

USER-CENTERED DESIGN AND DESIGN-CENTERED BUSINESS SCHOOLS

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ABSTRACT

User-centered design employs systems thinking to understand interrelationships driving change, and empathy to identify with users. Similarly, management could adopt a philosophy of user-centered management. Such a philosophy could transform business schools. I trace the emergence of user-centered design and discuss its implications for management and business education.

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Introduction

Within a long tradition of self-criticism, and recent commentaries paint management education as a technocracy governed by a rigid, self-serving rationality that is ill equipped to deal with change; business schools are seen as the incubators of this style of thinking. Ashkenazy (2007), in a special section of *Academy of management Learning & Education*, identified two unifying themes: *change*, and the need to *humanize* management education.

I argue that management educators can learn from the field of design. Facing similar challenges, the design profession developed User-Centered Design (UCD), which focuses on developing a rich understanding of human experience as the basis for the design of products, services and experiences.

As an example of critiques of management education in the literature, Bennis and O'Toole (2005) argue that business school professors are beholden to a scientific model of management that has little relevance to real-world management practice. Mintzberg (2004) asserts that business schools teach MBA's the science of management while ignoring its craft. Ghoshal (2005) and Pfeffer and Fong (2004) argue that management educators have failed to impart an appropriate set of ethical values to their students, instead promoting a set of "ideologically-inspired amoral

theories” (Ghoshal, p. 76) that allow students to divorce their actions from their impact on humans.

A design perspective can shed light on these issues. Designers have a characteristic approach to problem solving that has relevance for managers (e.g. Boland and Collopy, 2004), and, moreover, could transform business education (Dunne and Martin, 2006). More particularly, user-centered designers develop products, services and experiences that solve problems faced by users. To this end, user-centered designers develop a deep understanding of users, coupled with an attitude of empathy that appreciates the challenges they face. Beyond this, user-centered designers take trouble to understand the context within which products and services are used, and the changing business environment.

I begin by tracing the development of user-centered design and its implications for design practice. This is followed by a discussion of the relevance of this way of thinking for managers. I conclude with a discussion of the implications of this perspective for the curriculum and teaching methods in business schools.

The Emergence of User-Centered Design

The term User-Centered Design, or UCD, refers to the design of products, services and experiences to meet the needs and capabilities of those who will be using them. While it may appear self-evident that design should take into account users’ needs, there has been disagreement over the extent to which users should dictate the design

process. Donald Norman (1988), in his classic work, *The Design of Everyday Things*, argued that many designers had lost touch with users, with the result that common devices were often difficult, inconvenient and even dangerous to use. Norman advocated the introduction of UCD, which should make use of the natural properties of people and of the world, exploiting natural properties and constraints; as much as possible, design should operate without instructions or labels.

UCD resulted from a number of converging movements in the design field in the late 20th century. The field of human-computer interaction, or HCI, is concerned with the design of computer interfaces that are natural and easy to use (Gerlach and Kuo, 1991). HCI arose from a realization that interfaces that were difficult to use resulted in user frustration, lost productivity due to the time taken to learn the system and underutilization. This resulted in a shift in research emphasis from the technical aspects of computing to modeling human behavior in relation to computer systems (e.g. Card, Moran and Newell, 1983; Norman, 1986; Olson and Olson, 1990). A related field is computer supported cooperative work (CSCW), in which computer environments are designed to support collaborative work practices and researchers explore the role of computers in facilitating social interactions (Wellman, 2001). According to CSCW, technological systems must relate to existing orders of social practice and remain adaptable to the emergent needs of groups of users and user groups (Ackerman 2000).

Joint Application Design (JAD) was developed by Chuck Morris and Tony Crawford of IBM in 1977 as a process for involving users in system design (Asaro, 2000). JAD grew out of existing methods of design and engaged users, designers and external experts together in design; its focus was essentially pragmatic, on achieving the most efficient process of user-oriented system design. By contrast, Participatory Design (PD) originated in Norwegian and British movements to develop more democratic workplace technology. Its socialist underpinnings provoked reflection within the design research community on the political and ethical implications of workplace technology.

In spite of the differences between these approaches, their core idea was the same: the need to develop an intimate understanding of users as an essential component of the design process. This gave rise to the adoption of ethnographic research methods to develop close connections with users and understand their interaction with designed objects. Because users often had difficulty in articulating their needs in terms that designers could understand, these methods allowed designers to observe their interactions and draw insights from them. Norman (1986) showed that the principles of usability lie in users' mental models, their understandings of how things operate based on their experience, learning or the usage situation. To develop some insight into these mental models, designers needed to understand not only users' responses to proposed designs, but also the context of use and users' personal perspectives.

Users also became involved in design not only through ethnography and the more traditional focus groups, but through engagement in the design process itself. The methods for accomplishing this included collaborative workshops in which users and designers worked together to develop and test designs. This was the basis of both the JAD and PD approaches, with differing emphases: in JAD, the user was a necessary but often subordinate party to the design process, while under the “techno-populist” PD (Asaro 2000) users were seen as equal partners in the design process.

For design to be truly user-centered, however, it needed to go further than merely adapting products to users’ physical and cognitive needs and capabilities. Norman (2004) shows that users’ emotional state also influences how they respond to design, and that this response in turn affects the functioning of the design itself: objects that feel better actually work better. Hence designers need to develop a rich, deep understanding of the emotional context users bring to designed objects.

To go further still, designers need to pay attention to the user’s overall experience, which is not confined to his or her reaction to the physical attributes of the product. Experiences comprise not just the product itself, but services, interactions, processes, and environment. However, each user’s experience is essentially a subjective and only partly observable event: each user creates his or her own experience through the usage of the product, in its particular context of use and in conjunction with the user’s own physical, cognitive and emotional perspectives. Hence the traditional, instrumentalist view of users among businesses as “consumers”

of design is called into question: if each user is essentially a creator of his or her own experience, he or she is on an equal plane with the designer, as proponents of PD would advocate for more political reasons.

These ideas have echoes in the management literature. Leonard and Rayport (1997) show how users' unarticulated needs can be observed through a process of empathic design; and there is an extensive literature on the use of ethnographic methods in market research (e.g. Arnould and Wallendorf, 1994; Mariampolsky, 2006; Underhill, 2000). Prahalad and Ramaswamy (2003, 2004) take up the question of user engagement in the design process, arguing that consumers today are more connected, informed and active than ever before. They contend that, as a result, the traditional firm-centric view of value will give way to "co-creation" of value between firms and consumers in which firms develop capabilities to respond flexibly and quickly to customer needs. For Prahalad and Ramaswamy, the task of innovation is one of developing experiences in partnership with customers, rather than products targeted to customers.

It is one thing to say that designers are engaging users in the creation of value. UCD, however, also implies a different way of thinking that emphasizes interrelationships within systems and empathy with users. I explore this way of thinking and its implications for management in the next section.

How Managers Could Think Like User-Centered Designers

Problems in management are increasingly characterized by complexity and instability (Boland and Collopy 2004). In this environment, managers need to develop an ability to understand “wicked” problems: complex, dynamic problems involving multiple stakeholders that defy easy resolution (Churchman, 1967). Failure to appreciate the full complexity of such problems can lead to disastrous results (Hackett, 2007). Since Herbert Simon (1969), in *The Sciences of the Artificial*, called for new management curriculum based on design, several authors have argued that managers can learn a great deal from the approach taken by designers (e.g. Senge, 1994; Boland and Collopy, 2004; Dunne and Martin, 2006).

Because designers are traditionally engaged for their creativity, it is with this quality that they are most closely associated (e.g. Kelley and Littman, 2001). However, a great deal of research and reflection are required to develop ideas. Designers frequently need to reinterpret a brief to identify the underlying problem; to visualize abstract solutions; and to integrate information from multiple sources. Conley (2004) argues that design competencies, such as the ability to frame problems in a meaningful way and integrate the components of a solution, can be applied to managerial problems; as an example, Kumar and Whitney (2003) show how data from ethnographic research conducted in a wide variety of contexts can be integrated through the use of thought tools for analysis and synthesis. Boland and Collopy (2004) go beyond skills and argue that a design “attitude” views managerial problems as opportunities for invention and development of elegant solutions. Schön (1983)

represents design as a “reflective conversation with the situation”, in which the designer attempts a solution, reframes the problem and tries a new approach.

A representation of the design process, adapted from the processes used at the Institute of Design at the Illinois Institute of Technology in Chicago, is shown in Figure 1. This is by no means the only way of approaching design problems, but it offers a reasonable representation of the process applied by many user-centered designers. The emphasis is on developing a deep understanding of the problem before attempting to develop solutions.

A notable feature of this process is that problem definition is provisional and iterative: the design team begins with “Statement of Intent 1.0” and modifies this according to the findings of its research into users and their context, business and market issues, and design and technological constraints. Several Statements of Intent may be developed before a definition of the problem is agreed upon and design principles developed. Throughout the process of problem definition, the team experiments with tentative solutions and explores aspects of the design problem through research and prototyping.

With an agreed set of design principles, the design team proceeds to use creative techniques to develop solution concepts and business models, and to implementation of the design. This part of the process is also iterative as the team delves into its research on users and business issues to refine and tailor its solutions.

With UCD in particular, the critical element is the impact of the design on human beings. It follows that designers need to understand users' needs intimately and integrate this information with information from other sources. As noted earlier, ethnographic research provides a deep understanding of users' physical, cognitive and emotional perspectives. To interpret this information, user-centered designers approach it with an attitude of *empathy* and employ *systems thinking*.

Empathy is defined by Rogers (1959) as

To perceive the internal frame of reference of another with accuracy and with the emotional components and meanings which pertain thereto as if one were the person, but without ever losing the 'as if' condition. Thus, it means to sense the hurt or the pleasure of another as he senses it and to perceive the causes thereof as he perceives them, but without ever losing the recognition that it is as if I were hurt or pleased and so forth.

When Leonard and Rayport (1997) refer to "empathic design", therefore, they are not merely discussing how customers can be treated as instrumental objects of study, but of engaging in an intimate process of feeling and sensing with other human beings. Observational methods in ethnography include "participant" observation, in which the researcher interacts with the subject: in the traditional anthropological/sociological approach which is the root of ethnographic methods in design, the researcher

becomes an “insider” by engaging directly with subjects and assuming a role in the family or community over an extended period of time (Mariampolsky 2006). The effect of such exposure is to develop a close identification with subjects.

“User-centered management” can have a broader interpretation than UCD, where management is concerned not only with creating value for customers, but also developing tools or methods for the administration of the business. Hence the “user” of a balance sheet may be financial analysts, or the “users” of an organization design may be employees. Managers need to be just as engaged with these users as user-centered designers are with users of their designs: as human beings who bring a personal context to their engagement with the initiative.

Designers need to develop *systems thinking* - an ability to think broadly about the design problem - for two reasons. True empathy with users is only possible if one understands the user’s context of use: not merely the usage situation, but the user’s personal perspective based cultural, linguistic and emotional factors (Mariampolski, 2006). The second reason is that effective design is not limited to products alone, but provides value to users from the integration of resources (Carr, 1999). Thus effective design requires the designer to understand both the user’s context and that of the business.

In understanding the context, user-centered designers consider the entire system of use: for example, the design of an office chair needs to take into account other

elements in the office, such as the desk, the table; the user's own physical needs; and the type of work that will be conducted. At a broader level, the designer needs to consider the user's relationships with other users and his or her level of physical activity. Because the design of a chair affects, and is affected by, its context, the designer needs to think about the relationships between the elements of a system.

Russell Ackoff (1999) argued that humanity was leaving the "Machine Age", which had been characterized by analytical, reductionist and deterministic thinking: the idea that there exist clear, independent cause-effect relationships between phenomena that can be identified by breaking down the relationship into small pieces and testing their effects. In the "Systems Age", by contrast, problems are more complex: interdependent variables together combine to form a system, defined as a set of interrelated elements that loses some of its essential properties when it is taken apart.

Systems thinking has two components: analysis and synthesis (Allio, 2003). Analysis takes a system apart to reveal how it works, but because the system loses its essential nature when taken apart, analysis alone is not capable of understanding the system as a whole. Synthesis reveals why the system works as it does. Systems thinking integrates analysis and synthesis to understand the system.

In systems thinking, the problem solver attempts to understand the nature of the system and frame the problem accordingly. Since designers (and managers) are

boundedly rational (Simon, 1969), the problem frame chosen will restrict the set of solutions available. Using Donald Schön's classic example, Boland and Collopy (2004) express this as follows:

If we think of an urban neighborhood as a blight, it evokes a particular problem space where certain types of design intervention are seen as most appropriate (cutting out the blight, curing the sick, bringing in a fresh form of life) ... if we look at the same situation as a folk community, we may instead not see it as a problem but as an opportunity, and develop plans to support its fragile infrastructure (p.9).

Designers have long been aware of the importance of systems: the field of CSCW evolved because of a growing consciousness among information systems designers that technology could not be separated from the social system in which it operates (Ackerman, 2000). Yet reductionist analytical techniques that narrow the problem space are inappropriate for understanding the interconnectedness of systems (Ackoff, 1999). To appreciate the relationships that form the system, designers both use traditional analysis and develop a synthesis of the system as a whole. The role of the systems perspective in the design process was captured by Gharajedaghi (1999) as follows:

Designers seek to choose rather than predict the future. They try to understand rational, emotional and cultural dimensions of choice and to

produce a design that satisfies a multitude of functions. The design methodology requires that designers learn how to use what they already know, learn how to realize what they do not know, and learn how to learn what they need to know. Finally, producing a design requires an awareness of how activities of one part of a system affect and are affected by other parts. This awareness requires understanding the nature of interactions among the parts.

(p. 23)

Because management problems are often shifting, difficult situations characterized by complex interrelationships and multiple stakeholders, they also defy easy solutions. Systems thinking has therefore been of interest to management scholars for some time. Jackson (2000) traces the history of systems thinking and argues that its growth has been limited by a perception among managers that it is too theoretical for practical problems; nevertheless, the popularity of Senge's (1994) book *The Fifth Discipline* attests to the desire for a fresh approach to complex problems. In user-centered management, as in user-centered design, the key considerations are the relationships between consumers, employees, shareholders, managers and other stakeholders.

A Model of Management Education Based on UCD

While the basic idea of putting users at the center of management thinking is simple, it has profound implications. As noted earlier, the term "user" needs to be defined broadly: the "user" of a financial statement may be investors, financial analysts or

creditors. What is important is an explicit appreciation of the full range of users and an intimate understanding of them.

In management degree based on the principles of UCD, students would develop skills in systems thinking and an attitude of empathy. To accomplish this, they would be required to solve “wicked” problems by framing the problem, understanding users intimately, thinking abductively about possible solutions, using analysis and synthesis to develop an understanding of systems and their component parts, and collaborating in diverse teams (Dunne and Martin, 2006). This does not, however, mean that design courses would supplant those courses currently being taught in business schools: what is needed is mostly a shift in attitude and focus rather than a large new body of material.

Nevertheless, these principles have important implications both for curriculum and teaching methods. These implications are discussed below.

Curriculum

MBA students learn a wide variety of techniques for analyzing business problems, but typically apply them to well-defined problems. Problem sets, exams and cases, for example, often spell out the alternatives available for comparison. Missing from the education of a typical business student is a discussion of how to identify the correct problem to work on, and how to think about new, untried alternatives. While business students learn some models designed to help them look at the bigger picture

[Porter's (1979) model of competitive forces would be an example], there is scope to go much further and consider the implications of problems for users, markets and societies.

Essential to a user-centered approach is an attitude of empathy: that users are not just “consumers” to be targeted, but real human beings with thoughts, feelings and needs; that employees are not merely factors of production; and that collaboration with others means understanding how the world appears from their perspective.

In a user-centered MBA curriculum, students would learn the following topic areas. In principle, all of these could be woven into existing courses. However, foundational courses in these topics would encourage students to approach all their courses with a different frame of mind.

Problem Framing: To solve problems rather than merely treat their symptoms, students must learn to identify the underlying problem. With the considerable research in framing since Kahnemann and Tversky's (1979) articulation of Prospect Theory, students would learn that one's perception of a problem, and therefore one's readiness to accept solutions, depends on how it is framed. From fields such as Root Cause Analysis (Wilson, Dell and Anderson, 1993), students would learn practical methods for understanding the dimensions of a problem. The important issue here is perhaps an attitudinal one: the understanding that real-life problems rarely are what

they appear to be and that extensive research and reflection are required before solution development can begin.

Ethnographic Research: As noted earlier, ethnographic research methods are used extensively by designers and are becoming popular in business (McFarland, 2001; Mariampolsky, 2006). Qualitative methods, including user observation, are currently included in many market research courses. One difficulty with this, however, is that the epistemologies and assumptions underlying ethnographic methods differ fundamentally from those associated with quantitative methods. Interpretivist approaches, for example, assume that truth is a set of socially constructed realities, and the researcher's task is to look for meanings held by participants; other traditions, tracing their roots to Foucault and Marx, emphasize the interrelationships between power and knowledge (Harlos, Mallon and Jones, 2003).

In a user-centered MBA, there is room for both quantitative and qualitative approaches. Both would be used in concert to develop a subjective, intimate, understanding of the user, in contrast to the distancing and dehumanizing effect of regarding consumers as statistics. Because of the differences in underlying epistemologies it makes sense to offer separate courses, but framed by a common philosophy of user intimacy.

Abductive Reasoning: Abductive reasoning, in contrast to deductive reasoning and inductive reasoning, is thinking about what might be possible. In Aristotelian logic,

inductive reasoning is generalization from specific instances, while deductive reasoning involves inference from logical premises. Charles Peirce (1903) described abductive logic as “the process of forming an explanatory hypothesis. It is the only logical operation which introduces any new idea”. Abductive reasoning proceeds by the observation of a surprising phenomenon that confronts pre-existing beliefs, reflection on the assumptions that led to the surprise and revision of these assumptions (Quilici Gonzalez and Haselager, 2005); it includes creativity, which Boden (2004) defines as transformation of the conceptual space. To learn about abductive reasoning, students would learn to identify their own implicit beliefs and assumptions and to confront these by generating alternative solutions to problems through creative processes (e.g. Czikzentmihalyi, 1990; DeBono, 2000). They would additionally learn how organizations can be managed to encourage abductive reasoning (Amabile, 1998).

Synthesis: As noted earlier, the components of systems thinking are analysis and synthesis. Students would learn to integrate analytical and synthetic methods to arrive at an appreciation of the larger context for business problems. This does not mean abandoning a reductionist approach, but learning that the relationships between components of a problem are just as important as the components themselves. The approach has already been widely applied in operations research: for example, Daellenbach and Petty’s (2000) application of the MENTOR system originated by Belton, Elder and Thornbury (1997) has three stages: Problem Formulation, Modelling and Implementation. Synthetic and analytical methods are

used throughout the process, in which identification of the problem and the system are emphasized and the process is iterative.

Collaboration: The prevailing approach in business schools to working with other students is a confrontational one in which ideas compete for acceptance (Dunne and Martin, 2006). This works against the need to confront one's own assumptions in framing and solving problems, and the element of surprise when these assumptions are confronted. In a user-centered business school, students would learn to work collaboratively, rather than confrontationally, in groups. However, groups of relatively homogeneous business students are unlikely to go very far in shaking each other's assumptions, and there is a role for external intervention, either through facilitation that pushes students to reflect or through group organization to maximize diversity (Kelley and Littman, 2001). There is also an opportunity to increase group diversity through alliances with other institutions.

Teaching Methods

Contemporary management problems are characterized by instability, unpredictability and conflicting interests among multiple stakeholders - in other words, "wicked" problems (Rittel and Weber, 1973), a "class of social system problems which are ill formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing" (Churchman, 1967). A

significant portion of students' effort in a user-centered MBA would be devoted to learning to deal with wicked problems.

Standard teaching methods in business schools - lectures and cases - are capable of providing students with some of the concepts and tools of user-centered management. However, since these methods typically present problems as well-defined and indeed often provide students with alternatives to compare, they will not be successful in imparting some of the concepts and skills of user-centered management. The role of lectures and cases would be to help students understand the concepts in simplified form; students would then apply these skills in real-world projects that defy easy definition and require them to generate their own alternatives based on their understanding of users.

Conclusion

Management education can learn from the user-centered movement in design. This involves building innovative solutions to problems based on an intimate understanding of users and the context of use, in addition to the circumstances faced by the business.

The change required of business schools is both attitudinal and epistemological. Business students need to learn to put users, broadly defined, at the center of their efforts as managers and to collaborate to provide them with value. Attitudinally, this entails true identification with users and the circumstances in which they find

themselves, along with a high degree of openness and curiosity. On an epistemological level, students can be provided with research methods and thought tools to focus their attention on users. To achieve these changes, business schools need to develop a curriculum that pushes students to experience users' issues face-to-face by working on challenging, dynamic, ill-structured problems.

References

- Ackerman, M. 2000. The intellectual challenge of CSCW: the gap between social requirements and technical feasibility. *Human-Computer Interaction*, 15 (2), 179-203.
- Ackoff, R.L. 1999. Our changing concept of the world. In *Ackoff's best: his classic writings on management*. New York: Wiley.
- Allio, R.J. 2003. Russell L. Ackoff, iconoclastic management authority, advocates a "systemic" approach to innovation. *Strategy & Leadership*, 31, 3, 19-26.
- Amabile, T. 1998. How to kill creativity. *Harvard Business Review*, Sept-Oct.
- Arnould, E & Wallendorf, M. 1994. Market-oriented ethnography: interpretation building and marketing strategy formulation. *Journal of Marketing Research*. 31, No. 4. (Nov., 1994): 484-504.
- Asaro, P.M. 2000. Transforming society by transforming technology: the science and politics of participatory design. *Accounting, Management and Information Technologies*. 10, 257-290.
- Ashkenazy, N. 2007. Critiques of management education and scholarship and suggestions for change. *Academy of Management Learning & Education*, 6, 1, 102-103.
- Belton, V., Elder M. & Thornbury H. 1997. Early experiences of MENTORing: design and use of multimedia materials for teaching OR/MS. *Omega* 25: 659-676.
- Boden, M. 2004. *The creative mind: myths and mechanisms*. London, UK: Routledge.

Boland, R. J., & Collopy, F. 2004. Design matters for management. In Boland, R. J., & F. Collopy, Eds. 2004. *Managing as designing*. Stanford, CA: Stanford University Press: 3-18.

Card, S.K., Moran, T.P., and Newell, A. 1983. *The psychology of human-computer interaction*, Hillsdale, NJ: Lawrence Erlbaum Associates.

Carr, N.G. 1999. Visualizing innovation. *Harvard Business Review*, Sept-Oct.

Churchman, C. W. 1967. Wicked problems. *Management Science*, 4(14) December, 141-142.

Cooperrider, D. L., & Whitney, D. 1999. *Collaborating for change: appreciative inquiry*. In P. Holman, & T. Devane, (Eds.), Berrett-Koehler Publishers.

Cross, N. 2003. The expertise of exceptional designers. In N. Cross and E. Edmonds (eds.) *Expertise in Design*. Sydney, Australia: Creativity and Cognition Press, University of Technology, 23-35.

Csikszentmihalyi, M. 1990. *Flow: the psychology of optimal experience*. New York: HarperCollins.

Daellenbachand, H. & Petty, N. W. 2000. Using MENTOR to teach systems thinking and OR methodology to first-year students in New Zealand. *The Journal of the Operational Research Society*, 51,12: Teaching OR: a review of current practice and developments, 1359-1366.

DeBono, E. 2000. *Six thinking hats*. New York: Little, Brown and Company.

Dunne, D. & Martin, R. 2006. Design thinking and how it will change management education: an interview and discussion. *Academy of Management Learning & Education*, 5, 4, 512-523.

Gharajedaghi, J. 1999. *Systems thinking: managing chaos and complexity: a platform for designing business architecture*. Burlington, MA: Elsevier Publishing.

Hackett, J.P. 2007. Preparing for the perfect product launch. *Harvard Business Review*, April.

Harlos, K.P., Mallon, M. and Jones, C. 2003. Teaching qualitative methods in management classrooms. *Journal of Management Education*, 27, 3, 304-322.

Jackson, M.C. 2000. *Systems approaches to management*. New York: Kluwer Academic/Plenum Publishers.

Kahneman, D., & Tversky, A. 1979. Prospect theory: An analysis of decision under risk. *Econometrica*, 47, 263 - 291.

Kelley, T. with Littman, J. 2001. *The art of innovation: lessons in creativity from Ideo, America's leading design firm*. New York: Doubleday.

Leonard, D., & Rayport, J. F. 1997. Spark innovation through empathic design. *Harvard Business Review*, Nov.-Dec.

Mariampolski, H. 2006. *Ethnography for marketers: a guide to consumer immersion*, Sage Publications.

McFarland, J. 2001. Margaret Mead meets consumer fieldwork. *Harvard Management Update*, August.

Norman, D.A.1986. Cognitive engineering. In *User Centered System Design*, D.A. Norman and S.W. Draper (eds.): 31-61. Hillsdale, NJ: Lawrence Erlbaum Associates.

Norman, D.A. 2004. *Emotional design: why we love (or hate) everyday things*. New York: Basic Books.

Olson, J.R. and Olson, G.M. 1990. The growth of cognitive modeling in human computer interaction since GOMS. *Human-Computer Interaction*. 5:2-3, 221 -266.

Peirce, C. S. P. 1903. Pragmatism as a principle and method of right thinking. In P. A. Turrisi, Ed., *The 1903 Harvard Lectures on Pragmatism*. Albany, NY, 1997: State University of New York Press.

Porter, M.E. 1979. How competitive forces shape strategy. *Harvard Business Review*, March/April.

Prahalad, C.K. & Ramaswamy, V. 2003. The new frontier of experience innovation. *Sloan Management Review*, 44, 4, 11-18.

Prahalad, C.K. & Ramaswamy, V. 2004. *The future of competition: co-creating unique value with customers*. Cambridge, MA: Harvard Business School Press.

Quilici Gonzalez, M.E. & Haselager, W.F.G. Creativity: Surprise and abductive reasoning. *Semiotica* 153-1/4 (2005), 325-341.

Rittel, H., & Webber, M. 1973. Dilemmas in a general theory of planning. *Policy Sciences*, 4, 155-169. [Reprinted in Cross, N. (ed.) 1984. *Developments in design methodology*. Chichester, UK: J. Wiley & Sons:135-144.]

Rogers, C. R. 1959. A theory of therapy, personality and interpersonal relationships, as developed in the client-centered framework. In S. Koch (Ed.), *Psychology: A study of science*, 3, 210-211; 184-256. New York: Mc Graw Hill.

Senge, P.M. 2006. *The fifth discipline: the art and practice of the learning organization*. Currency.

Schön, D. A. 1983. *The reflective practitioner: how professionals think in action*. London: Temple Smith.

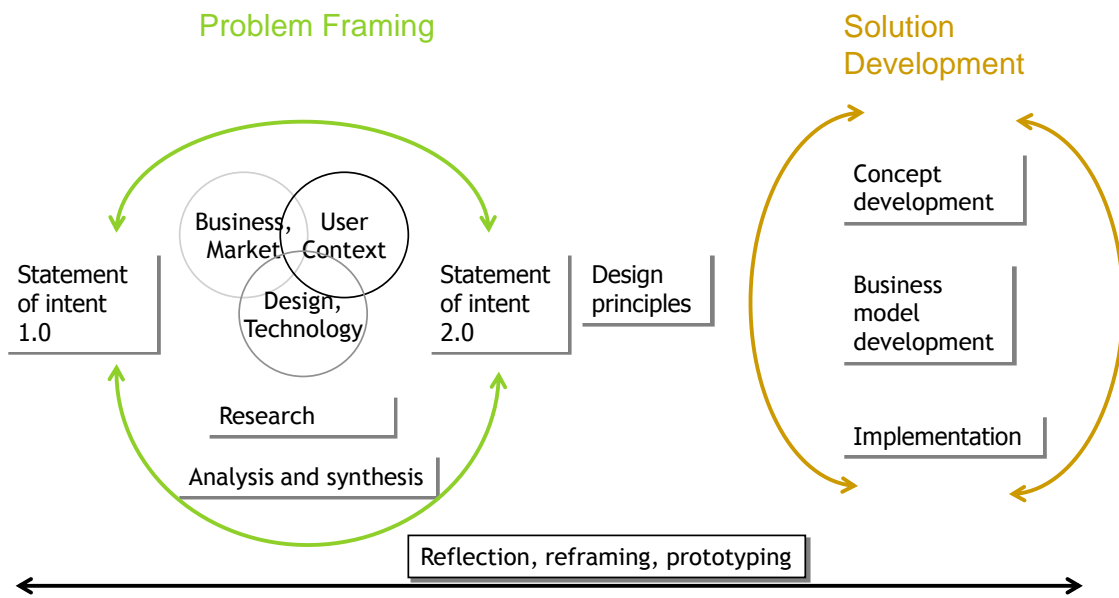
Simon, H. A. 1996. *The sciences of the artificial*, 3rd ed. Cambridge, MA: The MIT Press.

Underhill, P. 2000. *Why we buy: the science of shopping*. New York: Simon & Schuster.

Wellman, B. 2001. Computer networks as social networks. *Science*, New Series, 293, 5537, 2031-2034.

Wilson, P. F., Dell, L. D., & Anderson, G. F. 1993. *Root cause analysis: A tool for total quality management*. Milwaukee: ASQC Quality Press.

Figure 1
A Depiction of the Design Process



Adapted from IIT Institute of Design, Chicago