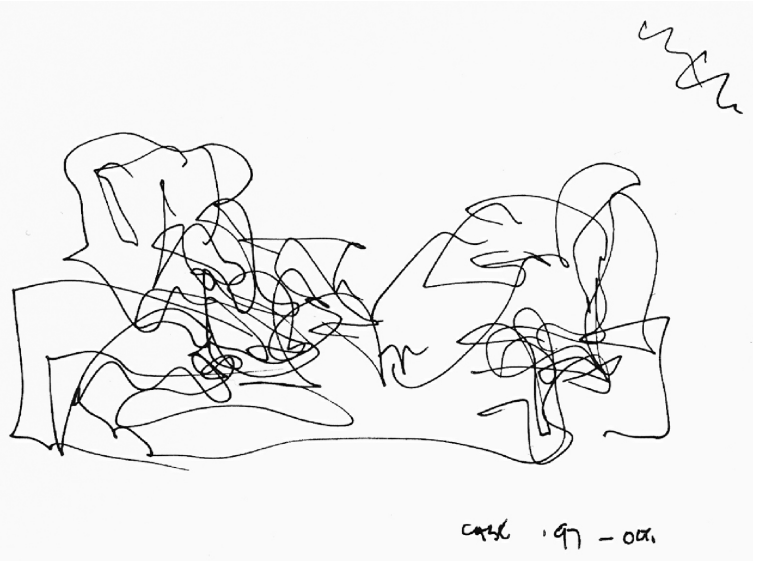
Balancing Liquid and Crystal States

Frank Gehry tells his clients at the beginning of a project that they will be in a liquid state for quite a while, and to expect that things will be changing as the look and feel, materials, methods, and design idea for the project evolves. He takes pains to not let a design crystallize too soon, and to keep the flow of ideas about the design in a liquid state. He uses many techniques to remain liquid. Some good examples that we encountered are found in his initial drawings and early models of a project. His initial drawings are a kind of stream-of-consciousness sketch, which is meant to evoke a dreamlike, emotional sense of what the building might be like. It is a sketch of the energy and power behind an idea for the building, not the idea itself. It serves as an open-ended invitation to his associates to explore possibilities for realizing the building, not a blueprint to guide its design. (Figure 3)

10 D. L. Cooperrider and M. Avital, *Advances in Appreciative Inquiry* (Vol. One) (Amsterdam: Elsevier Science, 2004).

11 C. C. Manz and H. P. Sims, "Leading Workers to Lead Themselves: The External Leadership of Self-Managing Work Teams," *Administrative Science Quarterly* 32 (1987): 106–128; R. J. House and B. Shamir, "Toward the Integration of Transformational, Charismatic, and Visionary Theories of Leadership" in *Impact of Leadership,* K. E. Clark, M. B. Clark, and D. P. Campbell, eds. (Center for Creative Leadership, Greensboro, NC, 1993).

Figure 3
An early sketch for a model study.

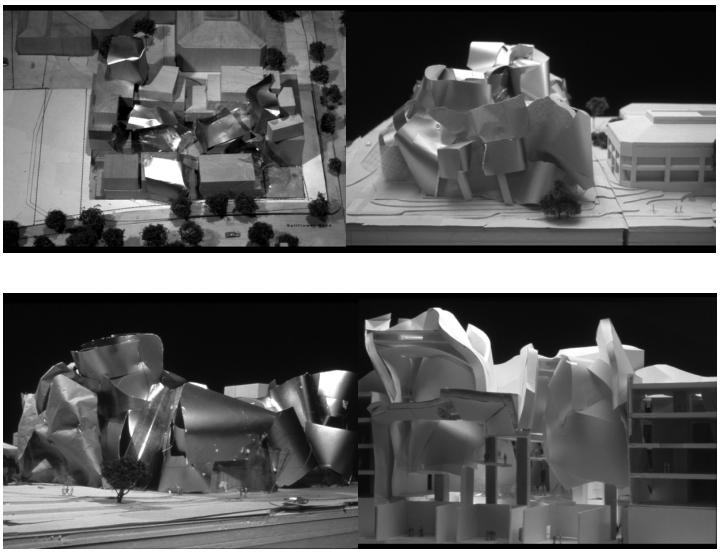


Another technique Gehry uses is to make his early design models purposely crude and unfinished. He calls these "shrek" models, which is Yiddish for "frighten." These early models are not just for the design team in his studio, but are shared with the client as well. It is another way to let the client know that what they are seeing is not the design, but a marker along the way. During the Lewis Building project, Frank Gehry often would say about a model he was presenting to the university team: "This is not what we are doing," and it was difficult to appreciate what he meant until we followed the design as it evolved through dozens of iterations. Some examples are shown in Figure 4.

In Frank Gehry's world, knowing what the finished project will be like when you are beginning the work is a good reason to not do the project. Similarly, in the manager's world, the first design idea should be suspect—it most likely is a familiar, default solution: "what everyone does" or "what we have always done"—and therefore not something to be especially proud of. Not knowing where you are going with a project may seem the height of financial folly to the conventional manager, but it is the mind-set that is most likely to open an established organization to new directions and modes of operations—which may well be a less costly course of action than the familiar, default alternatives.

A distinctive aspect of Frank Gehry's use of models is that they are tools for thinking; not just ways to represent a design idea. The design idea emerges in the process of constructing a model, with Frank Gehry and the project designer both actively involved in shaping and reshaping the models as they evolve. It is a form of thinking with their hands that allows them to experience the perceptual, emotional, and aesthetic feel of the building as they are thinking their way through the designing of it. The expectation of

Figure 4
Some design study models.



continuous change is built into the design process by their simultaneous use of multiple models—each one different from the others. The models themselves become the record of the design process. No one in Gehry's studio first draws a design and then builds a model of it, as often happens in other architects' offices. Drawings are only made after a physical model of the design is quite far along into being crystallized, and when the model is digitized into three-dimensional software from which conventional, two-dimensional drawings can be produced.

Frequently, in discussions with designers as well as managers, we hear them make reference to the importance they place on their intuitions. But where do these intuitions come from? Or, put differently, why do they come when they do? One possible answer is suggested in the work of the architect Maya Lin, who reports that her intuitions often occur when she is working with her hands—sometimes on models, sometimes at the site.[12] Joe Paridiso writes that, while we can understand concepts and ideas through literature and diagrams, a deeper kind of understanding comes from physically engaging with an actual object: "It stimulates the kind of intuition that is often critical to a designer." We are not suggesting that managers should trade their world of concepts and abstractions for one of sketches, physical models, and their associated intuitions, but we do believe that managers can expand their ability to create and appreciate good designs in their own work if they are open and engaged with both worlds. Indeed, Kant observed that when the two worlds of concepts and images merge, visualized thought is achieved. That, in turn, he considered access to "the real basis of nature."

12 F. Collopy, " 'I think with my hands': On Balancing the Analytical and Intuitive in Designing" in R. J. Boland and F. Collopy, *Managing as Designing* (Palo Alto: Stanford University Press, 2004), 164–168.

Love and Constraints

Design ideas have a special attraction for their creators, especially if they seem to be good ones. The temptation is to believe that a good design idea is worth committing to, and to focus on perfecting it. Once a design idea has captured us in this way, it is hard to give it up. Thus, Frank Gehry and his associates are explicit about the need to resist falling in love with an idea. They keep from falling in love by consciously treating every design idea as a step on the road, and not as the final destination. By saying: "This is not what we are doing ..." is a way to let clients know that the models they are viewing will change—perhaps dramatically—when they see the project again. But it is also a way for the design team to remind themselves that they are on a search, which requires them to not fall in love, but to keep searching, and to try other approaches. This paradoxical response to appealing ideas (avoiding an attachment to them) is mirrored by Gehry's response to the unappealing reality of constraints (embracing them).

In management, constraints are a hindrance to be overcome, but in Frank Gehry's practice, constraints are what make a design problem unique and worthy of their best efforts. Embracing constraints helps to overcome the temptation to fall in love with an idea too quickly, since only a truly great idea can "solve" a strong set of constraints. A good example from the Lewis Building is a request that surfaced early on during Gehry's work with the faculty to define program requirements. One faculty mentioned that in the tiered classrooms it would be desirable to have an entrance at the front of the room, where faculty and guest speakers would enter, and also to have an entrance at the rear of the room for students who arrive late. This seems like a simple request until you consider that mock-ups indicated that the maximum drop in our tiered classrooms should be about six feet from the front to the back of the room. Because there was going to be fifteen feet between floors, having an entrance at both the front and back of the classroom was not a simple task at all.

The "effective," modern manager simply would have said: "We can't do it," and moved on to putting an entrance at the front or rear only. But the Gehry team took this difficulty as a challenge, and kept it as a constraint. It led them to consider different floor heights in a section of the building that later evolved into a student lounge and study room area. Creating the dedicated student area offered students a sense of owning space in the building, and asserted their centrality to the school. It also allowed a platform for launching bridges to the tiered classrooms across the open atrium, so that students could enter the backs of classrooms as the faculty had requested (Figure 5). Embracing the two-entry constraint led them to think about varying floor levels in a section of the building, which then opened up the possibility of private student spaces, which set the conditions for other, unexpected design elements which not only met

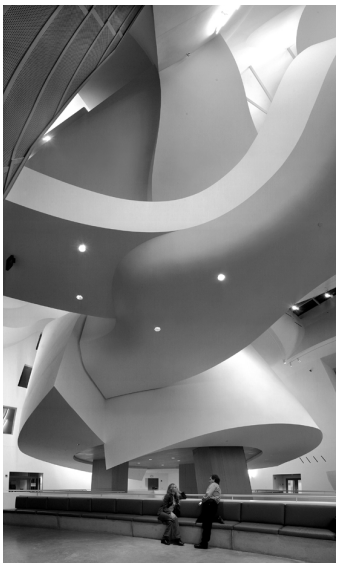


Figure 5
Atrium bridge in the P. B. Lewis Building.

the constraint, but strengthened the appeal of the building to students, symbolized their relation to faculty, and opened the way for a dramatic aesthetic element. So the embracing of constraints not only made the design problem more interesting, it also allowed for serendipitously inventing new and valuable elements in the design.

Concluding Thoughts on Lessons for Organization Leaders

Frank Gehry and his associates know that many of the things they are able to do in their design practice are possible only because of the unique "starlike" status that he has attained in the world architectural community. It probably is true that other architects might not be as successful in adopting his techniques, and that they operate under a different set of "rules of the game" in their projects. But it is our contention that elements of his design practice can be generalized to the leaders of organizations that are seeking to innovate substantially and successfully. It is because his practices are so much at odds with the standard management procedures in most organizations, and with most managers' ingrained sense of how they are expected to behave, that they could have such a transformative power for organizations and their leaders.

The possibilities for transformation in organizational leadership begin with the adoption of a design attitude. For organizational leaders, this means a shift away from empty platitudes about "goals" as normally conceived by management. By this we mean that typical organizational goals to grow by a certain percent per year, or to produce profits of a higher level than past years, really are empty statements that carry no design attitude with them. Such goals are excuses for stereotypical behaviors (buying or selling units of the firm, reducing "headcount," centralizing, increasingly detailed accounting and budgeting systems, etc.) and inimical to innovation or creative problem-solving. Adopting a design attitude, in contrast, sets a higher order type of goal for an organization, that of seeking new ways to achieve human betterment in their domains of expertise. Adopting a design attitude is a way to energize organization members to seek the ideals that lay behind their stated mission—to ask what is their real purpose, and to believe they can create better ways of achieving it. A design attitude enables leaders to set visions that inspire others to strive beyond normal expectations in creating a future they can be proud to live in.

The design attitude includes an expectation that an organization's familiar language will be subject to scrutiny, and that new vocabulary elements are expected as an emergent outcome of seeking to create a more desirable state of affairs. If the designing is successful, it will change the language that they and others use to approach the world. It will introduce new vocabulary elements that enable new possibilities for making meaning, and for making lives meaningful, in the world.

Part of the design attitude for leaders is to make a conscious effort to resist closure of a design problem and to maintain an open and liquid flow of design ideas. This includes explicit efforts to develop multiple models, theories, and conceptualizations of their business, their markets, their environments, and their competitors. It includes being wary of falling in love with what at first glance seems to be a good idea, to recognize and creatively respond to constraints, inside and outside of their firm, and, above all, to seek the highest and broadest form of functionality in their organization process and products. The design attitude seeks a functionality that is never fully realized, and is always possible to expand by including new realms of human experience. Functionality begins with a desire to achieve efficiency and effectiveness in a traditional sense, and expands to include an enlarging circle of concern for emotions, customer experiences, ethical behavior, environment, cultural norms, and aesthetic appeal. In a sense, the open-ended search that animates the design urge is a search for improved functionality, with functionality taken as a betterment of the human condition.

Our study also shows that, like the search for functionality, organizational designs are never complete. They are not finished things, but processes in the making—human enactments that continue to shift between liquid and crystal states, in a dialectic between crystallization and liquidity created by both applying doubt and engaging in action (i.e., reconceiving things abstractly while giving shape to ideas through prototypes) over and over again. This is better than assuming one model for organization design at the outset, and then moving quickly to reify it, or designing the organization without any model through random trial-and-error learning. The trick in keeping designs moving is not to mistake the models for reality, and to approach them as a means of exploring and imagining alternative realities. The benefit of applying doubt and suspending closure is well known from studies of software development.[13]

The design of large software systems is representative of the type of complex organization design attempted by their leaders today. The software design literature clearly shows that the design time spent in a liquid state, exploring alternatives and requirements early on in the process, results in fewer "bugs" and software repairs later on.[14] The net effect is that less time and money is spent on the overall project. But software developers do not know how to make that happen all the time and, in most cases, the love for crystallizing one design or designing blindly by random search wins out. This is a result of a managerial mind-set and an organizational reward system that favors design as a noun ("Where is the running code?"), and suppresses design as a verb ("Are we designing for the right functionality in our environment?"). As a noun, design is quick and not compelling, so that managers can get on with their "real" job of tracking accomplishment to goals, calculating returns on investment, and so on.

13 K. Lyytinen, "Different Perspectives on Information Systems: Problems and Their Solutions," *ACM Computing Surveys* 19:1 (1987a): 5–44; K. Lyytinen, "New Challenges of Systems Development: A Vision of the 90s," *Data Base* 12:2 (1989): 1–12; B. Curtis, H. Krasner, and N. Iscoe, "A Field Study of the Software Design Process for Large Systems," *CACM* 31:11 (1988): 1268–1287.

14 K. Lyytinen, "Different Perspectives on Information Systems: Problems and Their Solutions."

Like software design, organizational design is recursive in nature. Recursive design emphasizes the criticality of meta-design (i.e., sustained flexibility in the functionality achieved by the design) as good design practice. Meta-design helps to keep the design continuous and open, moving between liquid and crystal states. We argue that all good organizational designs should be able to continue to be redesigned, and to change their form over time. That is, the elements and configurations set in place by managerial design should keep the organization in dynamic motion. The foregrounding of motion and variation in organization designs (as things) has many connotations in the literature like *bricolage*, improvisation, emergence, and adaptation. If meta-design is not achieved, an organization is dead and lacks the capability to inspire and move us. For example, Frank Gehry emphasizes the practical nature of his designs, and is aware that his designs can be accommodated over time and made parts of everyday human activity.

> I think in the world you are in, you should expand the word "functional" to encompass more than just the simplistic notion of doing something well, but to encompass all these other issues. When I make a building, I want it to feel easy on the hand for people. This means we give a lot of attention to all the little details of how the building will feel to them, from door handles to passageways. I think about how to give people a kind of handrail, so that the unfamiliar can become familiar to them.[15]

A similar need for continued design and meta-design recently was observed in McGann's study of the continuous evolution of organizational practices and software designs.[16] Only in situations where users continued to design with and around the software applications, and the application enabled this to happen, did the organization reap significant benefits from deploying the computer systems.

Frank Gehry and his associates have showed us a number of heuristics to build and keep a design attitude. No doubt a study of other leading designers' practices would uncover more. Managers who open themselves to the design attitude, and set organization reward systems to encourage it, will find that organization change comes easier, is more effective, and reinforces itself over time. In short, it's worth trying.

15 F. O. Gehry in R. J. Boland and F. Collopy, *Managing as Designing*, 34.

16 S. McGann, "Coping with the Unplanned: The Dynamics of Improvisation in Information Systems Evolution within and across Organizational Boundaries" (Ph.D. thesis, Department of Information Systems, Case Western Reserve University, 2004).

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Product Development as a Vehicle for Organizational Change

Sabine Junginger

Introduction

In its essence, product development is all about change. And yet product development has been ignored for its role in changing the organization. Why is this? Today's organizations value product development for its ability to realign a business with its external environment, consumers, and markets. Product development has become synonymous with the creation and production of goods people want to buy. It has turned into the corporate response to challenges posed by social trends, economic forces, and technical advances.[1] As a result, organizations think of product development when they think of external change. This essay explores how product development might be a way to think about internal organizational change.

Why Change?

Every day, organizations face some kind of new challenge: new laws apply; economic conditions shift; revolutionary technologies call for implementation; and customers' needs change. Each novel situation can become a threat to the organization. Operational inefficiencies due to outdated equipment or work processes make it difficult to compete; ignoring customers' needs risks eroding a loyal base of buyers. Accordingly, organizations have to change unless they want to become irrelevant, or worse, extinct. This is the paradox of the organization: it needs stability to function well, but it needs change to survive.

Organizational change has become a topic in both management practice and organization research. Organizational change generally aims to improve an organization's internal processes.[2] Ultimately, performance metrics capture monetary gains or losses that can be linked to efficiency levels within an organization. But just what makes an organization efficient is in dispute.

For some, efficiency refers to a workflow that steadily leads to an increase in productivity. Under the dictum of minimizing input while maximizing output, this interpretation focuses on a smooth operation with as few interruptions as possible. Here, all effort is directed at eliminating delays and other disturbances in the workflow. For others, reducing overhead cost represents an alternative

1 These are what Jonathan Cagan and Craig Vogel describe as the "SET Factors." For more on the theory of SET factors, see *Creating Breakthrough Products* (Upper Saddle River, NJ: Prentice Hall, 2002).

2 See Steven J. Ott, Sandra J. Parkes, and Richard B. Simpson, *Classic Readings in Organizational Behavior* (Belmont, CA: Wadsworth/Thomson Learning, 3rd edition, 2003).

understanding of efficiency within an organization. Inefficiencies are measured in dollars allocated to tasks that do not directly contribute to profitability (i.e., do not generate income). Yet others count their "brain capital," and equate efficiency directly to the brainpower and skills they can attract and maintain. In this case, efficiency is about successfully accessing and utilizing people's skills and knowledge as sources for invention and continuous growth.

Recently, organizations have found customer experience to be a rewarding appraisal of their business efforts. This is a noteworthy development because it is a gauge that, at least at first glance, rests outside an organization's internal workflow and structure. Organizations are beginning to recognize that their internal operations may be intimately linked to the overall customer experience they provide. These organizations are seeking to move their organization from one centered on optimizing workflow and operations research to one centering on the people they serve. Often, however, they do not even know how to begin reinventing themselves. The task can seem so overwhelming that it is easier to revert to familiar ways of improving efficiency.

Radical Transformation and Revolutionary Products

Denise Rousseau differentiates two kinds of planned organizational changes: Organizations sometimes change in increments to accommodate new situations and, at other times, perform a "radical surgery" that transforms the organization itself.[3] Similar distinctions are being made in product development. New products that are based on changes to an existing product line are called evolutionary (i.e., incremental), while new products that establish a new market or solution within a market are deemed revolutionary (i.e., transformative).[4] Revolutionary products and organizational transformation both depend on a change in people's fundamental assumptions.

According to Rousseau, fundamental assumptions are "the often unconscious beliefs that members share about their organization and its relationship to them."[5] Fundamental assumptions have a stabilizing effect on the organization. They form the core of an organization's culture around which behavioral norms, values, behavior patterns, and artifacts, or products, evolve. Without understanding and articulating an organization's conscious and unconscious beliefs, significant change is elusive because existing systems try to maintain implicit system goals.[6] Unless these goals are made explicit, any attempt at change is bound to miss its target. Neither incremental changes due to accommodations, nor evolutionary product development strategies, affect inherently fundamental assumptions. Revolutionary products and organizational transformations do.[7] Organizational change and new product development therefore can go hand in hand. However, can it be planned? Can product development be a strategy to surface and change funda-

3 Denise M. Rousseau, *Psychological Contracts in Organizations: Understanding Written and Unwritten Agreements* (Thousand Oaks, CA: Sage Publications, 1995), 50.

4 Cagan and Vogel, *Creating Breakthrough Products*, 52.

5 Denise Rousseau, *Psychological Contracts in Organizations*, 50.

6 Peter Senge, *The Fifth Discipline* (New York: Doubleday, 1990), 81.

7 Ulrich and Eppinger state correctly that many of the steps and activities involved in the product development process are of an intellectual and organizational, rather than a physical nature. However, their process does not question current fundamental assumptions of the organization. Instead, it appears that their development process derives its cues from exactly these value and category systems. This kind of product development process may serve the organization well if its objectives are accommodational changes that do not require a change in norms, beliefs, and values held by the organization. Karl T. Ulrich and Steven D. Eppinger, *Product Design and Development* (New York: McGraw-Hill, 1995).

mental assumptions? The answers to these questions require some reflection on the role products and product development assume within organizations.

What Is a Product?

Traditionally, products have had a fundamental role in closing the gap between organizations and their environments. A look at popular definitions of the term "product" confirms the emphasis on the product being a commodity for sale by an organization to people not part of the organization. For example, a product is described as "something sold by an enterprise to its customers," [8] or as "a device that provides a service that enhances human experience, always part of a company that provides service to its customers." [9] Alternatively, it is defined as "anything that can be offered to a market for attention, acquisition, use, or consumption that might satisfy a want or need. It includes physical objects, services, persons, places, organizations, and ideas." [10] Common to all of these definitions is an understanding that a product is a fundamental part of the transaction an organization has with its customers.

Victor Margolin provides a different perspective. He describes products as "the human-made material and immaterial objects, activities and services, and complex systems or environments that constitute the domain of the artificial." [11] According to this definition, an organization can be a "product" in its own right. Consequently, product development activities become relevant for the organization itself. But as we will see in the next section, the focus on products as transactions has had a paralyzing effect on the activities that constitute product development.

What Is Product Development?

Product development today is defined as "a set of activities beginning with the perception of a market opportunity and ending in the production, sale, and delivery of a product," [12] "a strategy of increasing sales by improving present products or developing new products for current markets," [13] or "a phase in which the organization determines if it is technically and financially feasible to produce a new product." [14] In each of these definitions, the organization limits the realm of product development activities. As a phase, the value and role of product development to the organization is minimized, since its activities are merely something that the organization needs to contend with temporarily. Once the "phase" is over, the organization can go back to business as usual. By treating product development as a phase, the organization stabilizes and reinforces existing assumptions under which product development then has to operate. Similarly, product development as a cost turns the development activities into a budget item that can either be cut or raised. In this sense, product development only can affect the organization in

8 Ibid., 2.

9 Cagan and Vogel, *Creating Breakthrough Products*, 3.

10 See Philip Kotler and Gary Armstrong, *Principles of Marketing* (Englewood Cliffs, NJ: Prentice Hall, 10th edition, 2003), Glossary G-8.

11 Victor Margolin, "The Product Milieu and Social Action" in *Discovering Design: Explorations in Design*, Richard Buchanan and Victor Margolin, eds. (Chicago: University of Chicago Press, 1995), 121–145.

12 Ulrich and Eppinger, *Product Design and Development*, 2.

13 Philip Kotler and Gary Armstrong, *Principles of Marketing*, Glossary G-8.

14 Sally Dibb, et al., *Marketing: Concepts and Strategies* (Boston: Houghton-Mifflin, 4th edition, 2001).

financial terms. Again, the organization makes every effort to retain its existing framework rather than engaging in an inquiry about its relevance or feasibility.

Finally, the idea of product development as process is problematic, since it easily misleads people into thinking about product development as some kind of a mechanism. A process typically suggests a predetermined, or at least a predictable, path. In its extreme, it is akin to a formula. For a process to work, one needs to decide the variables and factors that go into producing the desired outcome. This is in direct opposition to the "Fuzzy Front End" that marks new product development, and in which neither all variables nor all factors can be known or decided upon in the beginning.[15] Organizations that liken product development to a "process" are prone to focus on process improvements. Achievements in this area include savings in time and cost but, unless the organization itself can change in this "process," the abilities of product development to deliver the desired outcomes are limited to innovations of a technical nature.

This also means that the possibilities for discovery are limited when they are confined to cutting cost, expediting schedules, and improving existing processes. When an organization assigns such artificial boundaries to design thinking and design methods, it closes the door to many possibilities right from the start. As a result, product development tends to retreat to the discovery of the material possibilities within the field of forces (for example, financial, technological, procedural pressures) the organization provides. While forces can be redirected, bent, and tweaked, they cannot be substantially changed or completely ignored. Bowen et al. provide an example of this kind of product development in their report on the findings of the "Manufacturing Vision Group."[16] A manufacturer of personal printers is looking for the next big product to help them maintain their market position. Market analysis indicates that the market is ready for a printer that sells for less than one hundred dollars. Thus, the product begins to take shape. The company turns the product specifications over to the product development team. All that is left to do is for the development team is to come up with a fully functioning printer that meets the specifications, in the shortest time possible. Of course, this presents a challenge in itself, but one that remains focused on material discoveries within the parameters already *given*—the organization's own field of forces. Design in this context is viewed as a "functional specialism": decisions related to marketing and manufacturing in this category are dictated by other functions.[17]

The activities of creating a new product come to resemble the way a pharmacist fills a prescription. A pharmacist does not need to know how to invent, but how to fill a medication "to order." This frees the pharmacist to devise ways of refilling medications faster than his competitors at a lower cost to customers. A pharmacist

15 Cagan and Vogel discuss the Fuzzy Front End. See their *Creating Breakthrough Products*.

16 The five-year study by the Manufacturing Vision Group marks an early attempt to illuminate the role of product development within the organization. However, it focused merely on product development as a technical capability of the organization, and held onto a traditional product definition. See Kent H. Bowen, Kim B. Clark, Charles A. Holloway, and Steven C. Wheelwright, *The Perpetual Enterprise Machine* (New York: Oxford University Press, 1994).

17 Helen Perks, et al., "Characterizing the Role of Design in New Product Development: An Empirically Derived Taxonomy" in *Journal of Product Innovation Management* 22:2 (2005): 111–127.

typically is not interested in changing the way the doctor's office is run. And that is fine for both the doctor and the pharmacist. But for organizations, the situation is strikingly different. They depend on innovation and change. Organizations that deny product development an active role should not be surprised to receive refills of the same medication at an ever-higher dosage.

The "Manufacturing Vision Group" concluded that product development *can* serve as the source for creating new organizational core capabilities, particularly technological know-how which, in turn, can renew the corporate enterprise machine. Yet the same study found that the majority of the companies being studied did not take advantage of this potential. One of the participating corporate members observed an "expectation boundary that limits any kind of change except technical change" among product developers. More important, he explained the reason for product development's conspicuous absence in matters regarding organizational change: "There is a tendency to specifically not use product development as a change agent" for fear that it would put the technological development at risk.[18] Barely ten years later, the debate in product development has shifted from innovative technology to innovative design.[19] This calls for a more active role of product development within the organization. It also means that if organizations want to take full advantage of their abilities to innovate and change, their idea of product development needs to change first.

Product Development as Inquiry into the Organization

When product development is allowed to be an active agent, the activities through which a product takes form simultaneously can become an inquiry into the organization. An organization that "allows" product development to explore product opportunities by conducting its own research into the context of the product acknowledges product development as a valuable organizational activity in its own right. If properly understood and applied, product development can be a tool[20] for managers who seek to transform their organization.[21]

In the development of a product, many aspects of the initial situation are indeterminate. What can be made? What should be made? Not only is it necessary to find answers to these questions, but equally, or even more important, is the *ability* and *responsibility* to generate *the criteria* to answer these questions. "Ability" here refers to the methods and skills that are needed to identify and define relevant criteria for a new product. "Responsibility" points to the ethical component of product development; the need to engage not only with the direct matter on hand, but also with its intentional and non-intentional potential consequences. "Criteria" form the base for judgments and decisions necessary in the development of a product. Without examining existing criteria carefully, and without redefining some of them, products are limited in the way they acquire new

18 Bowen, et al. citing Hewlett Packard Co. VP, Special Projects, Edmondson (retired) in *The Perpetual Enterprise Machine*, 279.

19 "When people talked about innovation in the '90s, they really meant technology. When people talk about innovation in this decade, they really mean design," states Bruce Nussbaum in an online article "Getting Schooled in Innovation," *Business Week Online* (January 3, 2005): www.businessweek.com/bwdaily/dnflash/jan2005/nf2005013_8303.htm (last accessed August 7, 2007).

20 A "tool" in the context of this essay is something that supports or facilitates a person's efforts in pursuing a particular goal or outcome. Thus, a tool can take a tangible or intangible form.

21 This situation is reminiscent of John Dewey's "body and mind problem": the organization itself presents the mind responsible for vision, strategy, and goal-setting, while product development acts as the body that turns the vision into a tangible product. See John Dewey, *Human Nature and Conduct—An Introduction to Social Psychology* (New York: The Modern Library, 1930), 67.

forms, meanings, and functions. For the product development team, every newly discovered criterion that is relevant serves as an additional guide in an otherwise fuzzy enterprise. With that, product development assumes the character of an inquiry. In fact, product development becomes the kind of inquiry John Dewey had in mind. In his book *Logic: The Theory of Inquiry,* he defines inquiry as:

> … the controlled or directed transformation of an indeterminate situation into one that is so determinate in its constituent distinctions and relations as to convert the elements of the original situation into a unified whole.[22]

Following this definition, the outcome of product development is a unified whole that is neither arbitrary nor is it determined at the beginning of the development process. Instead, the product emerges in the context of an inquiry into the organization—an inquiry into its people, structures, resources, and purpose. When product development becomes an inquiry, design thinking and design methods apply.

Designers continuously challenge people to reconsider what the world is about. In order to create new useful, usable, and desirable products, designers have to inquire about why things are the way they are and envision how things might be different. Designers inherently are concerned with bringing people, structures, and resources into alignment around an articulated purpose. For organizations, this purpose is to serve their customers. By introducing the user perspective to the internal organizational context, human-centered designers can assist organizations in reorganizing themselves in a way that enhances their customers' experience. This includes the invention of new products to close gaps in the paths users pursue when they seek to accomplish a task using the organization.

Designers therefore can generate and articulate a human-centered vision. They have the tools to communicate a vision to diverse groups of people and, with this vision in mind, to develop guiding principles and products that provide organizations with an incremental path to realize their vision. Because designers participate actively in "making" the change happen, they do not merely prescribe what needs to be done to reach a desired outcome. In the activities of making and creating, the learning is put into action. Learning and acting on that which has been learned are necessary preconditions for fundamental organizational change. With that, human-centered product development offers an avenue for organizations to learn about their customers and themselves. The organization develops and changes in the development of a new product. A more human-centered organization is one of the development outcomes.

22 John Dewey, *Logic: The Theory of Inquiry* (New York: Henry Holt and Company, 1938), Chapter VI, "The Pattern of Inquiry," 104.

The Organization as a Human-Centered Product

The more people an organization serves, the more complex are its systems and the more complicated becomes the task of organizing. Organizing a random assembly of things in a way that serves the needs of one particular individual is much easier than organizing the same items so that they make sense to radically different groups of users. Yet this is the task of large corporations and governments. Charles Perrow points out that any complex system is too overwhelming to be understood by an individual person and that, without functions and processes, complex systems remain inaccessible to people.[23] But the mere existence of functions and processes does not alleviate the problem unless organizations focus and clarify their operation for customers, employees, and managers according to Richard Buchanan. He refers to this as "a shift of our perspective from the massive totality of the system to the pathways of individual human experience."[24] Looking at the problem of organizing from the perspective of the individual human experience allows us to redefine the meaning of *being organized*: being organized means to have prepared the path for a specific action. Implicit in this definition is the recognition that an organization is always *organizing* yet seldom *organized*.

Organizing is crucial to the activity of preparing the path for a specific action. Organization facilitates action because, in the process of organizing, unrelated pieces and bits are put into purposeful relationships. Meaningful roles and functions emerge that clarify responsibilities, the kinds of tasks needed, and their sequences. These, in turn, build the foundations for intuitive paths that support the successful accomplishment of a given task. Things that do not indicate their potential use in time or circumstance are of little use to most people. In contrast, things that are organized in a way that makes sense to their users can become meaningful tools, since they are easily identified, readily available, and clear in their function when needed.

This may be the reason why much of human life involves organizing. People sort out documents so they can find important papers in case of an emergency; they coordinate events and persuade other people to share their cause; and they arrange their environments in a fashion that supports the way they want to live and work. While every form of organizing involves people, resources, structure, and purpose, an *organization* requires a group of people that utilizes available resources in an agreed manner to pursue a *common* or shared purpose. Consequently, four distinct systems interact with each other to produce the most complex system: the organization itself. People live and act within a social system; resources reside in the realm of physical systems; structure represents the management or decision-making system; and, finally, purpose belongs to the value system that provides the rationale for a particular undertaking.

23 Charles Perrow and Scott Forsman, *Complex Organizations: A Critical Essay* (New York: Random House, 3rd edition, 1996).

24 Richard Buchanan, "Management and Design: Interaction Pathways in Organizational Life" in *Managing as Designing*, Richard Boland and Fred Collopy, eds. (Stanford: Stanford University Press, 2004), 54–63.

An integrated organization is one in which all four elements—people, structures, resources, and purpose—work in unison to enable the people it serves to accomplish their goals. An organization so integrated also fulfills the important criteria of efficiency and productivity, because clearing the path for people means to remove obstacles that not only hamper people's ability to reach their goal, but waste the organization's time and money. The design of a product can become an organization's strategy for internal change when the goal is to create new paths of interaction for customers and employees.[25]

Human-Centered Product Development as a Strategy for Change

Human-centered product development invites organizations to see the world differently. It introduces the perspectives and experiences of "other" people—people who are not familiar with acronyms, processes, hierarchies, or standards created by internal experts. These people include customers, suppliers, and employees alike. To make the organization and its products work for them, organizations need to change around their experience—*from the outside in.*

In many organizations, interactions with customers still resemble a mechanistic man-machine interface in which the organization represents the machine to the customer. Customers have to fit the roles assigned by this "machine." The organization as machine represents a design from the "inside out": a mix of internal criteria (i.e., technological, operational, logistical concerns) shape its form and being. Because of this unidirectional focus, the impetus for change can only come from within the organization. Alternatively, the organization can change from the "outside in" by creating human pathways into the organization.[26] Embracing the needs and abilities of its customers, the organization can shape itself around them. In order to become "outside in"—that is, customer-focused—organizations need to change from the outside in.[27]

Human-centered product development can be a strategy for changing from the outside in because it constitutes a systematic approach that links and unifies the four elements of the organization, and therefore views product development as a relationship-building activity. Only by integrating all relevant elements into an appropriate form can the product assume its proper role as mediator between people.[28] As part of the strategy, human-centered product development inquires into the organization, its core principles and purpose. In doing so, it generates and establishes key principles that guide future product development.

One of the key characteristics of a human-centered product development is the early production of prototypes. Prototypes allow both the design team and the members of the organization to see the emerging work. At the same time, early prototypes serve as explorations of new possibilities since they provide the space and place to approach and visualize problems in a somewhat noncommittal and

25 Ibid.

26 Ibid.

27 Outside-In Design™ is a trademark owned by Australian design researcher Tony Golsby-Smith. He talks about "becoming outside in" in his work with organizations. For more on his work, go to: www.secondroad.au.com.

28 See Richard Buchanan, "Rhetoric, Humanism and Design" in *Discovering Design: Explorations in Design Studies,* R. Buchanan and V. Margolin, eds. (Chicago: University of Chicago Press, 1995), 23–66.

thus less threatening way. Scheduled review sessions of prototypes are one way to involve members of an organization in the development process. Such workshops provide a forum for employees to discover and discuss the problems that the current system poses. One of the many roles of the prototype here is to trigger a discussion that encourages fundamental assumptions to surface. Once these assumptions are articulated, they can be openly discussed and, in the process, reevaluated.

Prototypes lead to products. Each individual product can serve as an "intermediate act" that collectively and successively transforms the organization.[29] The important difference between incremental changes in the traditional sense and incremental changes due to human-centered product development is that, in the latter, the increments are part of a planned and systematic approach. Organizations tend to see products as ends, not as intermediary acts. Thus, a number of products have been mislabeled as "failures" instead of being recognized for their role as necessary intermediaries without which an emerging radical new approach would not have been possible. San Jose, California–based Apple Inc. based no less than three of its most successful products on a product that never made it to the market. One might look at these intermediary products from a merely technical and marketing point of view. The technical skills acquired during the development of the earlier products likely contributed to the company's core capabilities in the sense Bowen et al. had in mind. But this would lead us to overlook the least visible, yet most significant, impact of these projects on their organization: the generation of insights and information about how the organization as a whole would need to change in order to deliver the kinds of experiences envisioned in each project.

Unlike other organizational change efforts, human-centered product development does not need to start at the core of the organization. Instead, it offers the possibility to put new principles and ideas to the test in increments at the fringe of the organization. The larger goal in organizational change is to move closer to the organizational core with every "act" or product. Dewey's observation that "unless one takes intermediate acts seriously enough to treat them as ends, one wastes one's time and effort at changes of habits" very much applies to organizations. Pursuing a human-centered product development strategy, every new product inquiry moves to greater complexities and involves more people than the previous one. Thus, change can develop its own snowballing, or cascading dynamic that creates knowledge and products from the outside in.

This also represents a departure from traditional top-down or bottom-up approaches common to ordinary organizational change efforts. In human-centered product development, the direction is more horizontal. But the line is neither neat nor straight. Rather, the iterative and inclusive nature of the inquiry creates a path that "zigzags" through the organization from the outside in—and also

29 This follows Dewey's idea that means and ends are instances of one and the same, and are distinguishable only by the way we judge them. John Dewey, *Human Nature and Conduct*, 35.

from the inside out. These product development activities bring design *into* the organization, utilizing design thinking and design methods to develop products that improve individual organizational interactions to increase overall efficiency. They actively involve people generally thought to be external to the design process, thus literally bringing people from the outside in. Their participation, in turn, allows the organization to see itself through the eyes of people who experience the organization as external users: customers, field employees, suppliers, and others.

Many employees feel anxiety about changes in their organization. Being involved in a change process gives people control and information in addition to offering an outlet for their fears and concerns. This, in turn, makes them actively engaged participants. People who work with or witness change implementers who continuously keep asking pointed questions and encourage others do so provide an example of the culture they are hoping to create.[30]

For the organization, involvement in the product development process can mean a new level of learning, since this process builds on the sharing knowledge and the contribution of individual expertise to a shared problem. Argyris and Schön have pointed out the existence and the need for such "double-loop learning."[31] Yet what has been missing so far is a practical path for organizations to engage in double-loop learning. It is one thing to understand the need and the value of double-loop learning. It is another to make it happen in an entrenched organizational framework. The iterative and participatory nature of human-centered product development presents a viable path for double-loop learning.

Conclusion

This essay set out to explore the possibility that product development, which in its essence is all about change, can be a way to think about organizational change. The discussion shows that product development can be a strategy for generating and implementing internal changes. In particular, design activities such as prototyping are conducive to the surfacing of fundamental assumptions. However, for organizations to take advantage of these tools, they need to think of product development as an inquiry into the organization. Doing so opens the way for the organization to be a product to which design thinking and design methods apply. The integrative nature of human-centered product development, and its use of user research, participatory design and iterative processes facilitate organizational learning. Goodman and Rousseau have pointed to the need for linkages among different organizational areas for successful, observable organizational change.[32] It appears that human-centered product development can be this link.

30 See also Todd Jick's case study about implanting change in an organization: "Implementing Change," *Harvard Business School Case* N9-491-114 (1991).

31 Chris Argyris and Donald A. Schön, *Organizational Learning II: Theory, Method, and Practice* (Reading, MA: Addison Wesley Publishing Company, 1996).

32 Paul S. Goodman and Denise M. Rousseau, "Organizational Change that Produces Results: The Linkage Approach" in *Academy of Management Executive* 18:3 (2004): 7–19.

Reflection

On the Case Study Method of Research and Teaching in Design

Maggie Breslin and Richard Buchanan

Case studies have a rich history for exploring the space between the world of theory and the experience of practice. It is one thing to have an idea and another thing to make that idea concrete and real. Designers, by the nature of what they do, must become skilled at moving between those two places. But recognizing and understanding the transition from the one place to the other, and back again, is difficult. Case studies are a useful tool for research and teaching that focus on the transition between theory and practice. The format has been widely used in other disciplines, and it can be used effectively in design.

Law schools first showed the way for the case study approach, beginning in 1870.[1] Before that, law was taught by the Dwight Method, which emphasized memorization and recall, and left much of the practical learning to apprenticeships. Christopher Langdell changed that way of teaching when he arrived at Harvard Law School. He believed that, at its root, the art of practicing law involved understanding core principles and being able to apply those principles in different situations. Of course, the legal profession was fortunate in this respect, because there already existed an infrastructure by which cases were written to explain and interpret the principles used to reach legal judgment. When Langdell started teaching, he had his students read the original sources, which were the cases, and develop their own conclusions, guided by conversation and discussion in the classroom. The dialectic of discussion, rather than simply memorizing the grammar of the law, enabled the student to better understand legal principles and their possible application in different situations. Langdell set in motion a teaching approach that initially was met with resistance but, by 1920, became the dominant teaching mode in law schools and continues to this day.

Around 1920, the Harvard Business School began exploring the possibility of using the case study approach in their graduate program.[2] They, too, realized the need to prepare students for the job of making and implementing decisions in a murky world. The biggest hurdle was the lack of existing case studies, so Wallace P. Donham, the dean of the Harvard Business School, created a group known as the Bureau of Business Research, which developed and wrote case studies from 1920 to 1925. These cases served as a starting place, and the writing of additional case studies became an integral part of a law professor's duties.

1 David A. Garvin, "Making the Case" *Harvard Magazine* (September–October 2003): 58–59.

2 Ibid., 60–61.

The case study method continued to make inroads into new professions when the Harvard Medical School adopted it in the mid-1980s.[3] Professors there realized that the art of practicing medicine lay in the connection of scientific and medical principles with the unique social contexts in which doctors found themselves making decisions. Since the need to constantly be learning new techniques and approaches is more prevalent in the medical profession than in the law or business professions, the case study method evolved from being a practical example of principle in context to a catalyst for learning previously unknown principles. When what one already knew did not answer the question, one sought out other ideas that could. This was dialectic in a productive form, moving from the known to the unknown, seeking new ideas and methods.

In each instance of case study adoption, there was an understanding that problem-solving lay at the core of the professional experience. Scholarship could teach the underlying foundation of knowledge that informed the topic, but could not always make clear the process of analysis. Case studies are not a perfect solution to the problem. They cannot tell what decisions should be made, but they can connect the student to social phenomena, real life experience, and existential situations in a way that helps to sharpen thinking and inform decision-making.

Much of the groundwork for the use of case studies in design was laid in the last decade. For example, the continuum of design theory and design studies has developed a view of designers as problem-solvers who employ diverse methods and techniques. In turn, design research has evolved into a formal component of the design process. However, designers have not yet made the leap to writing and using case studies as an important part of design education and research development.

There may be several reasons for this. First, unlike law, business, and medicine, the principles underlying the design process are not well documented, articulated, or agreed upon. The pluralism of the field is a significant reality. While most design processes follow a similar pattern, they are subject to many variations in practice, based on personal idiosyncrasies as well as differences of circumstance and product type. Indeed, design processes sometimes are thought of more as corporate or organizational intelligence than public knowledge. As a result, a method of creating and developing a product often is regarded as privileged, proprietary information that cannot be shared with the public. This secrecy does not lend itself to in-depth examination by outsiders. Consequently, there is not a repository of cases from which to draw. Companies, themselves, sometimes attempt to conduct case studies of their work, but the results usually lack the objective rigor necessary for an effective case study and the report ends up serving primarily as a marketing piece.

In fact, the tendency in design to publish what amount to marketing pieces in design magazines—self-promotional articles

3 Ibid., 62–64.

on the work of a designer—has clouded the value of case studies as a tool of research and teaching. Without following the discipline or rigor of well-conceived case study methods, the numerous descriptive articles that merely report on a design course, or a new product or a new technique, pass for case studies but seldom are more than anecdotes when viewed from the perspective of research.

A second reason for the relative dearth of case studies in design involves the practice of design as an art. Well-designed products often are attributed to the genius of an individual or the innovation of a moment; and designers may be reluctant to believe that there are universal ideas to be extracted from these stories.

A third reason may involve the form of the case study itself. Among existing design case studies, most are written in the form of business case studies. While this is reasonable, given the position of design within business and industry, it may shift attention away from some of the core elements of design practice that are typically de-emphasized in a business case study of design. The influence of business considerations on design thinking is certainly important, but research in design requires a better understanding of other issues as well. The nature of a design case study deserves close attention if it is to serve the various needs of research and education.

As a research method, the case study is a recognized tool of the social scientist in gathering qualitative information. There are several types of case studies described and documented in the literature of the social sciences and elsewhere. For example, there are types such as exploratory, critical instance, program effects, and narrative case studies. In a sense, case studies are exploratory and descriptive by nature, identifying a phenomenon and placing it in the literature for further pursuit by other methods of research. But the limitations of case studies also are well discussed, making it important to follow the formal rigor of case study structure such as described by Robert Yin in *Case Study Research: Design and Methods*.

The application of case study methodology in the social sciences has correlations with the emerging field of design research, but the connection runs deeper than that. Formal case study structure requires researchers to determine a problem, make initial hypotheses, conduct research in gathering information and making observations, revise hypotheses and theory, and tell a story. These all are acts that are strikingly similar to the work of a designer. The result is that the act of researching and writing a case study easily can be seen as an application of the design process.

The integration of case studies as a way of teaching and learning is a more complex undertaking. To understand how to make case studies useful to designers, we first must understand how designers design. Historically, designers and design education have focused on the making of an artifact, whether that artifact is a communication or an industrial product. Project-based education and studio-based education have been central features of design education from early

Figure 1
The Four Orders of Design

	Symbols	Things	Actions	Thoughts
Symbols	Graphic Design			
Things		Industrial Design		
Actions			Interaction Design	
Thoughts				Environmental Design

in the twentieth century, if not earlier. This means that the core principles of the discipline are taught through practice, and are presented as part of a solution for a specific problem. For this reason, the learning from one project may not survive in the transition to other projects and problems. While the principles embody an element of theory, they are not presented as theory, but as rules-of-thumb and the slowly acquired wisdom of teachers and masters.

As a result, design case studies have a more difficult, two-part job of establishing theory and, at the same time, creating or recreating a bridge back to the practical. At a minimum, case studies provide examples for designers and students, and these examples can be a powerful, effective way to connect ideas and action. But there is a further opportunity in design case studies, the opportunity to begin talking about theory as theory instead of merely a practical application of wisdom and rules-of-thumb.

Case studies and studio education can work effectively together when the teacher begins to follow the dialectical, conversational approach of Christopher Langdell at the Harvard Law School: helping students enter the conversation, rising to theory and moving into application, and then moving back again in reflection. This may be an ideal in design education, but few teachers have truly mastered the art of this form of teaching. Nevertheless, the example of other professions that have made the transition to effective, theory-informed conversation should be encouraging for a new generation of design educators and researchers. The hope is that making a stronger connection with theory will illuminate principles that designers can use in their practice.

The possibilities of theory should not be lost on designers. Theory can provide opportunities to grow in one's practice by exposing previously unseen connections and relationships, as well as providing context for understanding changes that already are happening. For example, we can look at the theory of fourth-order

design (Figure 1). Fourth-order design provides a way to make new connections between what we make and how we make it.[4] The traditional first- and second-orders of design have focused on communication through images and symbols, and the construction of things or artifacts. The transition in design practice, when viewed as a move into third- and fourth-order design, expands the designer's concern toward actions and thoughts. In making that move, design is opened up to the world of human experience and the systems, environments, and organizations within which human interactions take place. This does not reduce our respect for graphic products and industrial products, but places them in a new context for design thinking. The idea of fourth-order design becomes a theoretical instrument—a tool for helping designers discover new possibilities and opportunities within a problematic design situation. Case studies such as "Design for Organizational Change: Ziba Design and FedEx" begin to assemble empirical evidence that illustrates the theory of fourth-order design, and suggests ways in which the theory itself may be extended and studied further. This generally is the role of case studies: to develop theory and practice in close relationship for the benefit of everyone involved in the enterprise of design.

4 Richard Buchanan, "Design Research and the New Learning," *Design Issues* 17:4 (Autumn 2001): 10–12.

ZIBA Design and the FedEx Project

Maggie Breslin

This paper starts with the question of how great products get made. While the question may not be entirely answerable, the exploration provides a useful understanding of how the art of design unfolds in practice. The vital connection between theory and practice is not immediately evident to all in the design community and, as a result, it often has gone unexplored. This paper seeks to rectify the situation, at least in one example. Building upon the model of the case study, which has proved a useful tool in connecting theory and practice in fields as diverse as law, business, and medicine, this paper uses an original exploratory case study on ZIBA Design (a product design company) and a series of projects they did for FedEx as a starting point for thinking about how design works in practice when it moves from traditional areas of communication and industrial design into human interaction and organizational change, what Richard Buchanan calls the third- and fourth-orders of design.[1]

Anyone who has had to send a package and waited too late for a scheduled pickup by an express delivery service may have found himself or herself in a FedEx retail center. These centers, which FedEx calls "World Service Centers" (WSC), display the chaotic nature of their business right where everyone can see it. Enter close to cutoff time, and one finds lines of people, questioning looks, hurried scribbling, and stacks of boxes rising towards the ceiling.

FedEx was going through a process of updating these facilities in November 1998. The WSCs typically are updated every seven to eight years, and this was the first redesign since FedEx's big branding evolution in 1994, when they officially changed the name of the company from Federal Express to FedEx and redesigned the logo. As part of a company review, the brand identity group at FedEx was invited to look at the plans.

The redesign was spearheaded by the Facilities Division, which put most of the emphasis on logistical and technical updates designed to get customers' packages to where they were going faster and more efficiently. For a long time, the fact that FedEx could deliver a package overnight was all it needed to set it apart. But in the years since its founding in 1971, the company had seen an increase in competitors such as the U.S. Postal Service, UPS, and Airborne Express, as well as changes in the marketplace from new technologies including fax, e-mail, and the Internet. When the brand identity group reviewed the new plans, they were not focused on the myriad of new ways FedEx was improving the shipping business.

1 Richard Buchanan, "Design Research and the New Learning," *Design Issues* 17: 4 (Autumn 2001): 10–12.

They were most struck by what had been missing from FedEx WSCs for a long time: the customer.

The brand identity group had been working to integrate the human element into FedEx's products for some time, and they had turned to ZIBA Design, a Portland, Oregon product design company, for help. The problem was that the brand group often did not get involved until a product was near completion. This meant that ZIBA's efforts were limited to bringing a product into alignment with the FedEx brand principles, which were mainly focused on the logo and establishing some usability guidelines. However, this WSC project was different. It was still in the review stages so they had an opportunity to get involved earlier in the process. The brand identity group asked ZIBA to come to Memphis and review the design of the World Service Centers.

ZIBA went to FedEx Headquarters, and watched the presentation by the Facilities Division. Returning to Portland, they prepared a report highlighting what they believed were the missed opportunities in the redesign project. Their primary critique was that FedEx was missing this chance to leverage and enhance their brand within the retail area. The report itself presents ZIBA's case as succinctly as possible:

> A significant amount of time and energy has gone into FedEx's current World Service Center prototype. Particular attention has been paid to solving logistical and technical issues. However, when it comes to leveraging these solutions to build brand equity, the current proposal for the WSC falls short on both appearance and interaction criteria.

As a result of the report, FedEx asked ZIBA to assist in redesigning the FedEx WSCs. The three-phase project began in January 1999.

Over the last ten years, practitioners of product development have ridden a wave of changes into what looks like a completely different place. Academic settings and job listings herald the introduction of new sub-disciplines with names such as "interaction design," "information design," and "design strategy." Design research and the idea of connecting with users has become an acknowledged, if underused, value. Waning is our image of a skill-specific designer working in a solitary studio, emerging with unexplainable, but somehow knowable, greatness. Now the key to great products is widely thought to be collaboration among a diverse set of disciplines which can include visual designers, programmers, industrial designers, architects, engineers, anthropologists, researchers, and sometimes even users themselves.

The nature of design is changing. We sense the shift in the products, people, and companies that surround us. We see traces in our language and processes. We feel that design is different, and yet the forces of change remain largely hidden and out of reach. How exactly are we designing differently, and why? The guiding prin-

ciples behind change hold the key to harnessing it as a tool for the designer. Until we understand them, the change leads design rather than design leading the change.

The products that surround us are our best clue to the principles working behind the scenes. Products are grounded by the thoughts and actions—the human and organizational experience—involved in their creation; not just their use. Recent products tell a story of shifting needs within the industry; not a desire to evolve design. This distinction is important because it means the forces for change came, at least partly, from outside the realm of design practice.

In the midst of change, many companies find themselves compelled to chart a new course. ZIBA Design is one of these companies. And its work with FedEx has all the qualities of an epic tale from this era; with products ranging from communication pieces to in-depth environments, innovative research, and articulated strategy. Woven throughout their story are three recurring themes, each with a deep connection to this new idea of design: brand, research, and argument. Like an archeological dig, the story of design's changing nature can be read in reverse. Start with a product that embodies the change, and in its story find hints as to how and why it came to be.

Brand

Brand has been changing almost as quickly as design. It first became a part of the modern corporate lexicon as a way to talk about a company's logotype, which was seen as the primary vehicle for corporate communication. Over time, more products meant more competition. Companies had to say more in order to differentiate themselves. To help companies figure out what they should be saying, brand evolved from being a thing (a logo) to an idea. Today, "brand" means talking about a company's values, goals, history, and traits: in short, a company's entire narrative. In a world in which every contact with the customer or prospective customer is a chance for a conversation, brand has become what the company is trying to say. But this extension of brand comes with a price. As an idea, brand has lost its clarity of direction for a particular form. What says "stability" in print communication is not the same thing that says "stability" in a physical form. Brand has become an idea in search of a translator.

Part of the shift in design thinking over the last decade has been the idea that design can embody a strategy. Historically, design has been seen as a set of skills and universal design principles tied to a specific form. Designers blended a client's desires with their interpretation of these principles for representation in a particular medium. But seeing design as a strategy requires something more detailed than universal principles and a client's whim. The products created from a strategic initiative should show that they contribute to an overall vision. But where does this vision come from? Since

design primarily is practiced in the service of clients and companies, the strategic vision often has roots outside the design world. Design, with a history of turning needs into products, has become a translator in search of an idea.

Bringing brand and design together is one of the fundamental shifts in thinking that guides design's recent changes. ZIBA had convinced FedEx that the WSCs were falling short in the areas of appearance and interaction.

Reimagining the World Service Centers meant dealing with many different forms within one space. Signage, displays, furniture, and environment all would have to speak with the same voice. To establish a foundation for the appearance criteria that could be used across multiple platforms, ZIBA's first course of action was a Visual Brand Study. The challenge came in three parts: articulate FedEx's brand strategy, transfer that strategy into the visual and verbal dimension, and establish design principles to guide a design language that would be applicable across an entire system.

First, ZIBA needed to know how FedEx defined its own brand. Starting with the brand work FedEx already had done, ZIBA held numerous brainstorming sessions internally and with FedEx to narrow the brand down to two continuums that would establish a frame of reference. One continuum was traditional versus modern. The other was dynamic versus stable. ZIBA used these to create a perceptual map, a graph allowing for brands or products to be plotted in relationship to each other using the same characteristics. ZIBA mapped FedEx's desires, and self-defined current and historical brand positions, onto this perceptual map. In essence, Ziba had FedEx define in very simple terms where it presently saw itself on these continuums, and where it saw itself going (Figure 1).

Once ZIBA knew where FedEx wanted to be, they started translating. It wasn't enough to know what FedEx thought about their brand. ZIBA needed to know what customers thought of the brand, and how customers would associate certain visual and verbal cues. Using these axis terms as the foundation, ZIBA developed a verbal exercise comprised of words describing personality characteristics and a visual component that dealt with assembled images. The act of translation is always a tricky one. Not only must it take into account what it being added and what it being taken away, it also has to consider how the very act of translation changes what is being said. In the verbal exercise, ZIBA sought out personality characteristics from sources such as Meyers-Briggs, VALS (a marketing tool that links personality traits and consumer behaviors), and FedEx's own brand attributes.

In planning for the visual exercise that would help ZIBA assign visual characteristics to each of the four quadrants on the perceptual map, they had to deal with the issue of content. While the content of the images was not the focus of the test, content that came with its own set of associations could distort the analysis of

the results. From an initial list that included categories as diverse as dogs, teapots, and automobiles, the group narrowed it down to three categories: architecture, materials, and products. The resulting images were cropped and abstracted to represent certain formal design principles without drawing associative bias.

Customers of FedEx and competing priority mail services then were asked to perform these verbal and visual sorting exercises. In the verbal exercise, customers associated personality characteristics with FedEx and its primary competitors: UPS, the U.S. Postal Service, and Airborne Express. The terms could be applied to any, all, or none of the companies. The personality characteristics were based on the perceptual map terms: traditional, modern, dynamic, and stable. For the visual exercise, customers were asked to sort the images under the four axis categories: dynamic, stable, traditional, and modern. Each image was presented as a pair, and the customer was asked to place each image on top of the axis descriptors. For example, an image pair could be placed on dynamic and modern. In total, one-hundred and eight customers were interviewed in three U.S. cities: New York, Los Angeles, and Chicago.

Once ZIBA had analyzed this data, they were able to do two things. First, they used the verbal component to develop brand personalities for FedEx and its competitors. These personalities then were charted on the perceptual map showing how customers' vision of FedEx related to the company's vision, as well as how FedEx looked compared to its competitors (Figure 2). The results were interesting in a number of ways. Customers saw FedEx with a much less focused brand personality than FedEx would have liked,

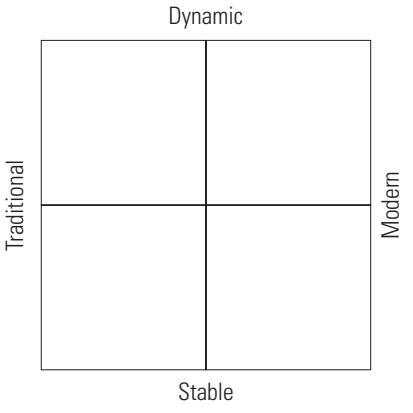


Figure 1
Perceptual map.

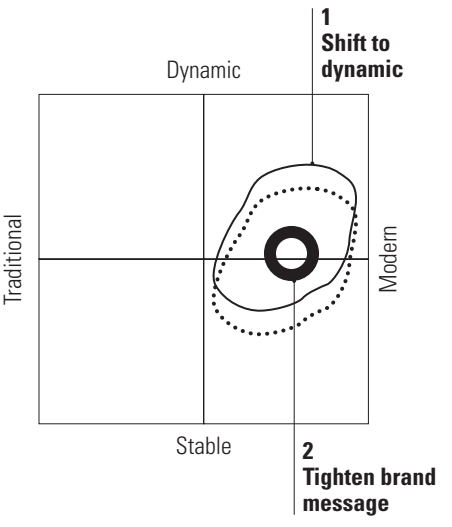


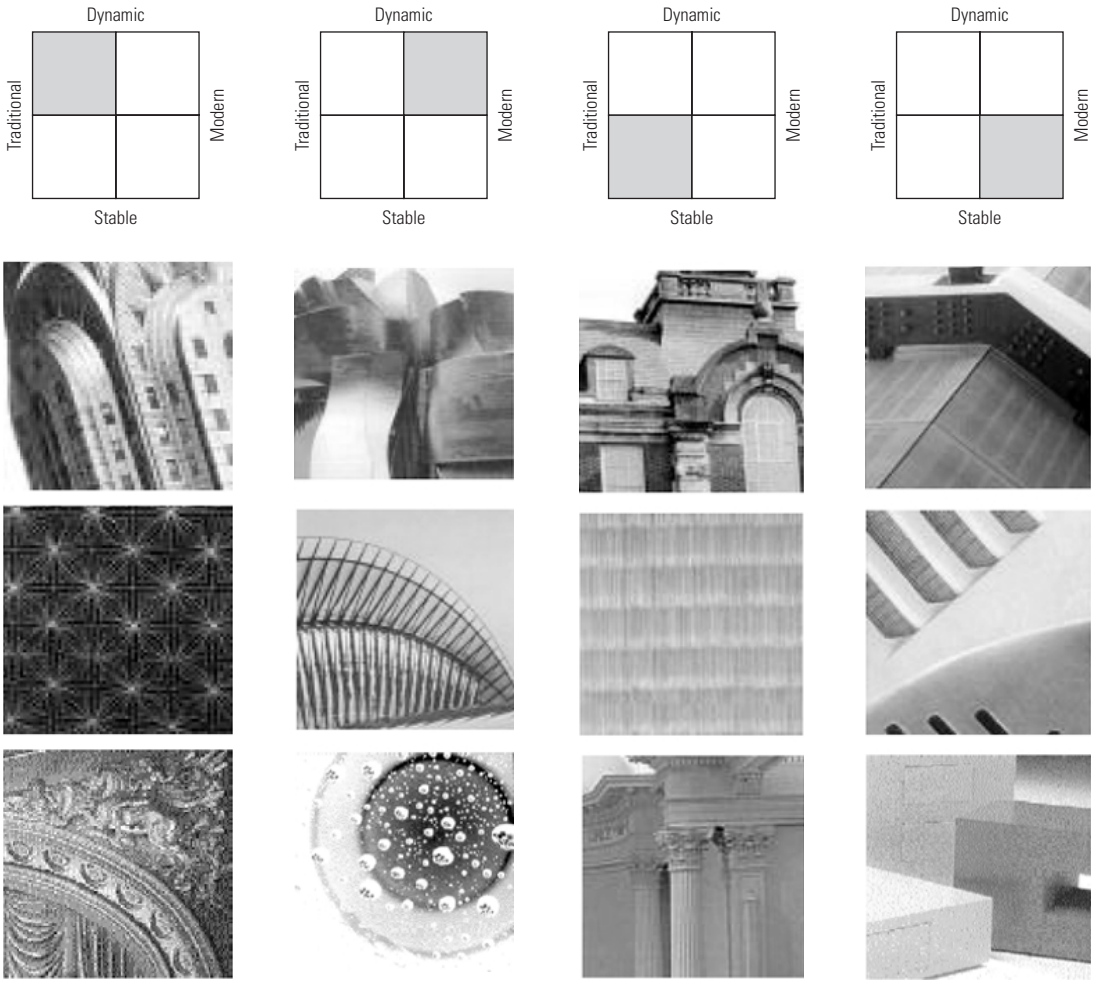
Figure 2
Findings charted on perceptual map.

and while they did apply some dynamic characteristics to FedEx, on the whole, they saw FedEx more entrenched in the stable characteristics. ZIBA's recommendation for changes to the brand message included shifting towards dynamic and an overall tightening of the brand message around the concept of modern.

The shift towards dynamic showcased one of the more interesting challenges for ZIBA in visualizing the brand: the desire to strike a balance between dynamic and stable. It was clear from the data that customers needed that balance. Companies perceived as too stable didn't have the necessary drive in a fast-changing business, and companies perceived as too dynamic made customers nervous about whether they could be trusted. So, visually and verbally, the FedEx brand would need to walk a line between opposites.

The visual component of the research allowed ZIBA to develop a visual and descriptive identity for each of the four quadrants on the perceptual map: traditional/stable, modern/stable, modern/dynamic, and traditional/dynamic. The development of these quadrant identities was a crucial step because it set the

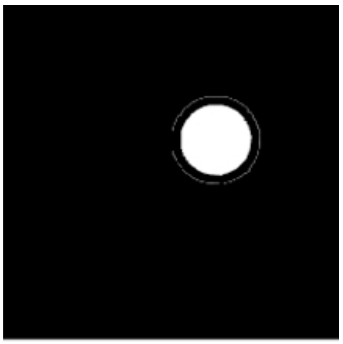
Figure 3
Visual identities for the four quadrants.



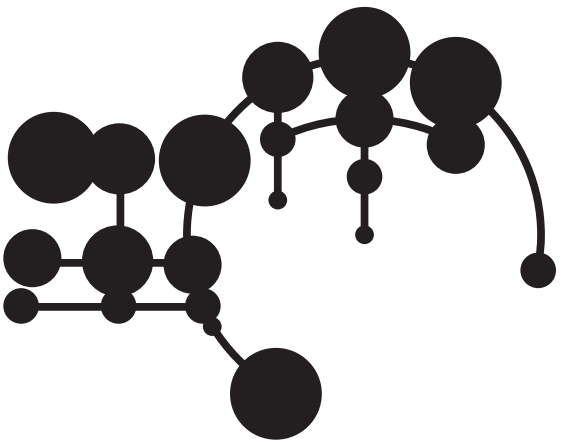
stage for the way ZIBA and FedEx would talk about the appearance choices for the rest of the project. In an interesting move, ZIBA did not shy away from terms and language more common to the design world, such as "controlled chaos" and "organic." They took this opportunity to bring FedEx along with them in translating the customers' voices into design principles, and it proved to be a vital step in maintaining a high-level discussion. The visual identities show how ZIBA used the images, design terminology, and personality characteristics to define each of the quadrants (Figure 3). Interestingly, during the visual component of the research, none of the participants put images on the dynamic/traditional quadrant. Lacking direct data, ZIBA created their own definition for that intersection of ideas so that the entire picture of the perceptual map would be available to FedEx.

Merging the visual and verbal research findings, ZIBA created the basis for Quantum, the design language they were developing for FedEx. The first step was to extrapolate some larger principles from the intersection of where FedEx wanted to be on the map, and what that place looked like. Numerous brainstorming sessions led them to settle on three principles: drama, plurality, and structured chaos. ZIBA visualized each principle with a created image that they felt embodied the idea, and they defined each principle in terms that included scale, tension, movement, perspective, structure, relationship, float, lightness, and experience (Figure 4). Again, at this phase, ZIBA did not shy away from more complex terminology and ideas. This not only helped to elevate the client's understanding of the brand personality, but also introduced terms and ideas that would be crucial to differentiating FedEx from its competitors. These principles became the basis for understanding FedEx's brand in visual terms, and would be embodied in the visual elements in the FedEx World Service Centers.

Drama



Plurality



Structured Chaos

Figure 4
Visual presentation of design principles, (drama, plurality, structured chaos)

About halfway through the Visual Branding phase, FedEx came to ZIBA with another project. A different division had been working on designing a "PowerPad," which would be the next generation of signature-capture devices for FedEx couriers. The project largely was completed by the time it was shown to the brand manager of FedEx, and she turned to ZIBA for help in bringing the device into alignment with the brand and exploring the best way to capture digital signatures. ZIBA did what they could, exploring a number of options for digital signature and making recommendations to the product group, but the final changes to the PowerPad were minimal. In other respects, however, the interjection of the PowerPad project was incredibly fortuitous. It provided ZIBA with a vivid example of how appearance and interaction could be the foundations for product development instead of elements added as an afterthought. From this realization, the Courier Tools project was born.

ZIBA knew that the data gathered from the visual brand study were not specific to the WSCs. They were applicable to many aspects of the FedEx product line. ZIBA proposed that they use these principles to develop an additional design language for FedEx that then could be used as a foundation for the development of courier tools. Couriers and the tools they used were an important touchstone for the customer, but largely had been neglected in FedEx's brand strategy. FedEx was wary that another design document with color call outs and descriptive text would be useful to people within the company. For the project to be effective, it needed to show how the brand could take form in a product, and how interaction could inform the design. FedEx decided that ZIBA would design a set of courier tools to the final prototype stage. From that point on, the Courier Tools project would run concurrently with the WSC project, both building on the foundation of the visual brand study.

Research

As the idea of what can be designed expanded to include systems of products working together, people and their actions have played an increasing role. Understanding what people do, how they do it, and why they do it often is grouped together under the heading of research. Research can take many forms, including everything from surveys to observation, and often borrows from other disciplines. When research is conducted in the name of design, it usually is attempting to bring human motivation and need into the product development process.

While the value of research had been making inroads for a number of years, the reality of conducting research has met some resistance from clients' budgets and time frames. In the FedEx project, ZIBA advanced the cause by making research an integral, nonnegotiable part of the work. When ZIBA told FedEx that the WSCs were falling short in the interaction realm, it meant that one of the

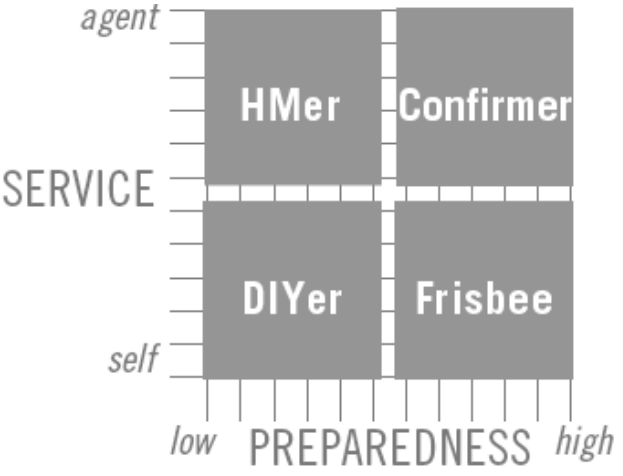
Figure 5
World Service Centers, before redesign.

primary criteria for judging the retail spaces should be what people were trying to do there. In establishing interaction as a foundational element in product development, ZIBA created an expectation that only research could fill.

In phase two of the WSC project, ZIBA began an interaction study. To define the interaction criteria for FedEx's WSCs, ZIBA employed a number of different approaches: video ethnography, behavior observation, environment mapping, "live the life" studies, and interviews with customers, agents, and couriers. The video ethnography component involved placing video cameras at four sites in New York, Chicago, and LA to capture daily activities at the WSC. Behavior observation took place in multiple cities over a three-week period, and included not only FedEx centers but also competitive spaces such as UPS Centers, USPS post offices, and the Postal Annex. In these observational instances, attention was paid to watching circulation and flow patterns, as well as user interactions with people and the space. With environmental mapping, the FedEx WSCs were diagrammed and photographed to capture wear patterns, wayfinding, spatial layout, graphics, and signage. In order to "live the life," ZIBA employees played the part of customers with different needs at FedEx centers and competitor sites. The interviews were done primarily as "nab" interviews in which ZIBA attempted to document the "life of the package" and the process involved in getting it shipped (Figure 5).

In attempting to analyze all this data, ZIBA eventually came up with six interaction criteria. Four of the criteria were definitions of the customer segmentations: "High Maintenancers," "Do-It-Yourselfers," "Confirmers," and "Frisbees." Each occupied a quadrant on the segmentation map created from the x axis of service (span self to agent) and a y axis of preparedness (span low to high) (Figure 6). A description of each customer type told the story of what they are looking for when they go to a FedEx WSC. The High Maintenancers arrived at the WSC completely unprepared.

Figure 6
Customer segmentation map.



They didn't have anything packed or an airbill filled out. They required and requested a considerable amount of service. The Do-It-Yourselfers also arrived at the WSC with their packages unprepared, but they understood what needed to be done and planned to prepare the package for shipment on their own with minimal assistance. The Confirmers had their package all ready to go, but they needed confirmation from the agent that the service they had selected and the way they filled out their airbill would result in the delivery they needed. The Frisbees don't need any assistance at all. They arrive with their package all ready to go, and just plan to drop it off. The two additional interaction criteria were time-of-day, which dealt with the ebbs and flows of traffic into the space, and package size, with the goal of minimizing the multiple moves of large packages.

This initial customer segmentation was useful in a couple of ways. For one thing, it provided ZIBA and FedEx with a story and some personality for their different customer types. Giving them actions and goals allowed them to be referenced easily as ZIBA continued with the design process. Secondly, it provided the gateway to understand the activities that took place in a FedEx WSC. The activities analysis showed where the customer segments crossed over each other, and where they had their own specific needs. The six main activities defined by ZIBA were: Find, Enter/Orient, Wait, Pack 'n Prep, Trade-off, and Hand-off.

Concurrent with the WSC research, ZIBA was conducting interaction research for the Courier Tools project. FedEx initially asked ZIBA to explore the possibility of six tools: PDA, holster, printer, transmitter, cart, and bag. To get an understanding of how the tools would be used, ZIBA researchers spent time with couriers on their routes. The research spanned three cities and multiple types of routes, including those located in one building (Sears Tower in Chicago), and those that cover entire neighborhoods. The goal was to understand how couriers use their tools throughout the day, and then distill that information for the designers into criteria that defined what, when, where, why, and how each tool would be used. The analysis resulted in courier behaviors being grouped into four distinct categories, each with a goal and a set of activities: organize, transport, interact, and process. In addition, research found that couriers moved between these behaviors very quickly, sometimes performing two or more at the same time.

The distilled interaction data was used to develop multiple concepts for each tool. These concepts were developed in sketch form and each included multiple views, indicators of how the tool would be used, a description of the tool's purpose, an indicator of the behavioral focus for this tool, and the key design requirements. The behavioral focus indicator allowed FedEx to understand how a PDA focused on organizing would be different from a PDA focused on interacting. It also constantly reinforced the idea that ZIBA was

developing a set of tools: separate products with their own interaction requirements that ultimately would have to work together to cover a courier's full breadth of needs.

Argument

Argument is an underused and undervalued tool, often disregarded or forgotten in the design world. It is the argument, however, that sets up expectations and allows even client service designers to maintain control over a project. The argument framework must be open enough to allow for creativity, and structured enough to keep discussion and evaluation on track. If used effectively, argument also becomes a way of educating clients and the community of use about what should be valued in the design.

ZIBA established a powerful and simple framework for design from the first moment of discussion: appearance and interaction. As a tool, it was useful internally as a way of focusing and critiquing their work, and externally as a way of communicating to FedEx the power of an overall design language. In fact, the strategy was so successful that FedEx hired ZIBA, even before the WSC project was done, to do another project using the same framework: the Courier Tools. Having established the framework, ZIBA's challenge came in combining the appearance and interaction criteria into products that visually and functionally shared an underlying system.

Having identified the form and interaction requirements of the basic set of tools, ZIBA's goal was to integrate this information with Quantum in the development of the courier tool design principles. At this point, Quantum was still just a set of principles (drama, plurality, and structured chaos) and an understanding of FedEx's brand. The next phase was to integrate the interaction data and start producing actual physical models. The first initial set of ideas began as sketches. As they narrowed in on certain ideas, they moved to making physical models. The making of physical models early on in the process proved to be important for testing the interaction specifications, but also for evaluating the appearance principles. They realized as they were designing that, since the principles moved beyond color and shape, the ZIBA team needed their models to move beyond color and shape as well.

In this early phase, the ideas were allowed to run fairly free, and the designers took their guidance from the Quantum principles. In fact, the fairly esoteric terms, drama, structured chaos, and plurality became an incredibly useful way of checking the design direction. It gave them all a common language and reference point. Initially, the team created four different design languages, and took these out into the field to get feedback from couriers and customers. The results of that research informed the design of the final set of tools, which would exemplify Quantum. As the design became more focused, the need to justify every design decision became more evident.

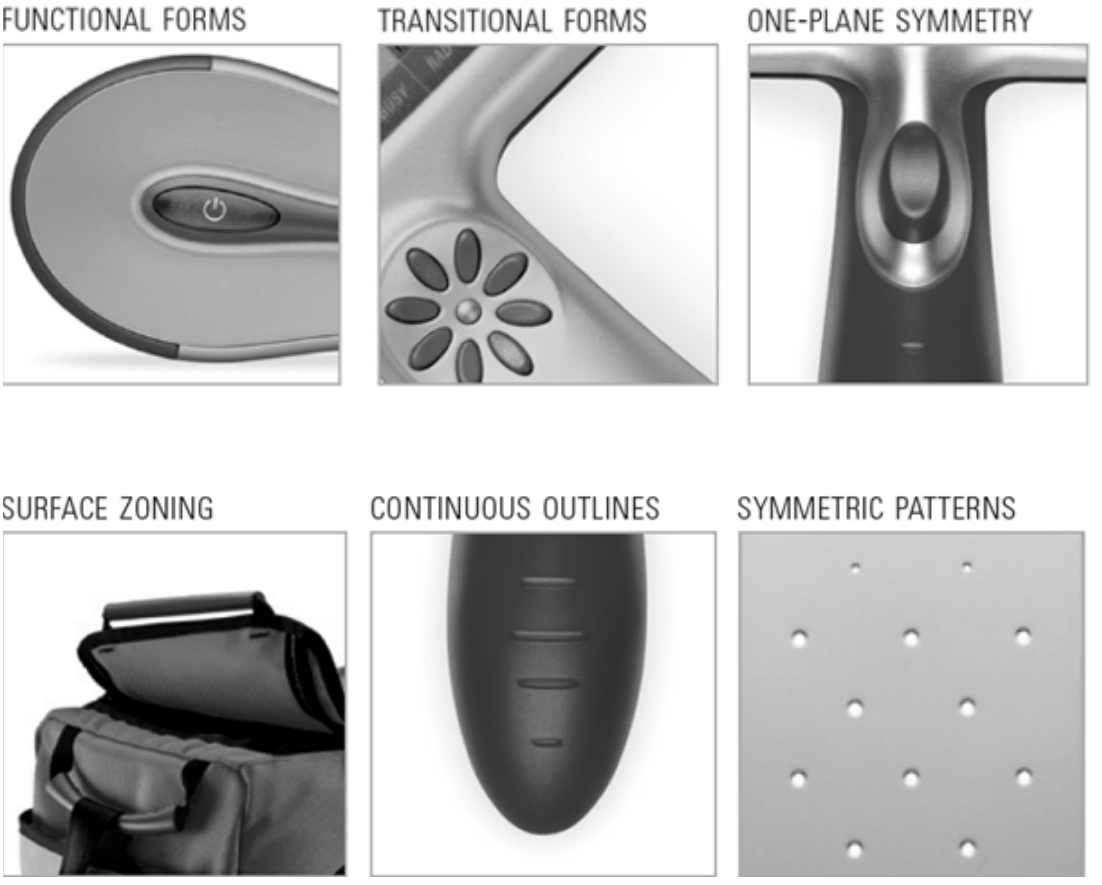


Figure 7
Courier Tools Design Language.

According to Bob Sweet, the project manager, "…choices really had to be questioned towards the end. We found ourselves asking questions like why is this logo small and on the front and this logo is three times bigger and on the back? There ultimately had to be a visual/appearance reason or an interaction reason for every decision in the product."

When it was finalized, the Quantum design language as interpreted for courier tools was comprised of six principles: functional forms, transitional forms, one-plane symmetry, surface zoning, continuous outlines, and symmetric patterns (Figure 7).

In a different corner of the ZIBA offices, interaction and brand data were merging in another way. To accommodate the many variations between centers, the design for the WSC focused on a kit of parts approach. This plan envisioned neutralizing the space, and then rolling in the furnishings. There would be certain elements that every WSC would have, and others that would be added depending on the space. It also allowed for the new design to be leveraged in partner sites.

The kit of parts itself was designed to accommodate certain general and specific customer needs. For example, a FedEx orange clock that extended perpendicularly from the building was designed to provide easier identification and orienting from outside. The digital menu board above the agent counter allowed for up-to-the-minute messaging and customization from store to store, which provided much-needed information for High Maintenancers and Confirmers. A drop slot right inside the door allowed Frisbees to get in and get out as quickly as possible. A glass front allowed all customers to orient themselves before they even entered the space. Drop slots in the wall behind the agent counter allowed Confirmers and all customers to feel confident that their package was on its way, and provided a protected area for agents to deal with the onslaught of processing that happens near cutoff times. The packaging area provided all of the materials and space necessary to prepare a package for shipment, a must for the Do-It-Yourselfers. The prototype World Service Center, built in a warehouse in Memphis, became a living example of the intersection of appearance and interaction.

At the end of the Courier Tools project, ZIBA delivered the prototypes of the tools, as well as reports detailing the courier tools guidelines to FedEx. These reports included detailed descriptions and diagrams of the work process and the methodology. Sensing that perhaps FedEx didn't fully understand the power of the design language they had just created, ZIBA decided to provide one, final example. Led by Sohrab Vossoughi, the team set out to redesign the "SuperTracker," FedEx's current scanning tool (Figure 9).

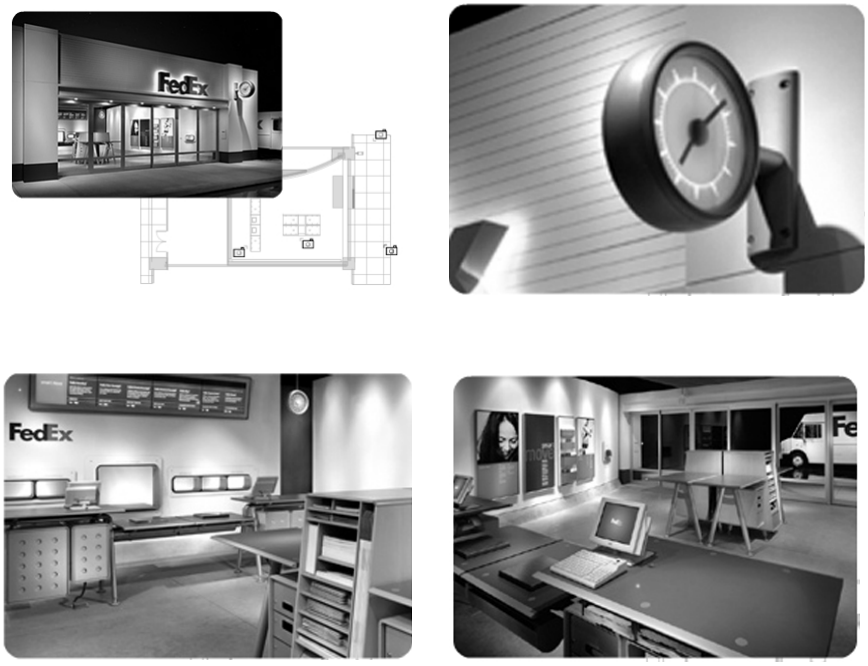
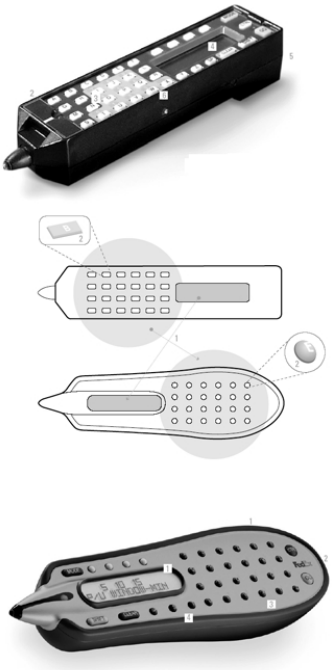


Figure 8
Prototype WSC.

Figure 9
FedEx Supertracker.



In just three weeks, with no changes to the functionality, the ZIBA team redesigned the SuperTracker according to the newly devised design principles and interaction criteria. They improved the ergonomics, improved the usability; and brought the appearance of the tool into alignment with the FedEx brand and courier tool language. The resulting product is a powerful example not only of the impact design can have on an individual product, but also of the impact that strategic design can have on a company.

Conclusion

When designers even subtly change the framing of the problem they set out to solve, they change the nature of their practice.

ZIBA looked to brand as the foundation for an entire platform of products, and found themselves forging innovative methods in order to translate the brand concept into visual criteria they could use. ZIBA critiqued the interaction component of the WSC project, and research became a necessary and vital component of the redesign. They argued that interaction and appearance were valuable missing elements from the FedEx product development process, and the shift in perspective made the customer present in the retail environment and the courier an extension of the brand.

In each instance, the change to ZIBA's practice was influenced by a new way of thinking that then was translated into a new way of working. This distinction between the vision and the method is an important one. Adopting new methods does not mean much if the idea guiding the process is the same as before. In fact, a well-articulated vision can be more enduring than the resulting product. Trace the line from FedEx's old retail centers to their decision to purchase Kinko's in 2003. It runs right through an awakening to the customer's values.

The point in investigating the ZIBA/FedEx story is not to catalog exactly how design has shifted, and then formulate a new static definition of design. The great learning in this story is simply that design can shift. And designers and design organizations can be the force behind that change. In setting out to solve new problems, or to solve the same problems in a new way, designers will find they need different tools, different media, different people, and different ways of talking, but these things shouldn't be mistaken for the change. They are merely the signs that change is happening; that something is going on beneath the surface.[2]

2 Ibid., 60–61.

Design in the Australian Taxation Office

John Body

Use of Design in the ATO

Paying tax is the same as purchasing any other product or service. We pay out money to receive goods and services as a community—just like any other payment that we voluntarily make. So why do people feel differently about paying tax? The difference is that the link between the money we pay out and the goods and services we receive is less direct than most transactions we undertake. And the price varies depending on what we can afford to pay. The goods and services that we receive include defense, policing, health care, education, roads, infrastructure, social, economic, and environmental programs, and income redistribution to those whose need is greater than others. The services are delivered at the federal, state, and local government levels but, in Australia, a large proportion of the taxes are collected at the federal level by the Australian Taxation Office (ATO). The ATO employs about 20,000 staff, collects more than ninety-five percent of the federal government's revenue; and serves ten million individual taxpayers and three million businesses.

The federal government depends on the taxation system to provide the revenue to fund economic and social systems. It wants the tax system to ensure that people pay their fair share. Most Australians agree that people should pay their fair share of taxes. An A. C. Neilson survey conducted in 2003 found that, in response to the statement "I think it is important that everybody pays their fair share of tax," ninety-seven percent of respondents agreed.[1] The government uses the tax system to impose additional costs or to provide benefits where it believes this is fair. This makes the tax system more complex to administer, but achieves the government's desire for fairness.

In recent years, the ATO has adopted a design approach to the development of the tax administration system.

1 A. C. Neilson, *Community Perceptions Survey* (unpublished, Canberra, June 2003).

ATO Journey towards Design

There are several reasons why the ATO became interested in design:

1. Using design to better reflect the government's policy intent

A major review of business tax arrangements was conducted in the late '90s. While specific pieces of law were addressed, the initial chapters of the published review suggested an improvement to the overall way in which the policy, law, and administration of Australia's business tax system was designed.[2] These recommendations were given impetus when the senior public servant involved in the review, Dr. Alan Preston, took on a senior leadership position at the ATO. Dr. Preston's particular focus during his time at the ATO was to implement the findings of the review of business taxes, especially the findings relating to improving the design process. Dr. Preston established a special department, Integrated Tax Design, to develop the approaches to implementing the recommendations.

2. Using design to turn strategy in action

During the late '90s, the ATO was looking at ways to improve the way it identified and dealt with strategic issues. Dr. Richard Hames and Marvin Oka are consultants who assisted the ATO in improving its strategic understanding. They assisted the ATO to understand its environment and how various issues might emerge in the future, and to make informed decisions on appropriate courses of action. But despite this enhanced strategic capability, the ATO still struggled with converting strategy to action. Design was recognized as the potential bridge between strategy and action.

3. Using design to make paying tax easier, cheaper, and more personalized

In July 2000, Australia introduced a new tax system that included a goods and services tax, and significant changes to the withholding of income tax payments during the year. Although the changes were successfully implemented, there was some concern in the community that taxpayers were experiencing difficulties with the new system. A major initiative, putting the client experience as the focal point for design, was adopted to improve the new tax system. This program has been underway for two years now, and several initiatives have been implemented as a result of listening to the community and designing an appropriate response.

A key idea used by the ATO to guide decision making is known as the "Compliance Model."[3] In short, it says that, in order to optimize overall compliance, individual taxpayers should be treated differently depending on their past behavior and their motivation. For example, a taxpayer with a history of paying on time should receive assistance to encourage compliance, such as a reminder if

2 Review of Business Taxation, *A Tax System Redesigned* (AGPS, Canberra, July 1999).

3 Australian Taxation Office, *The Cash Economy under the New Tax System* (Department of Communications, Information Technology, and the Arts, Canberra, 2003).

they are late in paying. Conversely, a taxpayer with a record of late filing and late payments should be the subject of escalating enforcement strategies, and receive the full force of the law if they continue to fail to comply. This principle of differentiation underpins much of the ATO's design thinking.

Defining Design

The word "design" has very broad meanings. Anyone who makes something is designing, whether or not that is an intentional process. In the ATO, the new design approach is about applying the discipline of design emerging from graphic and industrial design schools to the design of interactions with tax products and services; and to the design of the whole tax system. Professor Richard Buchanan describes design as: "The human power to conceive (invent) and plan (develop), and bring into reality all the products that serve human beings in their purpose in life."[4]

Professor Buchanan also talks about four orders of design.[5] The four orders may be summarized as:

1 Graphic design looks at visual symbols, and is aimed at communication in words and systems. The purpose is to get people to think by making a persuasive argument.

2 Industrial design produces tangible artifacts, usually mass produced, to provide a physical experience.

3 Interaction design is concerned with how human beings select and use products in daily life. While the profile of interaction design has been lifted by the rise of digital products, the concepts of interaction go back further than this and apply to all types of products. Interaction design is about people and how they interrelate with the product or service. It allows for a customized experience.

4 The fourth order of design is concerned with systems and environments. The systems that designers are concerned with at this level involve humans, not about material things. There is a recognition that people cannot experience a whole system, but rather experience their personal pathway through the system.

When the ATO is talking about design, it is focusing on the third and fourth orders of design. This means that the ATO wants to ensure that the products and services that it produces will be effective in their interaction with taxpayers. Furthermore, the ATO wants to ensure that the whole experience of a taxpayer is coherent, rather than a mixture of unrelated products and services.

4 2nd Road Thinking Systems Conference, *Beyond Cost Cutting—How Design Brings Innovation to Business,* Presentation by Professor Richard Buchanan (unpublished, Sydney, September 9–10, 2003).

5 Richard Buchanan, "Design Research and the New Learning," *Design Issues* 17: 4 (Autumn 2001): 321.

Design Conferences

Once design had been adopted as a strategy for the ATO, we then had to build that capability. The first steps were a series of design conferences. These conferences served two purposes. First, they provided an opportunity for those affected by design to hear first-hand from experts in the field. Second, the conferences provided a focal point for those building the design capability to present material to the rest of the organization.

The ATO has held three design conferences. The first was in February 2000 under the direction of Professor Richard Buchanan from Carnegie Melon University in Pittsburgh, Pennsylvania. One of the key ideas emerging from this conference was that a person cannot experience the tax system, but only a pathway through the system. This provided us with a way to work with complexity, and changed the way the ATO thinks about design, from the outside in. For example, during a typical year, an individual taxpayers may need to keep tax related receipts, get advice from an ATO call center, speak to their accountant, receive tax forms and instructions from the ATO, receive a payment summary from their employer, receive statements from financial institutions and companies with which they hold investments, prepare documentation to give to their accountant, file their tax return via their accountant, receive a notice of assessment, and finally make a payment. The totality of this experience is their pathway through the system. Designing with all these stages in mind produces a very different result than designing the individual components.

The second conference took place in December 2000 with Jim Faris as mentor. At the time, he was principal of Alben Faris Design. A key theme emerging from this conference was the value of prototyping. For many in the IT industry, a prototype is built once the user requirements and design process have been completed. Jim was advocating the use of prototypes much earlier on to help identify the user requirements. He told the story of a fishing tackle box that was purchased early on in a design assignment as a very early prototype of a computer-assisted device. The prototype then went through multiple iterations, but always kept the design process very physical.

Our third conference was headed by Darrel Rhea, principal of Cheskin Research. His key message was about the importance of user research in the design process. Without strong user research throughout the design process, we cannot design effectively. Inadequate user research will be paid for downstream with products that miss the mark with the intended audience. The challenge is to understand the intended audience well enough to produce sensible segments for design. User research runs throughout the design process. It is different from design, but integral to the process.

These conferences provided a focus for all those involved in design, whether they had arrived at that point via the review of business taxes, the strategic management work, or the new tax system. They were the point at which the journeys converged, and the conferences gave some strong intellectual input into the design thinking.

Implementing Design in the ATO

When the ATO embarked on this approach, our advisors suggested that building a design capability in a large public institution may be a ten-year exercise. With three years of development now behind us, this estimate appears to be accurate. However, it presents some risks. In a rapidly changing environment, a ten-year commitment to a change initiative is very difficult. The design approach has taken several different shapes even in the three years it has been running. With changes to the accountabilities across different government agencies, the design function has narrowed its scope from the whole tax system to the tax administration system. With a current organizational decision to work with a third party to implement major software enhancements and corresponding business processes, the design capability must again reposition itself to remain relevant in that context.

Design has maintained its success so far because of the unarguable centrality of the user to the whole approach, and the opportunity to work with the degree of complexity that user-based design provides.

There have been two intellectual challenges to building the design capability in the ATO. One is obviously obtaining enough understanding of design and applying it in the context of the tax system. That is a challenge that has kept us working with our design mentors and consultants to break new ground. The second big intellectual challenge is actually building the capability. That requires a strong understanding of change implementation and the specific character of the ATO—what will or won't work in that context.

As we have developed our approaches, we have tended to oscillate between being very general about what we mean by design to very specific. At first, we had a very general vision about what design could mean for the tax system. Then we became more specific with Dr. Preston leading the development of a detailed blueprint for the Integrated Tax Design capability. Part of this blueprint included a design process in six stages (Intent, Blueprint, Product Design, Build, Validate, and Implement). It also included an explanation of how multiple projects would run concurrently, the concept of user pathways, and product families.

These approaches were applied to a limited number of projects, but eventually there was some rejection of what was seen as a prescriptive approach. Our response was to become more general

again by selecting the core principles that were not negotiable, then providing a menu of techniques that could assist with each principle. This gave people an understanding of the core ideas, and some tools and techniques to help, without reducing design into a "tick the box" process.

More recently, the organization has been seeking more specifics again—insisting that design be embedded in some of the organizational processes and approval points.

This oscillation between general and specific is not a bad thing. It reflects the journey of change, and the need for people to come to a general agreement that something is worthwhile before they are prepared to have things described in more detail or mandated.

Design Roles

As the ATO began to expand the use of design, we established a service delivery area that could assist teams throughout the ATO with their design work.

Establishing a design capability in an organization is not simply a matter of bringing in some designers. We wanted to build a sustainable capability, but to do this we had to establish several dimensions.

Supporting the whole initiative, we needed a continuously developing knowledge base of design. This included the techniques, methods, case studies, skills, and induction programs. It also included the technical tools to store and share information about design.

We also needed a strong "practice management" area. This function ensures that we can handle requests for design services and provide the people needed to meet these requests. It includes marketing the services, prioritizing requests, and furnishing the financial and human resource management support for the whole area.

The knowledge base and practice management area are essential support areas for the more visible part of the service delivery area, in which we are directly delivering design services to projects and building design capability in the organization.

As we began to recruit people, we had to consider the types of skills that we needed to support these changes. This was difficult because we were not drawing on established skill sets. We had to identify the roles, and then recruit accordingly. The recruitment was challenging because these were not job titles that would be recognized by the reader in a job advertisement. We were looking for people with a range of backgrounds. One of the key requirements was that applicants had well-developed creativity and innovation but, at the same time, a systematic approach to their work. We defined three roles. These were:

1 Design Facilitators—These people understand the whole design process. They assist in setting up the design team, and then lead it through the discovering, inventing, and evaluating phases as the design development progresses. They need to know what skills and techniques are required and when and where to apply them. They need strong leadership skills, especially the ability to facilitate a group. They have to be comfortable with ambiguity, but also be able to see patterns emerging from the ambiguity.
2 Information Designers—They have expertise in capturing the emerging design, and communicating it to the participants. This is a critical role, a labor intensive role but, without it, the design teams would not feel they were making any progress. Within any given design process, there might be a number of different products produced by the information designer. These could range from capturing the discussion as it occurred to highly synthesized designs or discussion papers.
3 User Researchers—The user researcher needs skills across a broad spectrum of user research. User research includes contextual research to identify the strategic context for design and the key user segments. It also includes techniques for generating ideas from users, as well as techniques for evaluating design ideas to determine which ones warrant further development and production. User research must occur in parallel with the design process, identifying and applying the best techniques to engage users, and then incorporating that knowledge into the design process.

The Design Principles

As stated earlier, the design principles were developed to describe the "non-negotiables" of design. They give designers freedom to innovate within the broad framework provided by the principles. These seven principles are set out below.

1 *The problem*—designing from the inside of the organization out to the user can mean simpler computer systems or staff processes, but the taxpayer is required to make sense of the complexity. The taxpayer might receive several unrelated pieces of communication from the ATO in quick succession which then necessitates a phone call.
We are committed to taking a user-centered approach, creating products and services that are easier, cheaper, and more personalized.

2 *The problem*—We all have very different concepts of what we are talking about until something physical is produced. We may disagree with what is produced, but at least we are all talking about the same thing. Failure to produce something visible early on can significantly slow down the design process.
We are committed to making the emerging design visible early through documentation and prototypes that focus dialogue, sustain energy, and facilitate co-design.

3 *The problem*—If all people involved in design work individually, then the finished product reflects a lack of integration between people involved in the policy, the law, the IT systems, the skilling, the marketing and education, and the work and job design.
We are committed to working collaboratively in interdisciplinary teams ensuring that changes to the tax system are fully integrated.

4 *The problem*—The intent can drift over time as each discipline becomes involved. The implemented administration may not do what the government originally intended. For example, the ATO primarily is an organization that collects revenue. When the government wants the ATO to administer a payment system, we may build in such strong compliance safeguards that the actual intended beneficiaries may find it difficult to qualify.
We are committed to building a shared understanding of intent, ensuring that, when change is implemented, the user experience reflects that intent.

5 *The problem*—With no process, a lot of activity can be generated which does not yield the intended result. Conversely, a highly structured process may create work that is inappropriate for the problem being solved.
We are committed to following a disciplined yet flexible process that stays true to our design principles and achieves a higher quality in less time.

6 *The problem*—Designing individual products may miss the overall experience. When the ATO was designing a new technology based product, it did comprehensive testing with taxpayers. But when the product was released its acceptance was disappointing. Subsequent research showed that, while the new product was good, the original paper-based product still was easier to use. We had not looked at the whole user experience.

We are committed to mapping the user pathway and other layers of design upfront to create a coherent blueprint for change.

7 *The problem*—We shouldn't be complacent and settle for incremental improvements all the time. We sometimes need to look for a major improvement that may completely eliminate some of the things that irritate taxpayers.
We are committed to looking for innovative solutions that align with corporate directions, and achieve a balance between tax system integrity and user experience.

Tools and Techniques

We have developed a broad range of tools and techniques to deliver on the principles described above:

- User research—conducting research early in the design process to better understand the underlying needs of the community, and how we should best segment them for design.
- User testing—observing users interacting with products and services to see firsthand how they experience aspects of the tax system.
- Walk-throughs—developing displays of how proposed legislation might work, and taking those displays to major cities with experts on the subject matter to explain and seek feedback from those who may be affected.
- Co-design workshops—running half-day or two-day workshops with ATO staff, affected taxpayers, and other specialists to examine specific issues and develop solutions.
- User pathway models—representing the results of user research in a way that shows the pathway of a taxpayer group through the tax system. This usually is an annual pathway. Examples of pathways include youth, wage, and salary earners, investors, retirees, and micro, small, medium, and large businesses.
- Prototyping—making something early on that can be shown to people to gauge a response before making a major investment.
- Design blueprint—a document that reflects the high-level design of a project including the intent of the proposed change, the users who will be affected, the new and existing products and services the users will need to interact with; and the processes, technology, and staff changes that will occur.
- Core design teams—a small group of people chosen for their specialist knowledge and their predisposition to innovate. People who can think of all the reasons why some-

thing won't work have a role in the design process, but not at the core design team stage. The core design team is an incubator for fragile ideas, many of which may seem to be radical or unworkable at first. About five people is a good number for a core design team, and the team may form and reform along the way as different specialists are needed. However, some common thread among the members is necessary.

- Shared understanding of intent process—We have developed a process that brings together the people who were involved in the development of the initial goal with the people who will be involved in the subsequent design.
- Intent document—This is the product of the intended process. The document on its own is insufficient to ensure that there is a shared understanding of intent but, if properly developed, is a useful artifact to remind people of that shared understanding.
- Integrated Tax Design Wheel and Stacker—The Wheel is the design process for a project. The Stacker describes the way in which multiple projects run concurrently.
- Integrated Tax Design Guide—The Guide articulates the process of design in the ATO. It is not prescriptive, but rather gives some guidance and examples, and puts forward some questions that each phase of the design process should be able to answer.
- Debriefs—We encourage teams to debrief after a design assignment.
- Quality Assurance Reviews—Quality Assurance Reviews ensure that there is confidence that the process and principles have been followed with the completion of each phase of a design assignment.
- Simulation Center—We built a simulation center in Brisbane that allows us to observe interactions between taxpayers and staff, and rapidly prototype changes.

Introducing Change

Much has been written about implementing successful change. We followed the thinking of John Kotter[6] as a checklist for areas to pay particular attention to. The change initiative to introduce design into the ATO has several hallmarks of success:

- There were several converging factors that made change imperative. There were known problems with the implementation of new government policy. We were grappling with how to act faster. The taxpayer community was voicing concerns about the usability of some of our products and services.

6 J. Kotter, *The Heart of Change* (Boston, MA: Harvard Business School Press, 2002).

- Several senior people were committed to the proposed change. A senior person from Treasury had joined the ATO to champion the change, and others in the organization and outside of the ATO took up the challenge.
- A vision for what the future could be like was created, together with more detailed thinking about how it could work. People saw that there was not only a vision, but a description of what needed to be done to achieve it.
- A lot of time and effort went into the communication phases, especially with the series of design conferences. Bringing in experts in various areas of design and using the conference approach built interest and energy, while exposing the staff to some of the best minds in the field.

  Financial resources were allocated, allowing staff and consultants to be employed to work with others in the organization to effect the change.
- Considerable skilling has taken place, including the transfer of skills from consultants.
- Physical design spaces have been set up.
- Attention was given to setting up the core design teams for different assignments.
- While we have made significant progress, we realize that this is a multiyear effort and we are not there yet.

Finally, we have thought very hard about the best way to set up design areas in the ATO. Should we adopt a centralized or decentralized model? We decided to go with a centralized area connected to decentralized areas. In setting these up, we have not used a top-down approach. Rather, we have adopted a franchise-type model, setting up areas in parts of the organization where there is an interest. We began in the superannuation (retirement income) part of the organization, and then moved to the area dealing with individual taxpayers. From there we have progressively spread into most major parts of the ATO. This approach has been a very successful because areas are set up only where the business area can see the benefit. The main stipulation that we give each area is to follow the design principles. Within that, they are free to follow or invent new methodology. Many of the new ideas are coming now from the distributed areas, which are then fed to the others by networks coordinated by the central area.

This approach has deliberately borrowed from the principles of chaos and complexity theory:

- We create simple rules, such as the design principles. We are not concerned with detailed procedures, but rather that people can self- organize around the objectives we are trying to reach.

- We look for emerging attractors in the organization. We nudge these attractors by providing support to areas that have a need and show an interest in adopting design approaches.
- We avoid using mandates until we are merely putting into written procedures the way things are done already.
- We articulate the patterns after they have emerged, rather than impose them.
- We value variety and new approaches, and actively seek the emergence of new ideas. We encourage the exchange of ideas wherever they emerge from. We avoid saying: "This is the way we do it here."
- We read the organizational context, and strive to make design relevant to the strategic shifts that inevitably occur.

What's Next?

With all that in place, there still is a lot to do to embed design within the organization.

We still need significantly more capability in user research. We have some skills at testing prototypes, but upstream research to identify design challenges and establish design segments requires much more development. Our user research capability tends to be separate from the design activity rather than integral with it. The importance of this research capability is stressed by our design mentor, Darryl Rhea: "The practices of design research and the unique skill sets of design researchers are invaluable in uncovering big innovation opportunities, and for leading the efforts of [the] advanced development team."[7]

We need an improved ability to connect our strategic work with our design work. We tend to treat these separately, but they are interrelated. Our strategic research should indicate the areas in which we should be focusing our research and development efforts.

We need to streamline the way we design in interdisciplinary teams. The concept of a design lead, with teams forming and reforming as required, is something we could do more. We currently run the risk of seeing design as an end in itself rather than as a means to a practical implementation.

We need to rely less on consultants and more on building tertiary level design skills in our own staff. A few years ago, the ATO recognized only skills in accounting and law. Subsequently, information technology skills have been recognized. More recently, the ATO is seeing that other specialized skills such as finance, human resource management, marketing, corporate management, and design are necessary to run a modern organization. The ATO still needs to build up these design skills.

7 D. Rhea in B. Laurel, *Design Research—Methods and Perspectives* (Cambridge, MA: The MIT Press, 2003).

We need to get better at reflecting on how the design capability is progressing, and make adjustments as required.

We need to recognize as an organization that we are charting some new territory in the application of the theory of design to the shaping of a national social and economic system. The Australian character is quite egalitarian, and this can translate into a reluctance to claim leadership.

We must not lose sight of the product focus and the interaction with taxpayers, even when there is a strong temptation to become internally focused to upgrade major IT systems.

Finally, we need to continue to read the tax system and the tax office context to ensure that design remains relevant to the ATO's needs. The leadership of any organization will not be interested in design as an end in itself. But the leadership of an organization is interested in ensuring that its products and services are useful, usable, and desirable. The leadership of an organization also wants to ensure that its products and services come together to provide a coherent experience for their clients or customers. For the ATO, this approach means an increase in community confidence, which is an essential ingredient in optimizing compliance.

High-Reliability Organizations: Changing the Culture of Care in Two Medical Units

Daved van Stralen, M.D.

"What the fire department does is solve problems the public cannot or will not solve themselves." [1] The melodrama of a crisis easily distracts one from observing the organizational structure of problem- solving in emergencies, and can interfere with teaching new members desired behaviors. All emergencies, regardless of severity, are resolved by problem-solving.

A critically ill patient, dying while the physicians work to make a diagnosis, must have urgent yet high-risk treatments performed to sustain life. Action must occur before the medical team can collect sufficient information, and before that information can reach the attending physician for orders. Decisions then made by a central authority (the physician) must be transmitted to the operations team (nurses and respiratory care practitioners) before further deterioration of the patient can cause sufficient change to, effectively, create a new patient. In these situations, the culture of medicine turns to experience and reason, particularly evidence-based medicine, to safely perform these functions. Within this culture, the physician has the role of decision maker and central authority in a vertical hierarchy.

The intensive care unit (ICU) follows this medical model, which works well with deterministic problems, when the situation determines the intervention and the intervention determines the outcome. For example, the identification of a specific bacterium in sputum determines the diagnosis of a specific pneumonia which, in turn, determines the choice of antibiotic. The choice of antibiotic then determines effectiveness of the cure.

Problems can develop when uncertainty (a poorly identified situation) has a time-dependent quality (demands intervention) with of a degree of risk (safety). Problems also develop when multiple interventions become available, each with unknown probabilities of success or failure. Experience and reason may not identify effective decisions in these situations, and the vertical hierarchy may not allow the responsiveness and flexibility necessary to manage evolving problems. The combination of uncertainty, risk, and time-dependence (the indeterminate problem) vexes deterministic systems with rigid, vertical hierarchies.

1 William J. Corr, Captain II, Los Angeles City Fire Department, Retired. Personal communication.

The risk of medical complications to patients has dramatically increased as both patients and medical care become more complex. The medical community now wrestles with solutions to the problem of patient safety and medical error.[2] Only recently has this search turned to organizations outside of medicine.

Organizations such as military combat units, coast guard units, fire suppression, emergency medical services, and law enforcement historically have functioned in environments in which the indeterminate problem is routine. After years of trial-and-error learning, these organizations have developed a structure for relatively error-free operations. The knowledge and techniques developed by these organizations can improve medical care culture. This is the story of two such organizations—the development of a pediatric intensive care unit, and the transformation of a nursing home into a chronic intensive care unit.

The Pediatric Intensive Care Unit (PICU)

In the late 1970s and early 1980s, pediatricians began to treat critically ill or injured children in newly developed PICUs. These programs did not develop from clinical research, as had adult critical care, but by early pediatric intensive care practitioners incorporating the experience and research of adult intensive care into their pediatric practice.

In 1989, a university medical center recruited two pediatric intensive care physicians to design and develop a PICU with the medical center's existing nursing and respiratory care staff. Medically unstable children, or those with the potential to become unstable, would be admitted to the PICU from within the hospital or from referring hospitals in a geographic area three times the size of Vermont. Though the PICU had the capacity to care for twenty-five children, the initial census was seven to ten children. Nursing and respiratory staff at the medical center consisted of Registered Nurses (RNs) and Respiratory Care Practitioners (RCPs).

The two pediatric intensive care physicians drew upon their past experience in nonmedical fields. One had a military career as a naval aviator during the Viet Nam War: the other had a previous career as a paramedic with a major urban fire department. The former referred to his Navy experience, where he saw the results of a command structure that did not appear to support the pilots who entered hazardous environments. He believed that people would function more effectively in high-stress environments if they received good support from higher in the hierarchy, and wanted his PICU to show support for the bedside caregiver. The former paramedic drew upon lessons in emergency work learned from veterans of combat, field emergencies, and major fires. He had observed the effects of not having a tradition in medicine of decision-making or leadership that functioned in emergency, high-hazard situations.

2 *To Err Is Human: Building a Safer Health System,* L. T. Kohn, J. M. Corrigan, and M. S. Donaldson, eds. (Washington, DC: The National Academies Press, 2000).

The medical model of gathering information, developing an assessment or diagnosis, and initiating a treatment plan did not provide sufficient means to treat medically dynamic disease states using novice critical care staff members. The pediatric intensive care physicians drew upon their previous nonmedical careers to develop methods for caregivers to use in these uncertain, high-risk medical situations. The challenge came from the lack of exposure of the experienced medical caregivers to uncertainty decision- making.

The PICU grew fairly rapidly within four years. From an initial average daily census of seven, the average number of patients admitted quickly reached twenty, and annual admissions soon reached 1,800. This number of beds and annual admissions placed the PICU in the top six percent in size in the United States.[3] Pollack and his collegues found mortality rates of 7.8 percent for PICUs with more than eighteen beds, while those with less than six beds had a mortality rate of 4.1 percent. This PICU had a mortality rate of 5.2 percent in 1996. To identify areas for improvement, especially important in the absence of published data for comparison or the means to manage the indeterminate problem of uncertainty, risk, and time-dependence; the PICU used itself as a benchmark.

Goals for the PICU

The unit grew in size faster than the experience of PICU members, and before the staff could appreciate the importance of action in live-or-die situations. Therefore, any information the intensive care physicians introduced had to be sufficiently compelling so that the staff would put it to use immediately. To set the initial goals of training staff to manage live-or-die situations, and to teach decision-making in uncertainty, they again drew upon their past experience.

The new program came from what one physician identified as wrong from his U.S. Navy experience, and what the other identified as good from his firefighting EMS experience. Combining the negative and positive aspects of their experience led to the goals of engendering trust through support of the bedside caregiver; addressing unrecognized fear; and improving decision-making skills for uncertainty. The knowledge and techniques taught had to have immediate utility, because of the disparity of this approach from what medical caregivers had learned from past lectures or experience. It must "explain yesterday" or "be used tomorrow."

Knowledge that would benefit the patient did not provide nearly as great a motivation to a caregiver to learn and apply than knowledge that would benefit the caregiver. For example, a physician might order frequent monitoring of a patient's vital signs. Sometimes the caregiver, based on tradition or experience, took this as unnecessary or an interference with other tasks that the caregiver believed should take precedence. When this happened, the "frequent evaluations" often would be "fudged," delayed, or not even performed: all with the excuse that time constraints did not allow completion of the

3 M. M. Pollack, T. C. Cuerdon, and P. R. Getson, "Pediatric Intensive Care Units: Results of a National Survey," *Critical Care Medicine* 21:4 (1993): 607–614.

assignment. Through compelling theory and examples, the caregiver would learn to appreciate the fact that monitoring for early signs of deterioration might prevent deaths when they heard true stories of occurrences in which a lapse of attention or observation by a good caregiver had led to a poor outcome that *had a negative effect on that caregiver.*

The stories that produced the greatest interest focused on why the caregiver believed it was necessary to act in that manner; that assumed there are no dumb decisions or poor judgment, and that mistakes were unintended. The approach then became important to the caregiver, and developed into a means of providing skilled, high-quality care. If the intensive care physicians had imposed this learning, the caregivers would have become alienated from the developing PICU culture rather than developing a passion for and feeling of inclusiveness for the new culture.

Support of the bedside caregiver in controversies had two benefits. First, people who feel supported will engage hazardous situations with a greater ability to observe and act. Second, they are more likely to remain with the job. Over time, these caregivers will gain greater experience, and provide enhanced monitoring, decision-making, and leadership to the care team. Experienced caregivers will identify warning signs indicating early deterioration that would have been missed by others. Identification of early symptoms of deterioration allowed interventions to begin when the treatments have greater efficacy and safety. This gave caregivers internal, personal pride in their role in saving a child's life.

A high-trust system modeled after the fire department service began to grow. When any team member called for help, he or she would receive it without question. Nobody criticized anyone for "crying wolf": all were taught by the intensive care physicians through precept. Any time the team believed a child had deteriorated, caregivers would respond without criticism. In time, they began to focus on this high-trust approach in a more structured fashion, with lectures and explanations of the high-trust culture.

At times, staff would make decisions the intensive care physicians would not have made. This created the predicament of having to accept some less-than-satisfactory solutions. By not correcting the individual and showing how his or her answer to the problem could work, the caregivers would listen, trust, and identify errors and mistakes they had made. This directly led to more effective approaches in care generated by the bedside caregiver.

As nurses felt more supported, they became more open in presenting unclear patient situations to residents and attending physicians. This led to increased trust within themselves, which increased their acceptance of the unpredictable and of novel approaches to problem-solving. The team began to identify patients earlier in the course of a disease, and resident physicians became more integrated into the team.

Trust began to develop between staff, but trust in one's self during an emergency did not develop without the involvement of the intensive care physicians to support these new behaviors and extinguish the old ones. For example, staff would work as fast as possible, as if speed where a tool to address threats and danger rather than focus on the smooth delivery of care. During one of the early, instructional situations, the team was resuscitating a child in respiratory failure from epiglottitis, a dangerous swelling from infection in the upper airway. The team's conventional treatment response was to hurriedly give medications and place a breathing tube into the trachea. This would occur as rapidly as possible, often with the caregivers' bodies moving faster than their minds could work. The intensive care physicians stopped the process in mid–action several times to allow the team to manually breathe for the child. Once the staff had calmed down, they realized they could keep the child alive with minimal tools. The feeling of emergency quickly passed, and smooth operations commenced. Speed, they had learned, came from smooth operations—not from hurried, panic-induced activity.

Stress reduction focused on matching demands to resources.[4] A person has internal attributes native to his or her abilities, skills, and knowledge, as well as external resources from the system including their education, training, and the support of those around them. In education and training, a "hands-off" approach worked well in which the caregiver would stand back and let the pediatric resident manage the situation or perform the procedure. Perturbations within a smooth-running setting would cause an alert for any indicated intervention. On-scene support and nonthreatening critique during resuscitations became the expected routine. This produced a pediatric resident confident in his or her ability to solve problems and conduct resuscitations.

Initial risk awareness education of bedside caregivers as a group took several years. Risk education included expected complications from diseases and treatments, as well as how to identify the unexpected. Excessive emphasis on risk awareness, though, produced hyper-vigilance in the team,[5] which resulted in situations where the team tried multiple interventions and actually began to treat their treatments. Stopping the excessive treatment allowed the team to stop other medical treatments.

During times of low patient load or the absence of high-risk patients, the team began to lose their risk awareness, which increased errors. The phrase: "Sometimes you have to fall apart to fall together" was used to call attention to the increased possibility of risks. This also offered an opportunity to educate staff about all of the risks encountered during critical care. The vigilance of the caregivers toward both individuals and the system ensured the program did not deteriorate and place a patient at risk.

4 R. W. Novaco, "Anger and Coping with Stress: Cognitive and Behavioral Interventions" in *Cognitive Behavior Therapy: Research and Application,* J. P. Foreyt and D. Rathjen, eds. (New York: Plenum Press, 1978).

5 I. L. Janis and L. Mann, *Decision Making, A Psychological Analysis of Conflict, Choice and Commitment* (New York: The Free Press, 1977).

Unrecognized fear responses were the greatest behavior issue addressed in the program. Fear has a hidden but active influence on behavior in high-hazard environments. Unrecognized fear reactions caused major problems in team formation and in interactions with physicians who did not participate in this model, and transient physicians and nurses who pass through the PICU for the occasional patient.

Fear manifests itself in a physiologic manner. Though described physiologically as the "fight or flight" response, it appears behaviorally as anger, plausible avoidance, and confused mental states. Adrenaline mediates the fight and flight response, while cortisol mediates the freeze response commonly found in infants and prey species.[6]

As a social interaction, fight presents as anger and argument generally focused on an individual rather than a situation or problem. Flight, to avoid engagement with the situation, shows as plausible avoidance such as checking another patient in stable condition or delaying critical decisions by asking for information, when the problem demands a decision such as in live-or-die situations.

If an attending physician yells or shows any other anger behavior, it reflects the physician's fear and not the performance of the team. Team members who believed the anger resulted from a member's poor performance would act to demonstrate improving or adequate performance. Since the anger comes from the inability to safely and effectively reach an objective, the team member would never assuage the physician's anger, but actually perpetuate it. However, if the team member could identify objectives that the physician or the team could reach, then the small successes and subsequent information flow that occurred could reduce the situational tension.

Freeze mediated by cortisol leads to the inability to think.[7] When the pediatric residents felt this brain immobility, they found that returning to an objective they had previously reached would lead them back to clear thinking. Independently, several of them found that evaluation of the airway tube used for breathing would clear their minds, and their brain would return to functionality.

Understanding that these fear responses were neurochemical reactions triggered by external events helped many of the PICU staff to direct efforts to resolve the fear response, rather than allow perpetuation and the subsequent downward spiral in individual and team performance.

The teaching of *decision-making in uncertainty* occurred early in the development of the PICU. Traditional decision-making in medicine consists of data collection for an informed diagnosis that allows a treatment specific to the disease. This reduces the risk of injury that comes from the treatment in comparison to the benefits of the treatment. However, to engage in life-threatening uncertainty, one must begin intervention before all of the information is available.

6 N. H. Kalin, "The Neurobiology of Fear," *Scientific American* (May 1993).

7 Ibid.

Looking to paramedic care as practiced in the 1970s helped introduce a new way of thinking in emergencies: "Doctors evaluate and paramedics decide." This led to discussions of how environment can limit decision-making, and the need for an internal check of a decision's actions. John Boyd's OODA Loop Decision-making (Observe, Orient, Decide, Act; then observe response to Action)[8] became instrumental in the development of rapid decision-making that would give novice emergency caregivers the ability to outmaneuver dynamic disease processes. Important to this rapid decision-making was the use of patterns which the caregivers previously had used as the basis for management of the critically ill or injured child. This system gave the team the ability to make decisions before they had complete knowledge of the circumstances of a situation.

Faced with such an uncertain situation, it frequently was easier to identify an objective first to give direction of one's actions. These objectives may have long time horizons, such as discharge from the PICU with normal physiologic function, or short time horizons, such as acquire and maintain the airway during resuscitation. If the objective could not be reached smoothly or in a reasonable time, the individual would decompose an objective to a series of objectives that could be reached in stepwise fashion. For example, one could decompose airway acquisition to neck extension followed by jaw thrust and suction for oral secretions.

Decision-making by identifying objectives rather than the situation; decomposing the objectives as necessary, and the use of OODA loops could allow decisions and authority to migrate to the bedside. If the patient should suffer rapid physiologic decompensation, the team could just as rapidly develop a response and intervention. In effect, they would out-maneuver the disease. In these situations, doing nothing is harmful (compare with the oft-quoted phrase in medicine: "First, do no harm"); but this interactive, real-time model allowed the team to learn what works through action.

The method developed to provide care placed greater importance on a common interpretation of early signs of deterioration and shared objectives. Bedside staff would change every twelve hours, and a particular caregiver may not have the same patient on consecutive days. Resident physicians would change service every month. The intensive care physicians would change service every week. Institutional knowledge, manifested through individuals, gave a consistent approach that could identify problems and intervene before the disease process became irreversible.

Resident physicians were not responsible for knowing answers, only for learning them. As the attending physicians, the intensive care physicians had the responsibility for knowing what to do and how to manage the critically ill patient. All would accept the actions of the team members: no one would second-guess decisions or discount the observations of others. Calling for help was not a sign of weakness, but represented active and aggressive communica-

8 R. Coram, *Boyd: The Fighter Pilot Who Changed the Art of War* (New York: Little Brown and Company, 2002); G. T. Hammond, *The Mind of War: John Boyd and American Security* (Washington, DC: Smithsonian Books, 2001).

tion during rapidly-evolving situations. Members of the team began participating in patient discussions as the team acknowledged the value of everyone's knowledge and experience.

To teach decision-making during uncertainty, an individual would be guided to develop two, alternative interventions. Depending on the level of sophistication of the individual, this could occur early in the presentation or as the last choice in a chain of decisions. At some point, the individual had to choose the treatment that would be followed. If a team member wanted to try a therapy, he or she had to present benefits, risks, possible outcomes, and a time limit for evaluating the therapy for effectiveness.[9] The individual needed to explain not only signs of success, but signs of failure; and how to recognize them if the therapy did not work.

At times, several body systems such as lungs, heart, and kidneys interacted with several disease processes such as infections and inflammatory responses. The resulting dynamics would lead to confusion because multiple variables were out of the normal range. To bring such complexity to a manageable state, the intensive care physicians would list all of the problems involved. Upon completion, the list could be grouped into three-to-four independent problems showing that, as a general rule, the patient would have only a few problems, each of which was manifested with multiple variables. Instead of a list of fifteen variables to manage, the staff had three or four independent problems. When listed on a board, the team clearly saw that the first three items were relatively inconsequential, simply items they routinely encountered or treated. This demonstrated the Availability Construct of decision-making: that the first things one thinks of are not necessarily the most important, but only the most available to the mind.[10]

The use of a new model in a traditional and established field required that the team closely watch for errors, mistakes, and variance. Focus on failure over success had a significant role in safely resolving high-risk, live-or-die situations. The staff, as is natural, would remember their successes, while emergency workers tend to remember their failures. During emergency management of a patient, the team had to continually evaluate decisions or actions were wrong. *Confirmation* bias describes the phenomenon that the first thing one thinks of is the most important.[11] One of the intensive care physicians urged the team to search for information that disproves one's hypothesis or action, in effect, to develop a *nullification* bias.

While this model emerged from personal experience with naval aviation combat conditions, and from fire and paramedic services in the 1970s, academic structure initially came from the field of social ecology. After seven years of PICU development the intensive care physicians adopted the codification of High Reliability Organization theory in the PICU.[12] This theory expanded their work by providing an over-arching theory for explaining how high-risk

9 I. L. Janis and L. Mann, *Decision Making, A Psychological Analysis of Conflict, Choice and Commitment.*

10 A. Tversky and D. Kahneman, "Availability: A Heuristic for Judging Frequency and Probability" in *Judgment under Uncertainty,* D. Kahneman, P. Slovic, and A. Tversky, eds. (Cambridge: Cambridge University Press, 1982), 163–178.

11 R. S. Nickerson, "Confirmation Bias: A Ubiquitous Phenomenon in Many Guises," *Review of General Psychology* (1998): 175–220.

12 K. H. Roberts, "Some Characteristics of One Type of High Reliability Organization," *Organization Science* 1 (1990): 160–176.

systems could become highly reliable in delivering care. With the ability to articulate these principles, the resident physicians could extend this model of care into their private practices.

The Loss of High Reliability

During the first eight years, five intensive care physicians joined the PICU. These new physicians retained the traditional model of a physician, with central authority and the belief that trust was a sign of naivety. They did not allow decisions to migrate because that gave the appearance of a physician who lacked knowledge. Initiative on the part of the bedside caregiver began to disappear. As staff members made fewer decisions, they also made fewer observations of the patient's condition—particularly early signs of trouble. In time, RNs lost this model, and new resident physicians never learned it. RCPs retained it as part of their culture, mostly by teaching it away from the presence of these new intensive care physicians, and limiting its use in communication with the physicians.

The counter-intuitive nature of high reliability compared to the medical model that physicians learn in medical school makes it difficult for many physicians to adopt it as a model for care. The new intensive care physicians saw the initial PICU program as unsafe. Security began to come from appeal to authority such as the attending physician's judgment, a research article, a medical text, a laboratory value, or a protocol. Self-protection came less from intellectual strength and more from defensive or offensive explanations, maneuvers, and intimidation. Within one year, both founding intensive care physicians left the PICU. One became the medical director of a nearby nursing home.

Nursing Home Care

In 1996, a nearby pediatric nursing home changed its license from an intermediate care facility (providing care to disabled children who needed close supervision) to a sub-acute care facility (SCF) for children whose disability was great enough that they relied on at least two technologies to live. Generally, these technologies are a tracheostomy tube for breathing and a gastrostomy tube for feeding. Although requiring a higher level of care, staffing is similar to a nursing home: certified nursing attendants (CNAs) with minimal medical education and training, and licensed vocational nurses (LVNs). One RN served on a shift as the charge nurse, and covered the entire facility. Several RCPs provided respiratory care and ventilator management for the four children dependent on a home mechanical ventilator (HMV).

Ratios of staffing nurses and RCPs to patients also followed a nursing home pattern. Patient-to-nurse staff ratios operated about 4-6:1, compared to a PICU with a patient:RN ratio of 2:1. RCPs in a PICU care for the mechanical ventilators usually were at a patient:

RCP ratio of 4:1, while this SCF had a ventilator:RCP ratio of 6-8: 1, with additional non-ventilator-dependent patients adding to the patient load. A general practice pediatrician visited the facility daily, and saw each patient weekly.

Fairly early on, the SCF came into conflict with the state licensing administration regarding the safety of a freestanding SCF not attached to, or affiliated with, a hospital. To demonstrate to the state a commitment to improve the quality of care, the facility contracted with the nearby medical school for a medical director. The SCF needed a physician with a knowledge and experience of technology-dependent children including continuous mechanical ventilation. Complicating the recruitment of qualified staff was the newness of this type and level of care, the image in the medical community of nursing home care in general, and the ongoing review by the state. This environment also amplified small problems into major problems that endangered the solvency of the facility.

The former PICU intensive care physician came to the SCF with the goal of using the PICU culture and the principles of HRO as tools to change the nursing home into a SCF with home mechanical ventilator-dependent (HMV) patients. This would involve the successful application of the characteristics of HROs[13] and the elements of mindfulness,[14] which had been codified from high-tempo organizations such as naval aircraft carriers, into the low-tempo nursing home organization and environment.

The basis for this change also would involve the use of the firefighting service and paramedic culture, adapted for dynamic states such as the fire and rescue scene, in an environment in which change occurs slowly and expectedly. The indeterminate problem (uncertainty, time-dependence, and risk) would apply since the patients could not communicate (uncertainty), decision loops, although slower than at a fire scene, would still be slower than the patient's disease progression (time dependence), and patients could die from complications of their disability (risk). A strategy evolved that derived from an observation by Joe Martin (Battalion Chief, Los Angeles City Fire Department, retired), "What you do every day is what you will do in an emergency." Routine SCF operations would be designed to easily and smoothly expand into emergency operations.

Because nursing home staff generally provided low-risk medical care, the former PICU intensive care physician developed risk awareness and self-efficacy in the caregivers. Unrecognized fear came from corporate management because of the pressure from the state to improve performance, and from criticism from the medical community regarding care for the profoundly disabled. Decision-making followed the PICU model.

13 Ibid.

14 K. E. Weick and K. Sutcliffe, *Managing the Unexpected: Assuring High Performance in an Age of Uncertainty* (San Francisco: John Wiley and Sons, 2001).

Nursing Home to Chronic Intensive Care

Risk awareness became the first concept for bedside staff to learn because of the state's concerns regarding safety. During individual and group sessions, the SCF staff demonstrated a lack of belief that they provided high-risk care, worked in a dangerous environment, or that their clients could die. To remedy this, the new medical director invited everyone to go to the parking lot for a two- to three-hour picnic. This stunned them, and they began to explain why they could not participate—that a child could die from dislodgment or plugging of the tracheostomy airway, aspiration of secretions or stomach fluids into the lungs, or falling out of bed over the guard rails. This awareness that children in the SCF could die suddenly helped to introduce methods of decision-making that would allow bedside staff to immediately engage a problem.

Risk awareness alone does not lead to reliability: it must change behaviors to acknowledge that risk. Later on, bedside clinical discussions helped staff to link risk with clinical interventions. One can evaluate risk as a probability, the odds an event will occur, or a possibility, the ease with which an event will occur. The concept of possibility facilitated a discussion of ambiguous or vague risks containing great threats.

Education focused on early signs of deterioration, when findings tend to have greater ambiguity and when benign processes would share findings of serious problems. Strong responses to these signs allowed caregivers to engage the problem when interventions were within their scope of practice, most effective, and with the least side effects or complications. The objective of early intervention was to increase the chance of success and to decrease th chance of failure.

A climate of unrecognized fear among management and bedside staff had developed in the SCF from the business practices used to maintain financial solvency, and from interactions with the local medical community and state licensing agency. Fear behaviors included fault finding, excuses, poor communication practices, avoidance behaviors, focus on individuals over the system, and failure to confront situations. The new medical director used the same design goals in the SCF as had been used for the ICU, but proceeded in a different manner. The SCF staff chose this career for the low tempo, and the opportunity to develop relationships with their clients and families. (Nursing homes care for residents or clients because there are no acute illnesses to treat: hospitals provide medical care for acute illness and therefore have patients.)

The more difficult part came from working with administration. Fear motivated a lot of behavior because of punitive measures from the state imperiling the facility's survival, and the personal management style of the senior administrator. An early attempt to schedule a regular meeting for all administrative and management staff failed to stop accusations, fear, and blame. So the medical direc-

tor created new rules and included only clinical management, and a separate meeting with the senior administrator. The rules for the new Clinical Staff Meeting included: (1) No shame, name, or blame; (2) No assigning jobs, tasks, or projects to other people; (3) If a task is important, someone will volunteer; (4) If a task is not completed by the next meeting, that is OK, with no explanations necessary; and (5) After several weeks, we must evaluate uncompleted tasks as not needed, not important at that time, or needing more resources. This improved communication, understanding, and cooperation among all clinical staff. Clinical decisions now were made by a group of clinicians with no undue administrative influences.

Self-efficacy and resilience were critical for developing the SCF into an HRO. Self-efficacy is the belief that one can influence outcome.[15] Resilience is the use of resources on hand for problem-solving, and is similar to improvisation. The SCF caregivers have little respect in the medical community for their choice of employment, and work without immediate physician supervision and with fewer medical resources.

Caregivers learned self-efficacy by progressive mastery of decision- making through the use of bifurcations in the same process as used in the PICU. Wrong decisions were addressed by the physician providing more information until the correct response was given. This serves to identify how much information a staff member uses in decision-making, and what areas of knowledge need improving. The final decision in all cases is made between two choices. The staff member's choice is the one used.

When faced with uncertainty, structure and rigidity often provide comfort. In this new approach, comfort came from the team and self-efficacy—that one can and will solve the problem.

Decision-making techniques as used in the PICU, along with risk awareness and self-efficacy, allow decisions to migrate up and down the hierarchy toward the individual with the most expertise in each situation. In these situations, expertise does not equate to experience.

Because there was not a continuous physical presence of a physician at the facility, a senior RCP managed ventilator problems. In time, this became an indirect reward system for those RCPs with risk awareness and decision-making skills, and they played a greater part in management. Any RCP could reach this level by participating in the decision-making exercises described above in the PICU.

Creation of this new model for this type of care necessitated a focus on "ignorance in medicine." New methods of treating disease cannot be developed without an acknowledgement of ignorance about the best way to care for these children. False and presumed knowledge were dangerous and best prevented by freely saying: "I don't know." The team began identifying medical objectives that would guide them in developing ways to give these profoundly handicapped children a childhood.

15 A. Bandura, *Self Efficacy: The Exercise of Control* (New York: Freeman, 1997).

Work at the nursing home further refined the use of the principles found to be successful in the PICU. However, as bedside and management staff internalized these values, norms, and behaviors, the SCF began to admit children needing a higher level of service than that provided in comparable facilities. Most transferred patients came from the PICU rather than a hospital ward, as is usual for a SCF. When the condition of the children deteriorated, they often would remain at the SCF including more than forty children who developed acute respiratory failure with sufficient severity to receive mechanical ventilation of the type used in the PICU, and numerous children with severe acute asthma receiving PICU treatment modalities. This occurred without a change in patient:staff ratios, which remained at nursing home levels; and an increase in the level of service without an increase in staffing, cost, or errors. During this time, the state licensing division changed their belief about the facility, and began using it as an example of how to provide this level of care.

Results

During the first five years of the SCF's existence, the nursing home ventilator census increased from four HMVs of the type used by nonmedical family members to forty mechanical ventilators of the type found in the PICU. Also, several disease conditions that routinely would lead to transfer to the PICU, such as ventilator-associated pneumonia and acute asthma, remained at the SCF for treatment.

But also a theory developed about care as it became evident that children benefited in unforeseen ways. Children who had received mechanical ventilation for survival now played and laughed, and attended school. Children with a previous diagnosis of persistent vegetative state could now operate computers and learn to read. High reliability and safety helped relieve the burden of disease and technology to allow each child to have a childhood: in fact, technology now enhanced life. If the technology is applied well, a technology-dependent, chronically unstable child will smile.

Conclusion

Methods to support front-line caregivers, make decisions under uncertainty, and improve individual performance in high-risk environments can create HROs *de novo,* reduce risk to the patient, and decrease the cost of medical care. A basic approach starts with problem-solving: "HRO is just problem-solving." [16]

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Document

Brighton 05-06-07

In early June 2007 a small, international, group of designers and design educators gathered in the Sussex countryside near Brighton for three days of intense conversation on the challenges and opportunities that shape the practice and understanding of design today. In a collegial atmosphere and facilitated by the editors of *Design Issues*, the participants, all involved in various ways with the University of Brighton, exchanged insights and ideas that reflected a rich diversity of personal experiences, professional concerns and national agendas. Rather than hindering the conversation, this diversity served to sharpen an appreciation for common concerns and fostered the recognition that the great challenge facing the contemporary design community is the promotion of wellbeing through design.

The document that follows bears the title "Brighton 05-06-07." More than the playful recognition of a felicitous numerical sequence, the date 5 June 2007 locates this discussion of design and wellbeing in a particular historical moment. The implications of this moment begin to emerge when cast against the background of earlier efforts to refine a shared understanding of design and focus on design-related agendas.

In the modern era design has always served as a revealing gauge of economic, political and cultural conditions. 2007, for example, marks the centennial of the founding of the Deutscher Werkbund, one of the most significant early modern efforts to align design with industry in an effort to promote national competitiveness in global markets. The years surrounding the founding of the Werkbund also witnessed the emergence of various programs and manifestoes such as the Founding Manifesto of Futurism (1909), intended to promote the provocative cultural agenda of an avant-garde movement. A half century later, nations on both sides of the Iron Curtain were busy organizing their displays for the 1958 Brussels World Fair where design, treated as both a tool of propaganda and a revealing index of the differences between Capitalist and Communist systems, figured prominently in this Cold War confrontation. A quarter of a century ago Postmodernism dominated discussions of design by introducing another element, emotional expression, that overrode the older emphasis on form and function. At the same time, a new tool, the personal computer, began to make its presence felt. Alignment with industry, promotion of political ideologies, cultural critique and engagement, exploitation of new tools and materials: these themes constitute the legacy of a century of sustained design activity and discourse. This list certainly

is not exhaustive and this legacy does not preclude further discussions, fresh perspectives, and intriguing new conceptions regarding design's contribution to the contemporary world situation.

Despite noteworthy differences among the participants, and the range of cultural perspectives and traditions they brought, one thing all shared was the conviction that design truly can be a significant force in the promotion of a noble end. The collective statement on wellbeing through design that follows is considered as the basepoint for future engagements and actions that will help to achieve the goals set out.

Wellbeing through Design

In a fragile, complex, world designers must envision and realize the routes to wellbeing—wellbeing in which peoples' basic needs are assured and individual and collective aspirations are realized through a process of forethought called design. Design can transform particular conditions in order to create wellbeing—wellbeing that is contingent upon a healthy, harmonious and equitable world. Design is a potent tool through which to achieve this goal.

To create human wellbeing in the twenty-first century, designers must act in harmony with the natural world, sustaining balance, lifecycles and climates. They must challenge the technological world to create means that will enhance our capacity to achieve wellbeing. They must engage with the political world in order to influence opinions and mobilize actions that are both affirmative and effective. They must nourish the inner worlds of spirituality and belief with due respect for human identities and cultures.

In doing this designers must ethically and responsibly:

- shape the visible world of signs, spaces, structures and objects along with the invisible world of systems, economies, narratives and networks;
- reconfigure elements of the physical world in order to make new materials, ecologies, and technologies as well as the immaterial world to create new environments, scenarios, and experiences;
- enable the transportation of people through space and time, with efficiency and comfort, along with the means to navigate landscapes and environments;
- develop skins, fabrics and objects that help people to function and survive in life as well as to manifest their personal identities within the social cohesion of a culture;
- embody the principles of good citizenship through designing for well-being.

Designers must recognize that the things they make will directly impact peoples' lives and have the capacity to stimulate new futures. This power must be knowingly exercised, with dignity, good humor, and a wisdom that is accompanied by responsible stewardship throughout the endeavor.

Our goal is to foster the positive effects that such actions can have upon peoples' lives. Design educators, design researchers, the design professions, and policy-makers each have a key role to play in achieving this. It will take our sustained, collaborative, efforts. Through these actions, we believe that good design can offer a route to wellbeing.

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