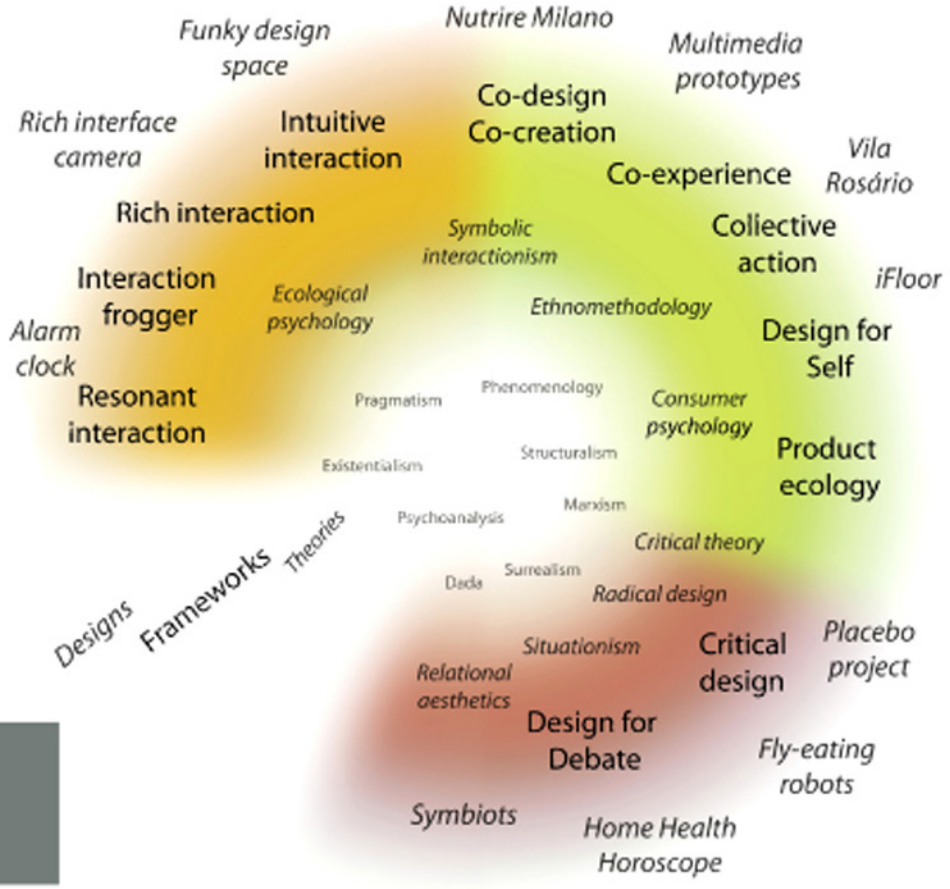
Design Research

Through Practice

FROM THE LAB, FIELD, AND SHOWROOM

Ilpo Koskinen John Zimmerman Thomas Binder Johan Redström Stephan Wensveen



MORGAN KAUFMANN

DESIGN RESEARCH THROUGH PRACTICE

From the Lab, Field, and Showroom

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FOREWORD

Twenty-five years ago I was lucky to find a visionary designer willing to take a leap of faith in hiring me—a human scientist and researcher. That designer was the legendary Bill Moggridge, who shortly afterwards merged his company with two others to form the global design and innovation consultancy IDEO. My charge was to strengthen IDEO's human-centred approach, and to integrate research with the practice of design. Back then there were few models for me to emulate. If I'd had access to a book like this one, certainly I would have felt more confident in my early endeavours. Design researchers will find this volume an invaluable guide as they navigate the options and challenges of their practice.

But constructive design research was in its infancy then, and my activities in that moment felt more like improvisation than evolving method. For me, that's one of most exciting aspects of this book: it puts the everyday activities of designers, researchers, and design researchers in historical context and reveals their varied influences. Readers "overhear" a rich and discursive conversation among five erudite authors. Ilpo Koskinen, John Zimmerman, Thomas Binder, Johan Redstrom, and Stephan Wensveen weave together perspectives from culture, art and design, cognitive psychology, and education as they discuss the blending of design and research. It's inspiring to see, through the selected work that they share, just how far that integration has come, to see the development of distinct traditions and intent—of lab, field, and showroom—and to imagine how far these will go within another generation.

Reflecting back on my early days as a new graduate of social science, I recall being frustrated that research and design were considered separate pursuits, developing in different academic spheres. Design was largely future-oriented; research focused on the past and the present. I found myself wondering, Wouldn't it be better if we *connected* research and design? That's precisely why I joined a design consultancy: I imagined myriad opportunities to link what I'd learned about people—about their behaviour, needs, desires, habits, and perceptions—with the design of places and things.

I did find opportunities, but linking design and research wasn't as straightforward as I'd hoped. My training in academic research, which emphasised the rigorous analysis of observed

conditions, undoubtedly provided me with a strong foundation. But that wasn't enough to be interesting or applicable to the work of designers. I needed to find some common ground.

What I *did* share with designers was an interest in the future, and in developing new and better products and services for people. Back then IDEO worked intensively with both emerging companies in Silicon Valley and with established manufacturers, bringing new technology to life: new input devices for computers (such as the mouse); electric charging systems for cars (anticipating the drive towards alternative fuels); digital cameras (heralding ubiquity of shared personal imagery). We sought ways to explore future possibilities, and that meant creating prototypes—tangible things we could look at, touch, share, and experience ourselves and show others. Just as the authors herein assert, we were not dealing with research that tried to describe or explain things, as "constructive research imagines new things and builds them." This was our common ground: a desire to examine and evaluate what we'd envisaged. This was crucial to learning what we needed to know to develop successful, world-changing designs.

Whether in the studio, the lab, or the field we used physical, mechanical, and interactive models—which usually represented new technology products that someday would actually get made—to help answer questions such as: How will this feel to use? Is it a good size, speed? How will it fit into daily life and support social behaviour?" By constructing prototypes, scenarios, role-playing, and body-storming we explored how to refine the design of those new things we were bringing into the world. Such design research applied whether we were developing a smart phone, reinventing a bank branch, conceiving a premium service for an airline, or creating new systems and processes for a fast-food company. It embodied the approach reflected in the current discourse about design thinking and "business in beta" which encourages companies to learn by doing—to commit resources to experimentation and prototyping as an on-going process rather than trying to pre-determine the details of a future offering through analysis.

Beyond refining the design of a future product or system, another important benefit of prototyping is in helping us explore the kinds of behaviour, attitudes and experiences that a new product, system, or technology might engender for people as individuals or communities. This is also constructive design research. It helps us answer questions like: What might it be like to design and grow artefacts from our own genetic material? How will new technology affect our experience of giving birth? Might a positive vision of the future encourage local action to minimize the effects of climate change? Here our constructions, though

real, are somewhat more speculative; they are created to provide a vision for observers to explore new possibilities and how these affect their hopes, dreams, and aspirations. Such design research is close to the idea of the "showroom" explored in this book; using prototypes to provoke reaction and conversation with the ultimate goal of making a positive difference to the world we live in.

Thus, working alongside designers now for many years, I have learned that design research is about far more than creating things to be made and marketed. Design research plays an important role in illuminating and tackling many complex problems facing the world today. It encourages and enables social change and challenges assumptions and beliefs about how we live, work, and consume. It raises questions that prompt us to consider other possibilities.

As human beings we tend to shift between pondering our existence in the world—the people, places and things that comprise it—and taking action to alter it. Sometimes we're inquisitive and seek to *understand*: How do people, places, and things interact? How do they shape our experiences, habits, lifestyles, and culture? Other times we're innovative and want to effect change, to *make* new things and experiences. Human beings are both *curious* and *creative*. We are *researchers* and *designers*, in ways that are inextricably linked. At IDEO today, my colleagues and I "think to build" and "build to think" as entirely reciprocal activities.

"Design Research Through Practice" is a critical exploration of this reciprocity as it plays out in multifaceted ways in the real world. It demonstrates how different traditions of collaborative construction have bridged the gap between understanding and making, and between theoretical and actual solutions. This is not a *how-to* book (which could never feel right to design researchers anyway), but rather a thoughtful examination of exemplary practice—a *how-they-did-it* book—and an inspirational foundation for others to reflect and build upon.

Jane Fulton Suri
Managing Partner; Creative Director IDEO
May 18th 2011

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PREFACE

The origins of this book are from observations we made a few years ago. It focuses on a small but growing slice of design research we call "constructive design research". There are many types of constructive design research, but only a few approaches have been successful for a decade or more. We call these approaches Lab, Field, and Showroom. They come from different places, with some having roots in universities, some in design firms, some in engineering and the social sciences, and some in contemporary art.

As we see it, design research is coming of age. Hundreds of papers have been written about design research and how it should be done. For this reason, any attempt to write about it has to be done as an informative narrative. For us, this informative narrative has been methodology — discussion of abstract principles at work behind actual research. Being abstract helps us to better understand what some of the leading design researchers are doing and why their work makes sense.

There are three main reasons for writing this book. First, design has increasingly become a growing academic field. We feel that a bird's eye perspective on it is useful for researchers, professors, and students alike. The second reason is that a PhD is fast becoming an entry criterion for teaching positions; however, this is not how design is traditionally taught: design has been like art, taught by masters to apprentices. The apprenticeship model has guaranteed that designers have sensitivities that are very difficult to put in words. To maintain these sensitivities, professors of the future need design skills, and one way to maintain these skills is to bring design into the middle of research.

The third reason for writing this book is to add tolerance. Designers are not traditionally well versed in scientific practice and tend to understand science narrowly. We still hear talks about *the* scientific method, even though there clearly are many methods. A good deal of astrophysics and geology is not experimental. In contrast, we argue that there is a need for many types of methods and methodologies in design, just as there is a need for many types of methodologies in the sciences and the social sciences.

When writing, we have kept in mind MA/MSc and doctoral students in industrial and interaction design, product design engineering, and in such emerging fields of design as services

and sustainability. We also believe that what we write is useful for the increasing number of practitioners who do research for a living. By now, there is a market for design research in cities like Los Angeles, Chicago, New York, London, Copenhagen, Helsinki, Rio de Janeiro, Seoul, Hong Kong, and Milan, just to mention a few. This dual audience explains some of the features of the book. The focus on the big picture makes this book fairly abstract, but this is what universities need. Some other features help practicing designers to skim through the book quickly: it is organized in parts, we give short examples of work we find inspiring, and our writing style is deliberately non-technical.

While talking about this book, many practitioners and researchers have found it immediately useful. One word of caution is required. Many people ask how their practice fits into the Lab, Field, and Showroom framework. However, we talk about practices that are seldom pure. In fact, Chapters 7–9 look at how theory, research practice, and the social environment create commonalities between these approaches. These chapters have their origin in a "deviant case": when we realized that it is impossible to classify Ianus Keller's PhD work under Lab or Field, we took a closer look at things that bridge researchers.

Each of the writers has participated in constructive design research for the past ten years, and some considerably longer. Some of us find our academic homes outside design, some have considerable practical experience, one is an industrial designer, and one is an interaction designer. Experience in design, engineering, the social sciences, philosophy, and filmmaking are all represented here. Two authors work in art and design schools, one in a technical university, one has a double appointment between design and computer science, and one author works in a research institute focusing on interaction design. Our native languages are English, Dutch, Danish, Swedish, and Finnish and as a team, we probably understand more than 12 languages. Due to this diversity, this book covers many subjects. Hopefully this means that many kinds of designers and people interested in design can find something interesting within its covers. For us, writing this book has been a marvelous learning experience, and we hope the result is useful for our readers.

May 22, 2011
Helsinki, Finland
Ilpo Koskinen

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You must include the United States when writing about research. In Boston, thanks to the people at MIT Media Lab, and in Chicago, Kei Sato. At Savannah College of Art and Design, we need to thank Victor Ermoli for opening the doors of design to us, Jesus Rojas for showing us the industrial design department, and Joel Wittkamp and Christine Miller not only for a pleasant dinner but also for telling us about the impressive Savannah school. In Los Angeles, we learned many things from Lisa Nugent (now in New York), Yee Chan, Sean Donahue, and Serra Semi. In Pasadena, we got to know Brenda Laurel's work, which became one of the starting points for us (Laurel 2003). In Palo Alto, our thanks go to Katja Battarbee and Jane Fulton Suri at IDEO and Larry Leifer at Stanford University. In Portland, Ken Anderson and Scott Mainwaring provided us with information about ethnography at Intel and also in Silicon Valley. Jack Whalen talked about his work on PARC and helped with the manuscript when it was getting too large. Jack also wrote an inset about one particularly successful project at PART called Eureka. Last but not least, Carnegie Mellon University has an amazing group of design research scholars; we need to thank in particular Jodi Forlizzi, Dan Boyarski, Suguru Ishizaki, Eric Paulos, Haakon Faste, and Will Odom. CMU has excelled in design since Herbert Simon's heyday and continues to do so with these people.

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At Elsevier and Morgan Kaufmann, we started our journey with Mary James and continued with David Bevans, Danielle Miller, and Rachel Roumeliotis.

Ilpo Koskinen, 2011

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1

CONSTRUCTIVE DESIGN RESEARCH

iFloor was an interactive floor built between 2002 and 2004 in Aarhus, Denmark. It was a design research project with participants from architecture, design, and computer science. It was successful in many ways: it produced two doctoral theses and about 20 peer-reviewed papers in scientific conferences, and led to other technological studies. In 2004, the project received a national architectural prize from the Danish Design Center.

At the heart of *iFloor* was an interactive floor built into the main lobby of the city library in Aarhus. Visitors could use mobile phones and computers to send questions to a system that projected them to the floor with a data projector. The system also tracked movement on the floor with a camera. Like the data projector, the camera was mounted into the ceiling. With an algorithm, the system analyzed social action on the floor and sent back this information to the system. If you wanted to get your question brought up in the floor, you had to talk to other people to get help in finding books.

iFloor's purpose was to bring interaction back to the library. The word "back" here is very meaningful. Information technology may have dramatically improved our access to information, but it has also taken something crucial away from the library experience — social interaction. In the 1990s, a typical visit to the library involved talking to librarians and also other visitors; today a typical visit consists of barely more than ordering a book through the Web, hauling it from a shelf, and loaning it with a machine. Important experience is lost, and serendipity — the wonderful feeling of discovering books you had never heard about while browsing the shelves — has almost been lost.

A blog or a discussion forum was not the solution. After all, interaction in blogs is mediated. Something physical was needed to connect people.

Design Research through Practice.

A floor that would do this job was developed at the University of Aarhus through the typical design process.[1] The left row of Figure 1.1 is an image from a summer workshop in 2002, in which the concept was first developed. The second picture is from a bodystorm[2] in which the floor's behaviors were mocked up with a paper prototype to get a better grasp of the proposed idea. Site visits with librarians followed, while technical prototyping took place in a computer science laboratory at the university (left row, pictures 3–5). The system was finally installed in the library (left row, picture at the bottom). How *iFloor* was supposed to function is illustrated in the computer-generated image on the right side of the picture.

iFloor received lots of media attention; it was introduced to Danish royalty, and it was submitted to the Danish Architecture Prize competition where it was awarded the prize for visionary products (Figure 1.2). In addition, as already mentioned, it was reported to international audiences in several scientific and design conferences.

However, only half the research work was done when the system was working in the library. To see how it functioned, researchers stayed in the library for two weeks, observing and videotaping interaction with the floor (Figure 1.3). It was this meticulous attention to how people worked with the *iFloor* that pushed it beyond mere design. This study produced data that were used in many different ways, not just to make the prototype better, as would have happened in design practice.

Developing the *iFloor* also led to two doctoral theses: one focusing more on design and technology, another focusing mostly on how people interacted with the floor.[3] Andreas Lykke-Olesen focused on technology, and Martin Ludvigsen's key papers tried to understand how people noticed the floor, entered it, and how they started conversations while on it. It was this theoretical work that turned *iFloor* from a design exercise into research that produced knowledge that can be applied elsewhere. In design philosopher Richard Buchanan's terminology, it was not just a piece of clinical research; it had a hint of basic research.[4]

iFloor is a good example of research in which planning and doing, reason, and action are not separate.[5] For researchers, maybe the most important concept *iFloor* exhibits is that there is value in doing things. When researchers actually construct something, they find problems and discover things that would otherwise go unnoticed. These observations unleash wisdom, countering a typical academic tendency to value thinking and discourse over doing. A PowerPoint presentation or a CAD rendering would not have had this power.

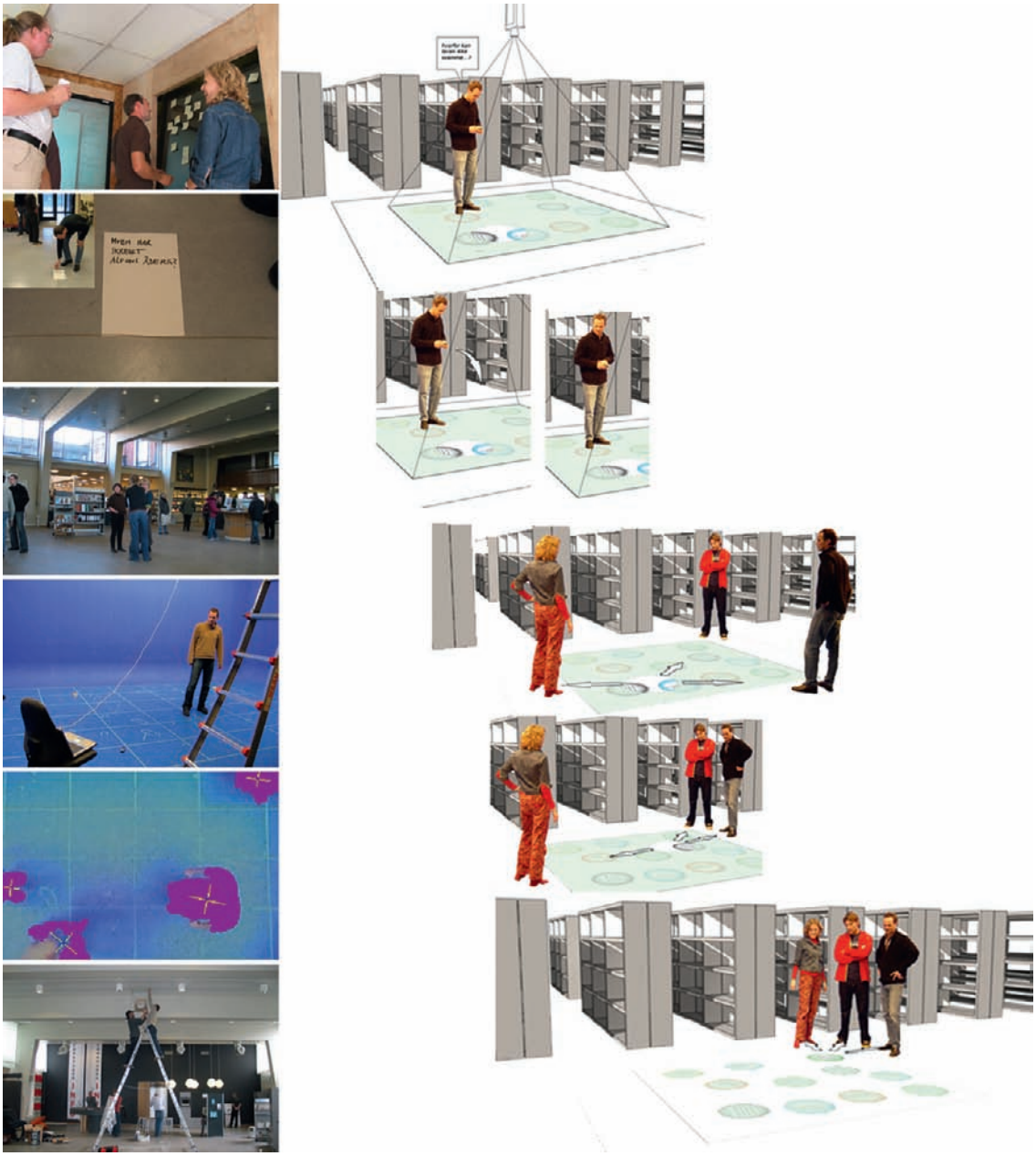

Figure 1.1 *iFloor* being designed. Left column: workshops, bodystorming, site visit, technical prototyping, what the computer saw, and building the system into Aarhus City Library. Right column: use scenario.

Figure 1.2 Picture of *iFloor* in Danish Design Centre's Design Prize booklet, 2004.

Figure 1.3 *iFloor* in action. Here seventh graders are exploring the floor.

1.1 Beyond Research Through Design

Usually, a research project like *iFloor* is seen as an example of "research through design." This term has its origins in a working paper by Christopher Frayling, then the rector of London's Royal College of Art (RCA)[6]. Jodi Forlizzi and John Zimmerman from Carnegie Mellon recently interviewed several experts to find definitions and exemplars of research through design. According to their survey, researchers

Figure 1.4 New term provides a fresh beginning.

> *make prototypes, products, and models to codify their own understanding of a particular situation and to provide a concrete framing of the problem and a description of a proposed, preferred state.… Designers focus on the creation of artifacts through a process of disciplined imagination, because artifacts they make both reveal and become embodiments of possible futures.… Design researchers can explore new materials and actively participate in intentionally constructing the future, in the form of disciplined imagination, instead of limiting their research to an analysis of the present and the past.*[7]

However, this concept has been criticized for its many problems. Alain Findeli and Wolfgang Jonas, among others, noted that any research needs strong theory to guide practice, but this is missing from Frayling's paper.[8] For Jonas, Frayling's definitions remained fuzzy. Readers get few guidelines as to how to proceed and are left to their own devices to muddle through the terrain. Jonas also says that the term provides little guidance for building up a working research practice — and he is no doubt right.

This concept fails to appreciate many things at work behind any successful piece of research. For example, the influential studies of Katja Battarbee and Pieter Desmet made important conceptual and methodological contributions in their respective programs, even though, strictly speaking, they were theoretical and methodological rather than constructive in nature. People read Kees Overbeeke's writings not because he builds things but because he has articulated many valuable ideas about interaction in his programmatic and theoretical writings. People read Bill Gaver because of his contribution to design as well as methodology, often against his wishes.[9]

For these reasons, we prefer to talk about "constructive design research," which refers to design research in which construction — be it product, system, space, or media — takes center place and becomes the key means in constructing knowledge (Figure 1.4). Typically, this "thing" in the middle is a prototype

like *iFloor*. However, it can be also be a scenario, a mock-up, or just a detailed concept that could be constructed.

We focus on leading examples of constructive research but follow Frayling's empiricist and pragmatist approach rather than offer a definition grounded in logic or theory.[10] By now, we have a luxury: a body of research that does most of the things that Findeli and Jonas called forth. When looking at the 1990s, it is clear that what people like Tom Djajadiningrat in the Netherlands, Anthony Dunne in England, and Simo Säde in Finland did in their doctoral work was solid, theoretically and methodically informed research that could not have been done without a design background.[11] Ten years later, there are dozens of good examples. For this reason, we explicate practice rather than try to define a field with concepts as big as design and research.[12] Introducing a new word is an old academic trick used to avoid difficulties with existing concepts and to keep discussion open, if only for a few years.

1.2 Constructive Research in Design Research

This book looks at one type of contemporary design research. It excludes many other types, including research done in art and design history, aesthetics, and philosophy. It also skips over work done in the social sciences and design management. It leaves practice-based research integrating art and research to others. Similarly, it barely touches engineering and leaves out theory, semantics, and semiotics altogether.[13] This book will not look at research done by design researchers if there is no construction involved, unless there is a clear connection to constructive studies.[14] Finally, it will not review design research that builds on the natural sciences such as chemistry as this research is most typically done in ceramics and sometimes in glass design and conservation. We are dealing with research that imagines and builds new things and describes and explains these constructions (Figure 1.5).[15]

What constructive design research imports to this larger picture is experience in how to integrate design and research. Currently, there is a great deal of interest in what is the best way to integrate these worlds. This book shows that there are indeed many ways to achieve such integration and still be successful. We are hoping that design researchers in other fields find precedents and models in this book that help them to better plan constructive studies. For constructive design researchers, we provide ways to justify methodological choices and understand these choices.

It should be obvious that we talk about construction, not constructivism, as is done in philosophy and the social sciences.

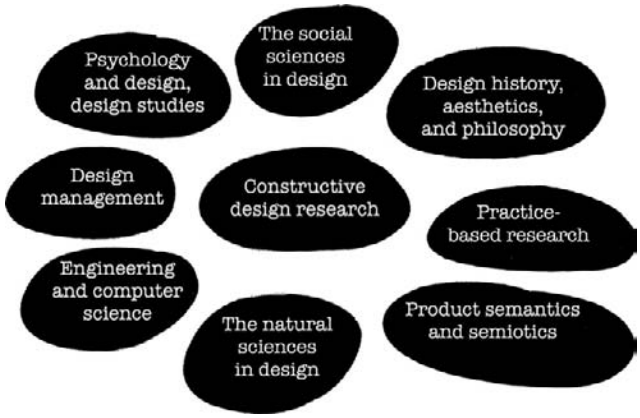

Figure 1.5 Current design research.

Constructivists are people who claim issues such as knowledge and society are constructed rather than, say, organized functionally around certain purposes, as if in a body or in a piece of machinery.[16] Many designers are certainly constructivists in a theoretical and philosophical sense, but this is not our concern. We focus on something far more concrete, that is, research like *iFloor* in which something is actually built and put to use. Not only concepts, but materials. Not just bits, but atoms.

One of the concerns many design writers have is that design does not have a theoretical tradition.[17] For us, this is a matter of time rather than definition. Theory develops when people start to treat particular writings as theories; for example, such as happened to Don Norman's interpretation of affordance. It became a theory when researchers like Gerda Smets and Kees Overbeeke in the Netherlands treated it as such.

For this reason, we focus on research programs rather than individual studies. Chapter 3 explains this concept of program in detail. Here, it is enough to say that research programs always have "a central, or core, idea that shapes and structures the research conducted."[18] Programs consist of a variety of activities ranging from individual case studies to methodology and theory building. This richness is lost in definitions of research through design that tend to place too much weight on design at the expense of other important activities that make constructive research possible.

1.3 What Is "Design"?

Any book on design has to face a difficulty that stems from the English language. The word "design" is ambiguous, as it covers

both planning (of products and systems), and also what most other European languages would loosely call "formgiving."[19] The latter meaning is more restrictive than the former, which may cover anything from hair and food design to designing airplanes.

This book is not about engineering or science, it builds primarily on work carried out in art and design schools. The art and design tradition has an important message to more technically oriented designers. Above all, designers coming from the art school tradition have many ways to deal with the "halfway" between people and things.

People negotiate their way through this halfway with their eyes, ears, hands, and body, as well as their sense of space and movement and many kinds of things they are barely aware of. Although everyone lives in this halfway every second, there are few words to describe it.[20] However, it is the stuff of design education. In Sharon Poggenpohl's words, it aims at developing sensibilities of visual, material, cultural, and historical contexts.[21]

There is no reason to be romantic or cynical about these sensibilities. Designers trained in the arts are capable of capturing fleeting moments and structures that others find ephemeral, imaginative, and unstable for serious research. They are also trained in reframing ideas rather than solving known problems. Above all, they are trained to imagine problems and opportunities to see whether something is necessary or not. It is just this imaginative step that is presented in discussions on innovation in industry.[22]

1.4 Industrial Design and Interaction Design

Even in this narrow sense, design is a complex category that covers many subjects ranging from paper machines to the conceptual designs of, say, Droog Design in the Netherlands.[23] This book does not try to cover all of these topics; it mostly builds on work carried out in industrial design and interaction design — the main hubs of constructive design research (see Figure 1.6).

Industrial design and interaction design differ in many ways. The most notable differences are in tradition and technology: industrial design has roots producing material goods, and interaction design is based on computer science, film, and Web design. Industrial design is product-oriented, three-dimensional, and relies heavily on sketches, mock-ups, models, and physical prototypes. Interaction design is time-oriented and relies on personas, scenarios, narratives, and software prototypes. Also, the skills required for each type of design are different.

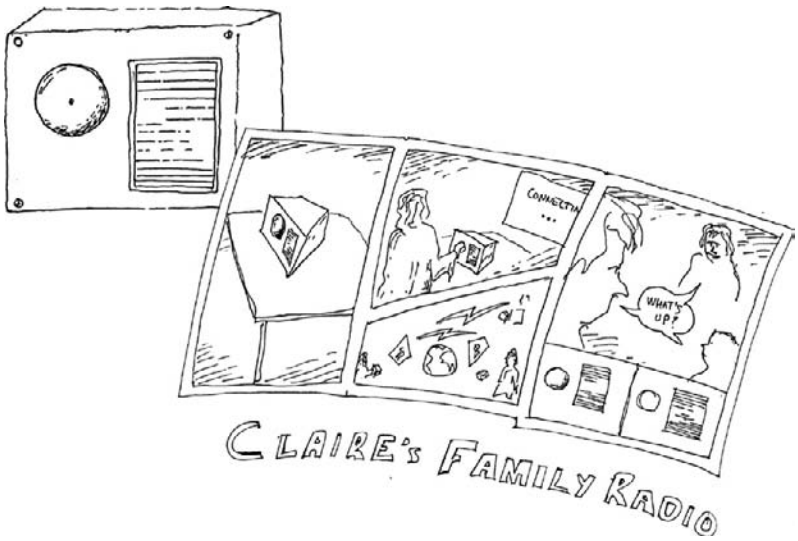

Figure 1.6 Industrial design and interaction design: physical things are the focus of industrial design, whereas interaction is the focus of interaction design.

Still, over the past 15 years these specialties have evolved side by side with many interaction designers with a background in industrial design and sometimes vice versa. Also, research communities overlap, sharing processes and many working practices.[24]

We believe that constructive design research continues to build on these two specialties, but with more overlap. One set of reasons lies in its technology, which is making interaction design an increasingly important design specialty. When information technology has "disappeared" from gray boxes to the environment, interaction designers increasingly deal with problems familiar to industrial designers.[25] Industrial designers, on the other hand, are increasingly using information technology (IT). Importantly, information technologies have no obvious shape. The key skills in coping with IT are not redoing and refining existing forms but imagining interesting and useful concepts that people want.[26]

1.5 Design Research in Second Modernity

Behind current research lie social forces larger than technology. After the reconstruction period after World War II, the 1960s witnessed major changes in society. Western economies became consumer driven and an ecological crisis influenced it, higher education democratized, and pop culture merged with youth culture. Media became global, taste became democratized, and

there was an upheaval in politics as traditional loyalties started to crack. In the 1950s, the main arbiters of taste were the educated upper middle classes, but by the mid-1970s, up-to-date design built on sources like pop art.

However, when the 1980s arrived, society was more stable. Andrea Branzi, one of the main revolutionaries of design, wrote:

> *During the period of forced industrialization that lasted from 1920 to 1960, the hypothesis had been formed that design ought to be helpful in bringing about a standardization of consumer goods and the patterns of behavior in society. Its work lay in a quest for primary needs…. Along that fascinating road design has hunted for many years the white whale of standard products, products aimed at the neutral section of the public's taste, products intended to please everyone and therefore no one…. Then, in the mid 1960s, things began to move in exactly the opposite direction. The great, pyramid-shaped mass markets, guided by enlightened or capricious opinion leaders, gradually disintegrated into separate niches and were subsequently reformed into new and multicolored majorities. Design had to skirt its attention from mass products to those intended for limited semantic groups. From objects that set out to please everyone, to objects that picked their own consumers. From the languages of reason to those of emotion…. Then the process of transformation slowly came to an end. The mutation was complete and it is now possible to say that a new society, with its own culture and values, has taken on a fairly stable shape.*[27]

For designers, Branzi's second modernity has opened many new opportunities.[28] The first ones who seized these opportunities were graphic, industrial, and interaction designers. There are also many other characters who populate design today: service designers, design managers, community designers, and researchers. As Branzi recently noted, design has become a mass profession.[29]

There is some friction between the two modernities. Institutions like universities react to society slowly and tend to be run by those who came to the field in the first modernity. However, many designers and researchers commute across the boundary with ease. As design has become more diversified in ethnic and gender terms, such skill is in high demand; there is no way back to the first modernity dominated by white European and American men.

Research plays an increasingly important role in this transition. As Branzi's colleague Antonella Penati noted, design is coming of age. Design education was typically established in universities after World War II, making it a relative newcomer in universities. However, design is now in its third generation. As Penati explained, design is currently maturing by embracing new computer-based technologies and research.[30] Research helps designers to navigate the second modernity (Figure 1.7).

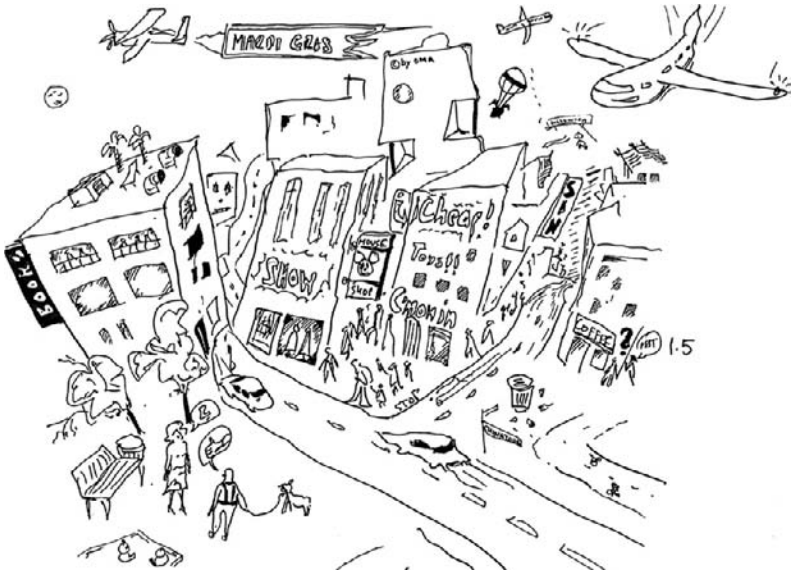

Figure 1.7 Second modernity offers many possibilities for design.

End Notes

1. See Lykke-Olesen (2006).
2. Buchenau and Fulton Suri (2000).
3. Lykke-Olesen (2006), Ludvigsen (2006).
4. See Buchanan (2001), who distinguished clinical, applied, and basic research. Clinical research consists of applying a body of (professional) knowledge to a case. Applied research applies such knowledge to a class of cases. In basic research, application is secondary: the goal is to produce knowledge that may be applied later in applied and even clinical studies.
5. As Pieter Jan Stappers (2007) from Delft University of Technology says.
6. Frayling (1993); Schneider (2008), Zimmerman et al. (2010).
7. Zimmerman and Forlizzi (2008).
8. Findeli (1998, 2006), Jonas (2007, pp. 189–192). Jonas points out some misunderstandings of Frayling as well.
9. See Gaver et al. (2004). The *Presence Project* had already been warned not to turn cultural probes into a method. Other references in this paragraph are Battarbee (2004) and Desmet (2002). Overbeeke is a professor at the Technische Universiteit Eindhoven and Gaver is a professor at Goldsmiths College in London.
10. For example, Zimmerman et al. (2007).
11. Djajadiningrat (1998), Dunne (2005), Säde (2001).
12. Andrea Branzi made a similar point regarding art and design in Burkhardt and Morotti (n.d., p. 65).
13. For history, aesthetics, and philosophy, see Dilnot (1989a,b), Julier (1991, 2008), Buchanan and Margolin (1995), Margolin and Buchanan (1995), Bürdek (2005), Fallan (2010), and Svengren (1995). For social sciences, see Molotch (2003), Brandes et al. (2009), and Shove et al. (2007). For design management, see Gorb (1990), Borja de Mozota (2003, 2006), Aspara (2009), and Verganti (2009). For artistic and so-called practice-based research, see Mäkelä and Routarinne (2007). For engineering, see Archer (1968). Product

semiotics and semiotics are explained in Krippendorff (1989, 2006), Butter (1989), and Vihma (1995). For an applied perspective, see McCoy (1996). Krippendorff's MA thesis in Ulm in 1961 was already studying semantics (see Krippendorff, 1989, p. 10, note 5). For theory, consult Branzi (1988).

14. Keinonen (1998), Desmet (2002). For user experience, see Schifferstein and Hekkert (2008).

15. See Slate (2002), Siikamäki (2006), Costa Gaspar (2003), Thampirak (2007), and Härkäsalmi (2008).

16. The classic statement is Berger and Luckmann (1967), although the history of empirical research on social construction of knowledge goes back at least to Karl Mannheim's sociology and, ultimately, German idealism in philosophy. For a philosophical critique of the notion of practice, see Turner (1994), who mostly — and in many ways, misleadingly, as Lynch (1993) pointed out — built on Ludwig Wittgenstein's discussion on rule following his criticism of practice.

17. This is the main concern for Poggenpohl and Sato (2009), perhaps partly in response to Krippendorff's (1995) fear that lacking a disciplinary basis, design always loses in collaboration with other disciplines. Krippendorff's talk is quoted in Poggenpohl (2009a, pp. 15–16).

18. Downton (2005, p. 9).

19. Germanic languages usually have separate words for planning and formgiving, including German *Gestaltung* and *Formgebung*, and also the more general *Entwurf* (verb *entwerfen*), Dutch *ontwerpen*, and Swedish *formgivning*. Latin languages build more on the idea of planning, drawing, and projecting, like the Italian *disegno* and French *conception*. Other languages, such as Finnish, build on Germanic roots; thus, *muotoilu* is a direct translation from the Swedish form, while *suunnittelu* comes from planning.

20. Merleau-Ponty 1973. As the philosopher Maurice Merleau-Ponty noted, this intertwining of the world and people had no name in philosophy. The word "experience" tries to capture it, but it is human-centric and too easy to turn into just another cognitive process. It also tends to focus on significant events rather than the prose of everyday life. The word "interaction," on the other hand, having its origins in the natural sciences, is too easy to turn into a model of a mechanism. Merleau-Ponty's term of choice was "flesh," also a less appropriate choice. Its carnal imagery downplays mindful and social aspects of human existence. This notion is from Merleau-Ponty's (1963, 1973) posthumously published essay "The Intertwining — The Chiasm." The word "prose," also from his posthumous writings, carries a heavy meaning. As Merleau-Ponty noted, our world is mostly prosaic rather than poetic. Certainly, prose dominates in design (Merleau-Ponty, 1968, 1970, pp. 65–66). Somewhat similar ideas are apparent in many other writings in design: design is about capturing something in the gray area between people and the things around them. In addition to Poggenpohl's essay quotes in this paragraph see, for example, Seago and Dunne (1999), and in particular Pallasmaa (1996, 2009), whose perceptive analysis of architecture is well in line with this understanding of design (especially Pallasmaa, 2009, pp. 11–22).

21. Poggenpohl (2009a, p. 7). She follows Polanyi's distinction between tacit and explicit knowledge, which we try to avoid in this book, as we believe it unnecessarily dramatizes the difference between design and research.

22. The second point builds on several writers. Characterizing design as an attempt to change existing situations to preferred ones comes from Herbert Simon (1996). The idea that designers reframe things through imagining several preferred situations rather than framing a problem and solving it comes from Horst Rittel and Melvin Webber (1973) and Richard Buchanan (1992). For recent discussion on design in innovation, see Verganti (2009).

23. Some caution is needed here. While it is easy to classify the work of groups like Memphis and Droog Design, and today, critical design, as conceptual work aimed at changing perceptions and ways of seeing things in design, it is equally true that these groups worked through material. Their work was certainly not designed to celebrate immaterial things like concepts. For a similar point regarding relational aesthetics, see Bourriaud (2002, pp. 46–47).

24. As with most concepts, a dose of caution helps a designer to not get distracted. If one looks at job offerings, interaction design is mostly about interfaces for the Web, computers, and machinery. In this sense, interaction design is a novelty in design, although its history goes back far longer than design folklore says. Many designers worked with interaction far before graphical user interfaces came to light in the 1980s. In a wider sense, interaction design may mean those things in which people meet their environment through some kind of computation. Here, interaction design is scarcely a novelty. For example, there are many industrial design programs that do not offer interaction design specialties. If industrial and other designers have been using interactive devices all along without specialized training, then why change? A word of warning about industrial design is also warranted, but this warning is about the relationship to product design. Usually, industrial design is an umbrella and product design a part, but the reverse holds in places like the Glasgow School of Art.

25. This sentence builds on Mark Weiser's (1991) idea of ubiquitous computing.

26. Thackara (1988), Redström (2006, pp. 123–127), Buchanan (2001). For how the object of art got dematerialized, see Lippard (1997).

27. Branzi (1988, p. 11). Castelli 1999. Contemporary design reflects change in society in that there is no common style or criteria for style today, as Catherine MCdermott 2008 and Penny Sparke 2008 have noted.

28. See Maldonado (1972, pp. 27–29). For an accessible version of Maldonado's thinking, see Gui Bonsiepe (2009, p. 125), who rightfully pays attention to a curious lack of design in a plentiful discussion of modernity in the social sciences, and compares this to Maldonado's concerns:

The debated tackling of the theme of modernity … have never taken the design dimension into consideration: design has been absent …. In [Maldonado's] essays, design is not merely understood as an incidental phenomenon or a secondary theme of modernity but, on the contrary, as a driving force of modernity itself. In the practice of design, modernity finds itself. Being radically modern means: inventing, designing, and articulating the future or modernity.

29. Branzi (2010).

30. Penati (2010).

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2

THE COMING OF AGE OF CONSTRUCTIVE DESIGN RESEARCH

Most early writings on design research are built on rationalistic assumptions. Perhaps the most ambitious call for basing design on rationalistic thinking came from Herbert Simon, who proposed basing design on systems and operations analysis. For him, design became an exercise in mathematics, and the task of design research was to describe the natural and human rationalities that govern it.[1] Such rationalistic assumptions were particularly strong in the 1950s and 1960s. At that time, the studio model of the Bauhaus became too limited to respond to the demands of increasingly complex and growing industries.

However, rationalistic methods failed to get much of a following in design, probably because they barely tackled the human and artistic faces of design—for example, the "design methods movement," which bloomed for a few years in the 1960s mainly in the United States and England.[2] Writing at the end of the 1990s, Swedish designer Henrik Gedenryd noted how this movement built on operations research and systems theory, trying to lay the foundations for design on

> *logic, rationality, abstraction, and rigorous principles. It portrays, or rather prescribes, design as an orderly, stringent procedure which systematically collects information, establishes objectives, and computes the design solution, following the principles of logical deduction and mathematical optimization models…. This view is still very much alive, and there is a good reason to believe that this won't change for a long time.*
>
> *However, discontent with this approach is widespread and quite old, even though no substantive replacement has yet been proposed. Experience from design practice and from studies of authentic design processes has consistently been that not only don't designers work as design methodology says they should, it is also*

Design Research through Practice.

> *a well established fact that to do design in the prescribed manner just doesn't work.*[3]

The leading rationalists like J.C. Jones and the mathematician-turned-architect Christopher Alexander quickly changed their earlier teachings about research. By the end of the 1960s, Alexander's advice was to "forget the whole thing," and Jones turned to music and poetry. In the end, they had encouraged designers to experiment with art.[4]

As Peter Downton noted, the rationalistic movement left a legacy of many useful means for improving design, but its problems went deep.[5] The rationalistic mentality faced many external problems. The 1960s saw the opening of the space era and Lyndon B. Johnson's Great Society, but is was also the high point of Branzi's first modernism. Soon after, the West was on a course to a second modernism. Along came a shift to consumer society, a general mistrust in authority, an explosive growth and diversification of higher education, and an awareness of looming ecological crises. Despite increasingly sophisticated methods aimed at handling complexity, human, social, and ecological problems proved to be "wicked" and unsolvable by rationalistic methods.[6]

In a sense, the design methods movement arrived at design when it was already too late. To claim that technical expertise somehow automatically makes the world better was hardly credible to people who had lived through Auschwitz and Vietnam.

The failure of the movement was more than a matter of changing mental landscape. The best known attempt to lay design on rational foundations was the Hochschule für Gestaltung in Ulm, Germany. Starting as New Bauhaus in 1953 with roots in art and design, by 1956 its agenda had turned to teaching teamwork, science, research, and social consciousness in a modernist spirit.[7] The Ulm school is typically seen as the first serious attempt at turning design into a science of planning.[8]

However, the Ulm experiment was short-lived. The long time head of the Ulm school, Tomás Maldonado, reflected on his experience 15 years after the school was closed.[9] For him, the main cause of failure was sticking to "the theoretical generalities of a 'problem solving' which did not go beyond a 'discourse on method' of Cartesian memory."[10] He wrote:

> *The driving force behind our curiosity, of our studies and of our theoretical effort consisted of our desire to furnish a solid methodological basis for design. One must admit that such a pretext was very ambitious: one attempted to force a change in the field of design which was very similar to the process which turned alchemy into chemistry. But our attempt was, as we know now, premature.*[11]

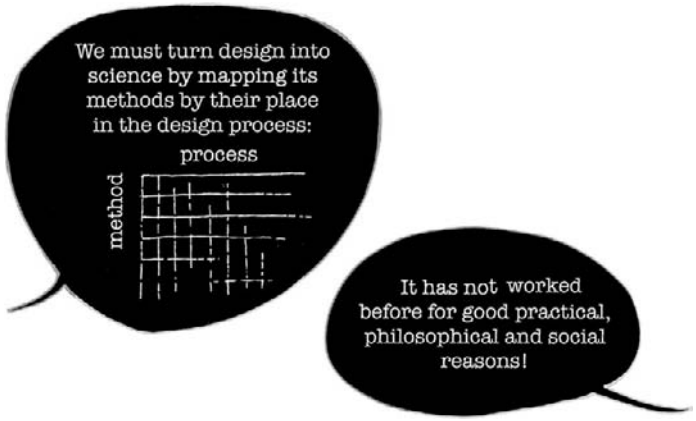

Figure 2.1 Rationalism faces post-Cartesian philosophy.

Indeed, how can anyone "solve" the problem of climate change through design? Modesty was in demand, given the scale of emerging environmental and social problems. Solving known problems rationally is a part of design, but can hardly provide anything like a solid foundation for it. Ultimately, the problem is one of creativity and critique, imagining something better than what exists, not the lack of rational justification (see Figure 2.1).

Small wonder that Gedenryd's conclusion about the usefulness of self-proclaimed rationalistic design processes was grim.[12] When he was writing his thesis, he was able to build not only on the disappointment of the rationalist program, but also on the rich debate of the limits of rationalism. For example, the Berkeley-based phenomenologist Hubert Dreyfus analyzed the assumptions at work in artificial intelligence. Despite their prowess in calculation, even the most sophisticated computers could do a few things any child could, such as speaking, understanding ambiguity, or walking. Several computer scientists followed in the footsteps of Dreyfus' critique.[13] The 1980s was a decade when most humanities and social sciences turned to French social theory and philosophy that further eroded belief in rationalism.[14] In the 1990s, Kees Dorst and Henrik Gedenryd followed Donald Schön's pragmatist perspective, arguing for seeing designers as sense-making beings rather than problem solvers.[15]

Also, there were several well-spoken critics in the field coming from the social sciences and the human-centered corner of computer science. For example, Lucy Suchman studied how people use copy machines at Palo Alto Research Center. She demonstrated how rational reasoning has little to do with how people actually use the machines, and urged designers to take social action seriously.[16] Participatory designers and critical information systems researchers borrowed from Ludwig Wittgenstein's philosophy

to understand how ordinary language works at the background in any system.[17] Groups at the University of Toronto, Stanford, Carnegie Mellon, MIT, and many other American universities proved that technological research can be done without complex rationalistic methodology on pragmatic grounds.

2.1 The User-Centered Turn: Searching the Middle Way

After the demise of the design methods movement, designers turned to the behavioral and social sciences in their search to find new beginnings. In several places, user-centered design gained a foothold.[18] In terms used by Nelson and Stolterman, the rationalists were idealists in their search for truth. When this search was over, the next place to look at was the real world.[19]

This step was not radical, given designers' self-image. Designers have long seen themselves as speakers for people in the industry. The global organization for industrial designers, ICSID, defines the basic ethos of the occupation as follows:

> *Design is a creative activity whose aim is to establish the multi-faceted qualities of objects, processes, services and their systems in whole life cycles. Therefore, design is the central factor of innovative humanization of technologies and the crucial factor of cultural and economic exchange.*[20]

As this definition shows, designers see themselves as proponents of people in the industry. This self-image has more than a grain of truth, especially when designers are compared to engineers.[21] This self-image has deep historical roots. The importance of studying people was first forcefully introduced to design in post-war America, largely through practitioners like Henry Dreyfuss, one of the founding fathers of design ergonomics. In particular, Dreyfuss' books *Designing for People* and *Measures of Man* influenced generations of designers.[22]

However, it was in the 1990s that industrial design and the emerging interaction design went through the so-called user-centered turn. The key idea was that everyone has expertise of some kind and, hence, can inspire design. In retrospect, the most important ideas from this time built on usability and user-centered design.

Usability fell on the fertile ground of ergonomics and spread quickly. Its roots go back to the early 1980s, with companies such as Digital Equipment Corporation and IBM at the forefront. Early on, usability was divided into two camps: practical engineers and researchers whose backgrounds were usually in cognitive psychology.[23] Usability laboratories popped up in hi-tech companies

and universities in North America, Japan, and Europe, and the academic community grew rapidly. Practitioners built on books like *Usability Engineering* by Jacob Nielsen, while the more academic field was reading books like Don Norman's *The Design of Everyday Things*.[24]

The problem with usability was that, while it did help to manage design problems with increasingly complex information technologies, it did little to inform design about the "context" — the environment in which some piece of design was meant to do its work. The image of a human being was that of an information processor, a cybernetic servomechanism.[25] Context was but a variable in these mechanisms. New, more open methods were developed, and they came from ethnography.

The design industry started to hire ethnographers in the 1970s, first in the Midwest and the Chicago area and slightly later in California.[26] The best known pioneers were Rick Robinson working for Jay Doblin and later E-Lab, and its marketing-oriented rival Cheskin. Interval Research at Stanford, funded by Microsoft's Paul Allen, hired John Hughes and Bonnie Johnson to teach fieldwork. Several anthropologists were hired by major companies in the 1990s, including Apple (1994) and Intel (1996). Another inspiration was fieldwork done in design firms like IDEO and Fitch. These were quick and rough ethnographies done very early in the design process for inspiration and provided a vision that worked as "glue" in long and arduous product development processes. Yet another American precursor was Xerox PARC, where design was infused with ethnographic techniques, ethnomethodology, and conversation analysis.[27] Through PARC, ethnomethodology influenced a field called "computer-supported collaborative work" (CSCW). The aims of much of this work were summarized by Peggy Szymanski and Jack Whalen:

> *Plainly, as social scientists these researchers were committed to understanding the fundamentally socio-cultural organization of human reasoning and action …. moreover, these researchers were equally committed to naturalistic observation of that action — to leaving the highly controlled environment of the laboratory so that what humans did and how they did it could be studied in real-world habitats and settings, under ordinary, everyday conditions.*[28]

In Europe, an important inspiration was Scandinavian participatory design, even though its radical political ideology was lost when it spread to industry. Although its direct influence was not felt much in design beyond the borders of Scandinavia, it had a degree of impact in software development and later in design in the United States.[29] It also had limited impact in art and design schools. Still, in retrospect, it managed to do two things typical to contemporary design research: working with people using mock-ups.[30]

Eureka: Fieldwork Leads to an Information System

Written by Jack Whalen

How can you design an information system that enables a firm's employees to easily share their practical knowledge, and then put this knowledge to use each and every day to solve their most vexing problems? (See Figure 2.2.)

Most companies have tackled this problem by brute force, building massive repositories of their reports, presentations, and other officially authorized documents that they hope contain enough useful knowledge to justify the effort, or by placing their faith in artificial intelligence, designing expert systems that basically try to capture that same authorized knowledge in a box. Yet everyone recognizes that much of any organization's truly valuable knowledge, its essential intellectual capital, is found in the undocumented ideas, unauthorized inventions and insights, and practicable know-how of its members. Most of this knowledge is embodied in the employee's everyday work practice, commonly shared through bits of conversations and stories among small circles of colleagues and work groups, with members filling in the blanks from their own experience.

Researchers at Xerox's renowned Palo Alto Research Center (PARC) came face to face with this reality only after they first took the artificial intelligence (AI) route, designing a sophisticated expert system for the company's field service technicians to use when solving problems with customers' copiers and printers. Its knowledge base was everything that was known about the machines — everything in "the book." But the researchers soon discovered, after going into the field and observing technicians as they went about their daily rounds, that technicians often had to devise solutions to problems for which "the book" had no answer — what you could call "the black arts of machine repair." A way to share this kind of knowledge throughout their community — an information system designed to work like those stories and conversations, and managed by the community itself — is what technicians needed most.

And so together the technicians and PARC researchers co-designed a peer-to-peer system for sharing previously undocumented solutions to machine problems that are invented by technicians around the world, and named it Eureka. From the very start, Eureka saved the company an estimated $20M annually and continues to do so, with Xerox being named "Knowledge Company of the Year" by *KMWorld Magazine* (and garnering several other IT and management awards) as a result (see Figure 2.3).

Figure 2.2 Observing technicians at work in Eureka project.

Figure 2.3 Research and design process in Eureka.

From such humble beginnings, the field has grown over the past few years into a community of industrial ethnographers sizeable enough to run an annual international conference, Ethnographic Praxis in Industry (EPIC). As its founder Ken Anderson explained, it was designed mainly to share learning between practitioners of design ethnography. Still, it also sought academic approval from the American Anthropological Association to make it more than a business conference where consultants run through their company portfolios (Figure 2.4).[31]

The outcome of this work was a series of fieldwork techniques that became popular in the second half of the 1990s. American interaction designers also created a blend of analytic

However, user-centered design had its problems too. Ethnography mainly focused on the early stages of design, and usability at its very end, which limited their usefulness. User-centered design was software-oriented in its tone, and slowly spread to other fields of design. Both were largely seen as imports from sociology, anthropology, and psychology. They were also seen as research rather than design practices. Also, if stretched to a prophecy, user-centered design fails: as Roberto Verganti argued, most products on the market are designed without much user research.[33] For reasons like these, user-centered design failed to attract a following, especially among more artistically oriented designers.

Figure 2.4 Why study people? It is not difficult and provides better results than thinking.

and communication techniques, such as "personas." These are constructed, detailed descriptions of individual characters done to both highlight research results and to encourage developers to implement the design team's design. Through scenarios, designers study the viability of these concepts in different future situations.[32]

For good reasons, both usability and user-centered design are alive and well today. In particular, they placed people into the middle of design and gave credibility to designers' claims that they are the spokespersons of people in production. It also produced many successful designs, and provided design researchers ways to publish their research.

2.2 Beyond the User

Despite these limitations, user-centered design created powerful tools for understanding people and creating designs that work. However, it was just as obvious that it was not able to respond to many interests coming from the more traditional design world. User-centered design methods may have helped to explore context for inspiration, but it left too many important sources of imagination in design unused.

Constructive design researchers have had good reasons to go back to contemporary art and design in search of more design-specific methods and ways of working (see Figure 2.5). The past 15 years have seen a proliferation of openings that not only build on user-centered design, but also go beyond it. Several research

Figure 2.5 Making people imagine is a problem in constructive design research.

groups have begun to address the problem of creativity with methodic, conceptual, technological, and artistic means.[34]

2.2.1 Design Practice Provides Methods

One push beyond the user was methodic. The 1990s and 2000s saw the growth of "generative" research methods that put design practice at the core of the research process. These design-inspired methodologies include experience prototypes, design games, and many types of traditional design tools such as collages, mood boards, storyboards, pastiche scenarios, scenarios, "personas," and various types of role-plays.[35] There is no shortage of such methods: Froukje Sleeswijk Visser listed 44 user-centered methods in her doctoral thesis at Delft, and IDEO introduced a pack of cards having 52 methods (see Figure 2.6).[36]

One striking feature of much of this work is the speed at which it has gained influence and has been adopted by its audience even beyond design. In the computer industry, scenarios and personas have become mainstream, while in industrial design, cultural probes, Make Tools, and action research have spread fast.[37] These methods have been quickly adapted to a wide variety of design work, often with a limited connection to the intentions of the original work.[38] Still, they have given designers ways to research issues like user experience. They also help to open the design process to multiple stakeholders.[39]

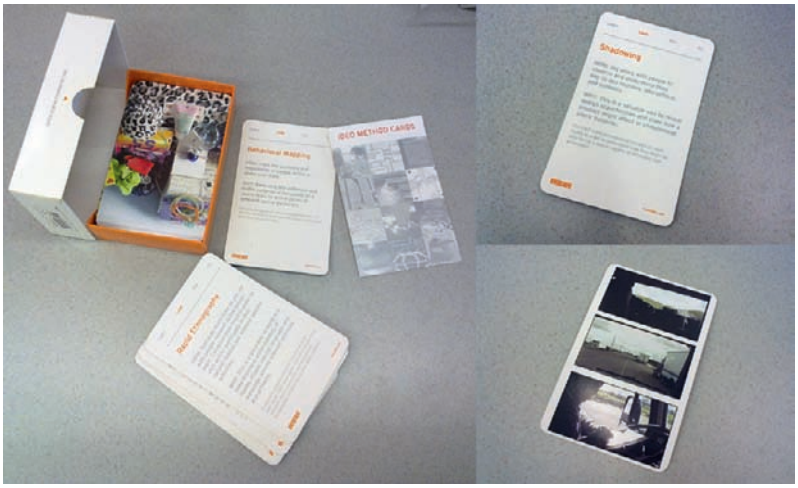

Figure 2.6 IDEO methods cards. These cards describe design methods in words on one page. The other side gives an illustration of the method.

2.2.2 Turn to Technology

Another important concept that has pushed design research beyond user studies can be loosely called the "sandbox culture." This is similar to engineering in Thomas Edison's Menlo Park, or in the hacker culture of Silicon Valley in the 1970s. One can, as engineers at the University of Toronto, turn a (computer) mouse into a door sensor without going into the physics of sensors. The *modus operandi* of the most successful design firm in the world over the past two decades, IDEO, has been characterized as "technology brokering": finding problems and solving them by finding answers by exploring technology creatively through engineering imagination, not scientifically.[40]

The most famous sandbox culture existed at MIT's Media Lab under the leadership of Nicholas Negroponte, where the old scientific adage "publish or perish" became "demo or die."[41] Other sandbox cultures that served as exemplars for design researchers were Toronto, Carnegie Mellon, the Interactive Television Program at Tisch School of the Arts at New York University, and Stanford's design program.[42] They showed that it is possible to do research with things at hand without complex justifications and theoretical grounds and just let imagination loose in the workshop.[43] This is typical of software design as well.[44] The prestige of these places has also given legitimacy to building new sandboxes in places like Technische Universiteit Eindhoven.

MIT Media Lab

Maybe the best known sandbox has been the Media Lab at MIT in Cambridge, Massachusetts. It was created in 1985 with a mission to explore and develop media technologies. It had precursors in New York University, where Tisch School of the Arts had run an Interactive Telecommunications Program (ITP) under Red Burns since the early 1970s.

However, while ITP focused more on media content, and gradually grew into technology, MIT focused on technology from the beginning. Its mission was to explore and develop new media technologies and to conceive and illustrate new concepts by prototyping them. This is where Media Lab started, and this is where it still stands. Its moment of glory was probably during the second half of the 1990s when the IT industry exploded with the Web and soon after with mobile technology (see Figure 2.7).

For a while, the Media Lab was one of the most closely followed research institutions in the world, as judged by the digital industries. Several other institutions were modeled after its example in Asia and Europe; the most famous of these was probably the short lived Interaction Design Institute Ivrea in Italy.

When one walks into the building in Massachusetts, there are no classrooms and corridors, only workspaces in which people sit in the middle of wires, sensors, circuits, computers, lights, and "old materials" of many sorts, most of them organized in open spaces where it is possible to walk around and try out the "old materials."

Several famous concepts have been discovered in the Media Lab. Some of the most influential in the research world have been Hiroshi Ishii's interactive ping pong table and his bottle interface for a music player.

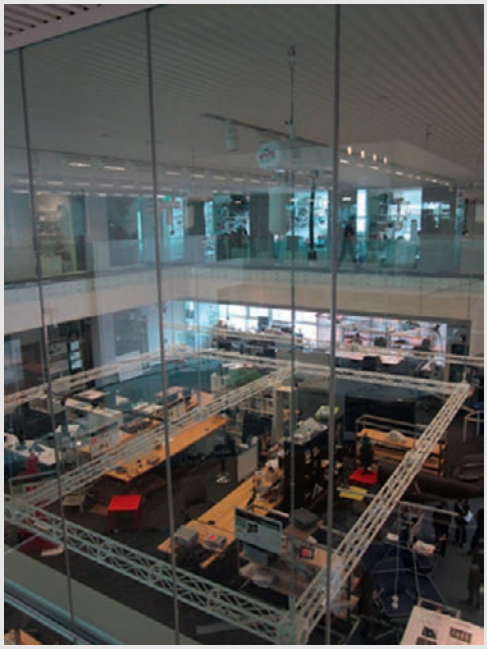

Figure 2.7

From a constructive design research standpoint, the Media Lab well illustrates three points. First, doing is important for designers: one can create new worlds by doing. Second, design research needs design; design happens at the Media Lab, but it is not a priority. Duct tape creations are enough, because prototypes are used to illustrate technological, not design possibilities. Third, a focus on technology means that technological research comes before wrting. The Media Lab is famous for the prototypes it creaters.

The co-founder of the Media Lab, Nicholas Negroponte, is said to have replaced the old academic adage "publish or perish" with "demo or die." (See Figure 2.8.)

Figure 2.8

The main legacy of this culture is several research communities exploring new possibilities in information technology. For example, by now, there are conferences specializing in ubiquitous and pervasive computing and tangible interaction. For those constructive researchers who specialize in interactive technologies, these communities provide many types of publication possibilities. Also, by now, there are many design frameworks ranging from resonant interaction to rich and intuitive interaction. Chapter 4 presents some of these frameworks in detail.

2.2.3 Enter User Experience

In the 1990s, design researchers created many types of concepts that paved the way to constructive research. Important trailblazing work was done at IDEO and SonicRim, where Uday Dandavate, Liz Sanders, Leon Segal, Jane Fulton Suri, and Alison Black emphasized the role of emotions in experience and started to build the groundwork for empathic methodologies.[45] In Europe, the leader was probably Patrick Jordan at Philips, who claimed that design

should build on pleasure rather than usability.[46] Influential studies like Maypole followed his lead, usually building on concepts like need.[47]

This hedonic and emotional movement was a useful correction to cognitive psychology, which had crept into design research through usability and design studies focusing on what designers know and how they think.[48] It remained individualistic. The key constructs of this movement were difficult to understand. It focused on measurable emotions at the expense of more finely tuned emotions like aesthetic feelings, which are crucial to design.

For reasons like this, the main conceptual innovation came to be user experience, which was open enough and avoided many of these problems.[49] It did not have unwanted connotations like the word "pleasure," and was not contested like "aesthetics," which has a history in aesthetics, art history, and philosophy. This concept has been so successful that leading universities, corporations, and design firms have built units to study user experience. Even the International Organization for Standardization (ISO) is trying to create a standard for user experience in industrial practice. Finally, pragmatist philosophy gave this concept credibility, depth, and openness.[50]

2.2.4 Design Tradition as Inspiration

Yet another push beyond user-centered design came from design. The key place was the Computer-Aided Design program in the Royal College of Art (RCA) in London. Its researchers explored new media in city space and alternative ways to design electronics. They explicitly built on art and design and had an agnostic tone when it came to science.[51]

For example, the main influence of the *Presence Project*, published in 2000, was an artistic movement called "situationism."[52] What came to be known as "critical design," on the other hand, built on designers like Daniel Weil who had questioned the design conventions of electronics.[53] Critical design was also influenced by Italian *controdesigners*, and from the Dutch design concept Droog Design, which was also inspired partly by Italian design.[54]

Today, many design researchers seek inspiration from art and design,[55] and many are also active debaters and curators.[56] The art and the design worlds are also converging commercially, with one-offs, limited editions, and prototypes becoming objects sold by major auction houses.[57] There are hundreds of books about designers' sketches in bookstores, effectively representing designers as artists. Media celebrates designers much as it

has celebrated artists. Also, there have been company research centers that have had artist-in-residence programs.[58]

2.3 Between Engineering, Science, Design, and Art

This history has left a legacy to constructive design research, which lies on several foundations. A good deal of early design research was built on rationalistic models that in the beginning faced many kinds of political and scientific difficulties. Constructive design research has turned away from this foundation. Researchers seek inspiration from engineering as well as from the social sciences and design traditions. What it is doing is important: it is bringing design back to the heart of research.

By now, constructive design research has gained a degree of maturity and autonomy. There have been several milestones in this maturation. Methods like scenarios, personas, Make Tools, and the cultural probes played an important role in lowering designers' entry into research. These methods have proved that many things in design practice can be turned into research methods fairly easily. After the end of the 1990s, conferences like Design+ Emotion, Designing Pleasurable Products and Interfaces, and Nordes[59] gave designers an opportunity to explore design-related topics with little gatekeeping from other disciplines. A few influential books have served as precedents; noteworthy are Anthony Dunne and Fiona Raby's *Design Noir* and Dunne's *Hertzian Tales*. Several dozen doctoral theses build directly on design rather than borrow methodologies and concepts from other disciplines (see Figure 2.9).[60]

The development is uneven. The strongest institutions have taken leadership. Among universities, the most research-driven are well-resourced schools such as Politecnico di Milano, technical universities in Delft and Eindhoven, Carnegie Mellon University, and what was the University of Art and Design Helsinki (now a part of Aalto University). Among global companies, leaders included Intel, Microsoft, and Nokia, and some of the largest design firms like IDEO.[61] Among pioneers were Delft's IO Studiolab, which combined several studios at the end of the 1990s, Smart Products Research Group in Helsinki's UIAH, Philips' visionary programs, and Intel's anthropological fieldwork.[62]

Underneath this canopy, a good deal of the design world went on as before. However, the strongest schools and companies set examples for others to follow. Once they did the trailblazing, others found it easier to follow suit.

Although constructive design research is coming of age, this is only one part of the story. This research is typically

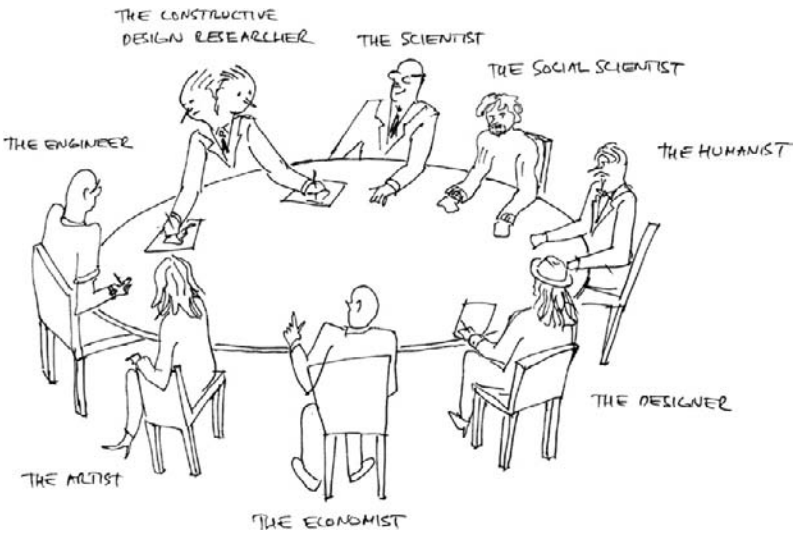

Figure 2.9 The two-headed design researcher (homage to Henry Dreyfuss).

multidisciplinary and takes place in institutions over which designers have little control. Constructive design researchers typically collaborate with sociologists, anthropologists, and computer scientists. In these research groups, design researchers are often junior partners who needed to follow the models of research from their more established colleagues.[63] Some consequences of this collaboration have left a mark on constructive design research. For example, experimental research became an almost unquestioned choice for constructive design researchers, especially in technical universities and the technology industry.

Design also juggles with the worlds of art and culture. Even designers who work with industry typically have one foot in art and culture, as in the famous case of Olivetti. Designers working for Olivetti in Ivrea, about 100 kilometers west of Milan, also continued living and working in Milan with company approval. This organization made it possible for designers like Ettore Sottsass and Michele de Lucchi to alternate between industrial work and Milan's artistic and intellectual milieux.[64] Today, it is easy to see a similar balancing act in some researchers' work coming from the RCA at Sheffield-Hallam University and several Scandinavian universities. These researchers sometimes work at the university and sometimes as independent designers and artists. They also mix these worlds in their work in various ways, especially in the ways in which they communicate their work through exhibitions rather than books.[65]

Constructive design research has managed to gain a degree of autonomy and recognition on its own, but it has to find its way through an environment that sets many standards for research.

In research today, coalitions are a norm, not an exception. These coalitions tend to be strategic and temporary, usually lasting for only one project, and then disappear as parties move to other projects.[66] To flourish in this environment, constructive design researchers need methodological and theoretical flexibility.

End Notes

1. Simon (1996, pp. 2–9). Perhaps characteristically, Simon's ideas remained open in *The Sciences of the Artificial*. The best way to understand this book is perhaps to see it as an opening into a new domain, a prolegomena, to borrow the words of his colleague Jim March (1978). His notes on design remained so abstract that there is simply no way to know where they would have led, should he have built a complete research program based on them. Simon's biographer, Hunter Crowther-Heyck (2005, p. 176), said that characterizing Simon's work as a collection of prolegomena is "uncharitable, but not entirely inaccurate." For more recent analyses of systems thinking in design, see Sato's notes in his 2009 paper (pp. 32–34), and Forlizzi (forthcoming).
2. Archer (1968), Jones (1992, but first edition in 1970), Alexander (1968), Simon (1996), and Lawson (1980). The most influential of these writers is probably Jones, whose text still appears, even at doctoral-level research, as the definitive document of what design research is about. His rational approach on design was based on the notion of "complexity," claiming that new problems like urban traffic systems required methods and processes that could not be found from existing design traditions. Jones' (1970) solution was a matrix in which methods were classified by their place in the design process. The process was one in which a problem was first discovered and then transformed into design ideas that were then broken into subproblems. These subproblems were to be solved one by one and then combined into alternative designs that were then evaluated to find the best solution to the problem.
3. Gedenryd (1998, p. 1).
4. The now (in)famous new introduction to Jones' (1992) *Design Methods* not only said that the rationalistic program failed but also changed its form: it referred mostly to artists like John Cage and consisted of drawings, poetry, and fictional narratives. His book *Designing Designing* (Jones, 1991) developed this radical approach further, telling designers to discard rationalism and focus on imagination instead.

   It is hard not to agree with his call, but it is also worth noting that his solution does not have to be followed, turning the very design process into a critique and even travesty of design or, by implication, design research. Here, the problem is the same as in science, but more general: scientists and social scientists sometimes turn to poetry and the performing arts in an effort to break the conventions of their craft. However, more often than not, their work is not on par with poets, performance artists, and dancers. It is far easier to behave as an artist than to be one.

   Similarly, Alexander (1971) said in an interview:

   > *There is so little in what is called "design methods" that has anything useful to say about how to design buildings that I never even read the literature any more…. I would say forget it, forget the whole thing. Period. Until those people who talk about design methods are actually engaged in the problem of creating buildings and actually trying to create buildings, I wouldn't give a penny for their efforts.*

This statement should be taken with caution. One irony here is that Alexander was talking about architecture. In this field where every building is unique, the idea of *the* method is consequently slightly offbeat. Another problem lies in the notion of method. There are methods that work perfectly well, even though their design could not be reduced to a particular method. That rationalistic methods failed does not mean that every method will fail forever. It depends on how "methods" are understood and even more on what foundations they build upon (see Chapter 7). Finally, Alexander talks about methods, not research, and these are different things.

However, Alexander points to an important issue — the connection between theory and doing. Given his background in mathematics, his interest in formalisms was understandable, but as the first ever to receive a PhD in architecture at Harvard, his theories most likely reflected his background more than his practice. Over time, the realities of practice won.

The difficulty here is that his analysis equates a person with his practice in saying that only practitioners' texts have value. This view does not take into account the social basis of architecture (or design). By his measure, a person like Kees Overbeeke has no value to design research because he is not a designer. This claim is blatantly false, and fails to take into account that Overbeeke's work is necessary in expanding design. We introduce language in detail in Chapter 3, and Overbeeke's work is essential to the welfare of one research program and contributes to design, even though his background is in psychology. Following Alexander's blindness to the social background of a discipline would be plainly destructive.

Coming from a similar background, Horst Rittel's notion of "wicked problems" is indebted to Herbert Simon's earlier work on the limits of rationality. This critique came from within the rationalist movement, and was a part of the paradigm change of the 1960s that paved the way to more philosophical criticisms of the 1980s. We will come back to these later in this chapter.

It must be noted that the design methodology movement continued to inspire design research quietly, in particular in design schools in England, with the exception of design studies, in an attempt to understand designers' thinking (Lawson, 1980, 2004; Cross, 2007; Visser, 2006). This field went into hibernation for two decades (see also Bayazit, 2004, p. 21).

5. Downton (2005, p. 35) noted how

> *Writings concerned with what design should be, have focused on attempting to improve the design process by devising a rational method…. such formulations (labeled as "Design Methods") were accompanied by virtual guarantees that their use would banish irrational design and herald the dawn of the era of rationality. Without wishing to decry such attempts, examination and attempted use over four decades have made it clear that they were ambitious and even misguided…. It is hard, perhaps impossible, to cite a single example of a building or urban design produced through the rigorous and unsullied use of one of these methods. They have left a legacy of many useful strategies and tools that can be used in research for design. The desire to promote means, if not methods, for "improving design" remains alive, although tempered with world-weary awareness, if not cynicism, of post-postmodernism. [italics removed].*

6. For wicked problems, see Rittel and Webber (1973).

7. For a recent review of teamwork and collaboration in design, see Poggenpohl (2009b, p. 139ff) who noted that collaboration has a long, though largely unwritten history in design and also reviews recent studies on managing information and communication as well as issues related to human dimensions of interdisciplinarity.

8. As Herbert Lindinger, himself trained in Ulm, noted in his introduction to a book he edited about Ulm in 1991. The school was established in 1952 as New Bauhaus. After 1956, the school first stressed teamwork, science, research, and multidisciplinary collaboration. From around 1958, scientists like Horst Rittel and Bruce Archer begun to formulate design methodology, and artistic extravagance gave way to scientific caution and value neutral design, both beliefs stemming from logical positivism. As Lindinger said, universal manifestos like "building a new culture" changed to working hypotheses, dubbing the years from 1958 to 1962 as years of "planning mania." Soon, designers became a minority in the school. There was a crisis period that led to a search for balance between theory and practice around 1962 until about 1966, with Tomás Maldonado and Bruce Archer as leading lights (Lindinger, 1991, pp. 10–12).

As this history suggests, the school's position on theory and methodology was not consistent after 1956. As Michael Erlhoff (1991, p. 51) noted in the same collection, Ulm "took the case of modernity … back to the last phase of the Bauhaus, and carried abstraction forward into systematization. The HfG set out to be on the side of the modern age and found itself … subscribing to humanistic principles and so resisting the truth of its own modernity."

The point, quite simply, was that the modern tendency to see the world through abstract, scientific concepts may carry the promise of a rational society, but it also leads to the horrors of the twentieth century. People at Ulm may have learned their methodology from logical positivists, but this dilemma was something they learned from the Frankfurt School of philosophers, most notably Theodor Adorno.

Bonsiepe (1999, p. 13) listed some of the influences of the Ulm School with the demurrer "if my memory does not fail me." His list has a place for positivists, pragmatists, the Frankfurt School, and apparently the late Wittgenstein as well as systems theory, concrete art/constructivism, Abraham Moles' aesthetics of information, and as he said, to a lesser degree, surrealism.

The case for turning design into a science was never on solid ground but was strong enough to attract people like Reyner Banham (1991, pp. 58–59), for whom Ulm was like "a breath of painfully fresh air blowing down from the snowy Kuhberg" after London, where designers still believed in old shibboleths like "form follows function." It was a place where one could take intellectual risks because every claim, no matter how outrageous, was subjected to intense research and debate.

Andrea Branzi had the most notable alternative view of Ulm. For him, people working on the hill of Ulm were extraordinary artists who disguised themselves as ordinary artists (Branzi, 1988, p. 42). We come back to this argument in Chapter 6.

9. Here Maldonado (1972, p. 22) talked about Western rationalism in generic terms, but he captures its spirit perfectly.

> *What is really happening today is that men are being transformed into things so that it will be easier to administer them. Instead of working with men, one can work with schemes, numbers, and graphs that represent men. In that context, models became more important than the objects of the persons of which they were a mere replica. For many years now, the fetishism of models, especially in the fields of economics, politics, and military strategy, has typified the attitude of the late Enlightenment of the modern technocrats.*
>
> *According to these people, perfection of the instructional and decision-making process is possible only if one succeeds in getting rid of all subjective interference with the construction and manipulation of the models used for obtaining that perfection.*

By turning design into a science, one could get rid of "subjective interference" and pave the way to a world of plenty. Revolution would come by design, as Buckminster Fuller once prophesied (cf. Maldonado, 1972, pp. 27–29).

10. Maldonado (1984). This critique, somewhat paradoxically, also extends to art. In a recently republished paper *Otl Aicher*, the Bauhaus gave too much priority to art at the expense of engineering and science. It built on a Platonic idea, in which art was the means to achieve knowledge of the idea, spiritual, and abstract world that lies behind things we see.

Aicher (2009, pp. 177, 181) asked:

> *is design an applied art manifested in the elements of square, triangle, and circle, or is it a discipline that derives its criteria from the task at hand; from function, production, and technology? and noted that this conflict remained unsolved at the Bauhaus "as long as the concept of art remained taboo, as long as an uncritical Platonism of pure form remained in force as a world principle." His example of such Platonism was Rietveld's chairs that "turned out to be nothing more than Mondrians for sitting, ineffectual art objects with the pretext of wanting to be useful.*

At Ulm, the models were designers like the Eameses. As Aicher wrote, "designers like Charles Eames were the first to show what it meant to develop products on the basis of their purpose, material, and methods of manufacture — on the basis of their function," rather than on the basis of geometry. "We all had good reasons to have reservations about the Bauhaus," he concluded (Aicher, 2009, pp. 181–182). In contrast, at Ulm, "the objective was not to extend art into everyday life, to apply it. The objective was an anti-art, a work of civilization, a culture of civilization" (pp. 178, 180–181). This realization in its part paved the way for user-centered design four decades later.

11. Maldonado (1984, p. 5). In this text, Maldonado also refers to Herbert Simon's "limited rationality" thesis. We have omitted this sentence, because we see it as another attempt to salvage rationalistic thinking and its "Cartesian" view of the world as a place of individual entities that can only be known by organizing painstaking observations into more abstract, meaningful entities.

Several intellectual movements have argued that Cartesian thinking presupposes those very things that make it possible in the first place. For example, we relate to things around us not only through ideas in our minds, but also with our bodies, and more often than not with other people. If one accepts the Cartesian worldview, many things are no longer considered. Out goes working with the body and hands; out goes sketching and prototyping; out goes basing design on social meanings; and out go dreams, beliefs, and emotions. Also no longer considered are working with people, studies of non-logical things like religion, integrating non-analytic tasks done by hand, and sketchy design processes designed for flexibility. For design research, this kind of rationalism provides a particularly narrow focus. (See also Maldonado, 1991).

12. Dreyfus (1972, 1993, 2001).

13. Winograd and Flores (1987), Winograd (1996), Dourish (2002).

14. These criticisms pointed out that rationalism has limits that explained a good deal of its elegance. For example, when one does not have to deal with the body, or anything social, it is far easier to imagine people making rational decisions and, as important, obeying them. From a post-Cartesian perspective, rationalism was only possible because something in our lives made it possible: language, social action, our ability to talk and act in an orderly manner. From this perspective, rationalism is but a special case of a far more general way of thinking about humans. Rationalism works in the community when it believes in it, and has the same idea of what is relevant and what is not. This is the case in some closed, isolated communities, and certainly in some academic groups, but rarely anywhere else.

15. Schön (1983), Dorst and Dijkhuis (1995), Dorst (1997), Gedenryd (1998).

16. Suchman (1987). Another important writer who pointed out the importance of looking at social action was Edward Hutchins (1996), who introduced the notion "cognition in the wild," referring to the need to study thinking in real settings. Activity theorists added that there also was a need to look at historical background in any attempt to understand action (Kuutti, 1996).

17. In addition to Ehn (1988a), see Lyytinen (1982, 1983, 1986), Hirschheim et al. (1995), and Nurminen (1988).

18. Focusing on humans is represented in many ways. The design program's Web site at Stanford claims that the idea of human-centered design was invented at Stanford when John Arnold built the design program in the mid-1950s. This may be true, but one should also remember that in the United States, designers like Dreyfuss and Teague had already been working with the military for a long time while putting humans into the middle of design work. In Europe, the Ulm school was built on the same idea, and ISCID was already working to make humans the center point of its definition of design.

When computers became design material in the 1990s, humans became "users," which suggests that they are seen as parts of technical systems (see Bannon, 1991). Seen against the history of design, this was an extraordinary semantic reduction. At its narrowest, people came to be seen as barely more than biological information processing units in technical systems. When reading, say, ICSID's definition of industrial design, one is struck by the discordance to its humanistic spirit.

19. Nelson and Stolterman (2003).

20. ICSID, icsid.org/about/about/articles31.htm, retrieved October 22, 2009. The definition goes back to the turn of the 1950s and 1960s and is based on Tomás Maldonado's thinking. See Anceschi and Botta (2009, p. 23), and note 5 in their text.

Maldonado had his predecessors. Ulm's first principal, Max Bill (2009), was trained in the Bauhaus and used Bauhausian language when writing about design as a human discipline in 1954:

> *the task of the artist is not to express himself and his feelings in a subjective way; it is to create harmonious objects that will serve people…. artists, as part of their responsibility for human culture, have to grapple with the problems of mass production…. the basis of all production should be the unity of functions, including the aesthetic functions of an object … and the aim of all production should be to satisfy people's needs and aspirations.*

For Maldonado and his colleagues in Ulm, the way forward was the then fashionable information theory and linguistics. Otl Aicher tells how one of the first books he acquired for the Ulm School's library was Charles Morris' *Sign Theory*. Its classification of information into semantics, syntax, and pragmatics became a theoretical foundation for him and for Maldonado. For Aicher, this classification revealed that the focus of design must be semantics, that is, communication, not the syntax of elementary geometry then prevalent in avant-garde graphic design and photography. For instance, in photography this led to a study of photojournalists like Felix H. Mann, Stephan Laurant, and Robert Capa whose job was communication, not art.

As Aicher related (2009, pp. 183–185), studies of mathematical logic led him and Maldonado to realize that any answer they wanted to get to their questions depended on the method: "the spirit was a method, but not a substance. We experience the order of the world as the order of thought, as information."

21. For some of the paradoxes here, see Redström (2006).

22. Tilley and Dreyfuss' (2002) *The Measure of Man* in 1959 was a landmark that described the dimensions of Joe and Josephine, two average Americans. The origins of ergonomics — or human factors, as ergonomics is also called in the United States — in America are in the war. As Russell Flinchum (1997, pp. 78, 84) noted, the exact history of how ergonomics came to be established in design is probably lost in old classified materials. Ergonomics in design was largely codified by Alvin Tilley, an engineer working in Dreyfuss' design firm. Tilley used a variety of sources creatively in *The Measure of Man* (Tilley and Dreyfuss, 2002), including military sources, as well as material from Manhattan's fashion industry (Flinchum 1997, p. 87). As Flinchum also noted, the characters of Joe and Josephine were meant to be used as guidelines in preliminary investigations in design; they were never meant to be used as exact descriptions of humans (Flinchum 1997, p. 175).

23. Dumas (2007).

24. Nielsen (1993), Norman (1998), with the original in 1988.

25. For a good analysis of where this worldview came from in computer science and psychology, see Crowther-Heyck's (2005, pp. 184–274) analysis of Herbert Simon and the early stages of artificial intelligence in America.

Few reliable sources exist about Japanese companies' user-centric practices from the 1970s and 1980s, but anecdotes reveal that they were in the frontline with the Europeans and the Americans. For instance, John Thackara (1998, p. 20) admired Sharp's "humanware design" in the 1980s, telling how the company anchored its practice in it and reversed the traditional production-led Western ways in which design attempts to fit product specifications to match factories and laboratories. Instead, "Sharp employs sociologists to study how people live and behave, and then plans products to fill the gaps they discover…. new technology is used to create when consumers are discovered to 'want,'" he wrote.

26. Wasson (2000, 2002), Cefkin (2010).

27. Szymanski and Whalen (2011), Suchman (1987), Crabtree (2003).

28. Szymanski and Whalen (2011, p. 5).

29. For a history of the early years of participatory design in the United States, see Greenbaum (2009). More history can be found in Bannon (2009). Obstacles to participatory techniques in organizations were mapped by Grudin (2009).

30. For participatory design, see Ehn (1988a), Iversen (2005), and Johansson (2005). For contextual design, see Beyer and Holtzblatt (1998). For recent work in combining anthropology and design, see Halse et al. (2010). We will come back to participatory design in Chapters 5 and 7.

31. Ken Anderson and Scott Mainwaring to Koskinen, August 19, 2010, at Hillsboro, Oregon.

32. The main statement of personas is in Cooper (1999). John Carroll has edited and written several books about scenarios (see especially Carroll, 2000).

33. Verganti (2009). One standard complaint about user-centered design is that it leads to unimaginative and conservative design. Although this is only a part of the story, there certainly is a grain of truth in this criticism. However, this criticism has its faults too: there are many examples of short-sighted, designer-driven design that has led to rubbish, and there are better ways to judge how effective a design approach is than by looking at traditional products like coffee pots and sofas. See Verganti (2009) for a defense of designer-driven design.

34. See Green and Jordan (1999) and Battarbee and Koskinen (2004, p. 5).

35. Dandavate et al. (1996), Sanders and Dandavate (1999), Brandt (2006).

36. Sleeswijk Visser (2009, p. 63).

37. Gaver et al. (1999), Mattelmäki (2006).

38. See Boehner et al. (2007).
39 For example, Sanders (2006).
40. Hargadon and Sutton (1997).
41. Our reference to "demo or die," as well as attributing it to the MIT Media Lab under Nicholas Negroponte, is from Peter Lunenfeld (2000).
42. Stanford's "d.school" is an informal name. The full correct name of the institute is Hasso Plattner Institute of Design at Stanford, after its principal source of funds.
43. For example, there exists human–computer interaction, and at least these "computings": mobile, urban, social, physical, collective, ubiquitous, embedded, proactive, and wearable. In interaction design, there are also many "interactions": tangible (Wensveen, 2004), interactive space (interactivespaces.net), aesthetic (Graves Petersen et al., 2004), rich (Frens, 2006a), intuitive (Lucero, 2009), kinesthetic, embodied (Dourish, 2002), emergent (Matthews et al., 2008), and resonant (Overbeeke et al., 2006).
44. Wroblewski (1991).
45. Dandavate et al. (1996), Segal and Fulton Suri (1997), Black (1998).
46. For a push toward hedonic psychology — psychology of pleasure — in the 1990s, see Patrick Jordan's (2000) work. For Maypole, see Mäkelä et al. (2000).
47. Maypole was a project funded by the European Union. Its aim was to study communication patterns in families to suggest new technologies. Participants were the Helsinki University of Technology (and through it, University of Art and Design Helsinki), IDEO Europe, Meru Research b.v., Netherlands Design Institute (which coordinated the project), Nokia Research Center, and the Center for Usability Research and Engineering.

Maypole did field studies of communication behavior. Based on these studies, it developed scenarios and concepts, tested methods and tools, and built prototypes that were then studied in countries like Austria and Finland. For example, one study connected a digital camera to a laptop in a back bag, which immediately allowed it to capture and send images immediately. See Mäkelä et al. (2000). For Maypole, see cordis.europa.eu/esprit/src/25425.htm, retrieved September, 12, 2010; maypole.org; and meru.nl.
48. Lawson (1980, 2004), Cross (2007).
49. For "user experience" in industry and universities, see Shedroff (2001), Forlizzi and Ford (2000), and Battarbee (2004). Theoretically, this notion is alternatively grounded in Dewey's pragmatism (1980; see McCarthy and Wright, 2004), symbolic interactionism (Battarbee, 2004), ecological psychology (Djajadiningrat, 1998, pp. 29–61), or emotional psychology (Desmet, 2002).
50. Usually the main reference is John Dewey (1980), and especially his *Art as Experience*. Over the past few years, there has been more interest in William James, but references to Dewey still dominate research.
51. See Chapter 6.
52. *Presence Project* (2001).
53. Dunne and Raby (2001), Dunne (2005).
54. For Droog, see Ramakers (2002) and Ramakers and Bakker (1998); for radical designers, see Celant in Ambasz (1972). Bosoni (2001) provides a long-term perspective on discourse in Italy.
55. There is no shortage on literature that maps the relationship of art and design. For example, for a particularly knowledgeable analysis of the relationship between pop art and design, see Bocchietto (2008). A good recent example is Stefano Giovannoni's work for Alessi (see Morozzi, 2008). A less consistent account on surrealism in design is Wood (2007).

56. For example, Alessandro Mendini works as an all-around cultural personality whose work is available in numerous designs, but is sometimes also exhibited as art (see Fiz, 2010), and Andrea Branzi continues to curate high-profile events in places such as Milan. For example, see Branzi's *Neues Europäisches Design*, which he curated with François Burkhardt in Berlin in 1991, and more recent exhibitions of *What Is Italian Design? The Seven Obsessions* in Milan's Triennale (Branzi, 2008).

57. For one-offs and prototypes, see Lovell (2009). See also Konstantin Grcic's *Design Real* (2010), which commented on this tendency by showing ordinary industrial products in a gallery. Ordinary products may lack the mystique of one-offs and prototypes, but not functionality and elegance. For how craft can be treated as art, see Ramakers and Bakker (1998) and Holt and Skov (2008).

58. For PAIR, an artist-in-residence program at Xerox's Palo Alto Research Center, see Harris (1999).

59. nordes.org.

60. Dunne and Raby (2001), Dunne (2005), Djajadiningrat (1998), Wensveen (2004), Frens (2006a), Battarbee (2004), Ludvigsen (2007).

61. See Kelley (2001) and Brown (2009).

62. For Philips, see De Ruyter and Aarts (2010) and Aarts and Marzano (2003); for Intel, see Cefkin (2010).

63. This dilemma, and a drift to the applied science model, was already discussed by Herbert Simon in *The Sciences of the Artificial*. Apparently because of prestige bestowed upon the sciences in years following World War II, leading engineering schools of that time were clearly opting for the science-based model, see Simon (1996, p. 111).

64. Ambasz (1972), Branzi (1984). The Olivetti case is from Kicherer (1990, pp. 17, 25).

65. For example, see Freak Show. Strategies for (Dis)engagement in Design, an exhibition in the HelmRinderknecht Gallery in Berlin.

66. Nowotny et al. (2008). We come back to this point at length in Chapter 3.

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3

RESEARCH PROGRAMS

A philosopher of science, Imre Lakatos, once argued that progress in research ultimately lies in research programs rather than individual studies.[1] Progress happens when some piece of research adds new knowledge to or corrects a research program. A successful research program generates new content and new problems in the long run. Any successful research program also has a negative and a positive heuristic. A negative heuristic consists of a "hard core" of beliefs that is not questioned, and a protective belt of auxiliary hypotheses that can be subjected to debate and can be wrong. A positive heuristic tells which questions and objections are important and in what order they are tackled when they show up (see Figure 3.1).[2]

Lakatos' concept gives us a good understanding of how constructive design research works. For example, we see how it consists of various activities. Some work focuses on theory, some on methods, and some on methodology, whereas the main body of work typically consists of constructive studies, reported in journals, conferences, and exhibitions. Also, we see how people take different roles in research.

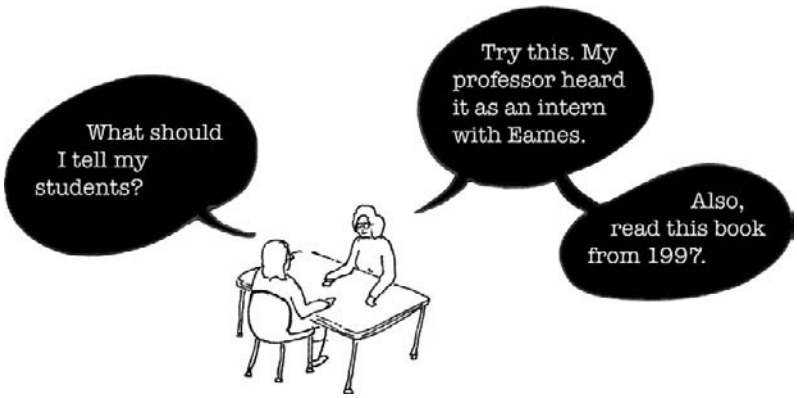

Figure 3.1 Research runs in programs and has a past: research programs enable imaginative dialogs with the past[3].

3.1 Some Features of Constructive Research Programs

By now, there are several successful research programs in constructive design research. Interaction design in Eindhoven is certainly programmatic, and critical design in London has generated excess content over the years. Empathic design, co-design, and action research in Scandinavia have been programmatic, as have service design and design for sustainability in Milan. Research on user experience in Carnegie Mellon also belongs to this group.

In theoretical terms, the most influential work came from the Netherlands and from Pittsburgh. In this work, conceptual and theoretical development took several routes. In Delft, researchers first built on J.J. Gibson's ecological psychology, but soon they turned toward design issues like pleasure and emotions. A few years later, research focus in the Netherlands shifted to Eindhoven, where researchers were increasingly interested in emotions and experience. So far, these researchers have created several frameworks for designing interactive technology.[4] On the other side of the Atlantic at Carnegie Mellon, user experience became the new cornerstone, followed by an interest in social ecology and the concept of self.[5]

Initially these programs created little new theory. Instead, emerging interaction design borrowed theory from more established fields and researchers like the cognitive and ecological psychologist Don Norman.[6] However, recent work in places like the Netherlands and Carnegie Mellon University has clearly gone beyond cognitive psychology. Researchers are currently interested in issues like identity and how people function in the world with their bodies.[7] Constructive design research is gaining a theoretical core.

Some programs are also gaining a "hard core" of non-debatable beliefs—for example, the fate of "cultural probes" (see Chapter 6). Their main ideologist was Bill Gaver, a former cognitive scientist, who rejected scientific methodology and built an artistic methodology to replace it. His main inspiration was situationist "psychogeography," which urged artists to construct situations that would lead people to notice how their unthought-of routines restrict their lives.[8]

However, with few exceptions, designers and human–computer interaction (HCI) researchers who used the probes overlooked this artistic background and turned the probes into a data collection technique akin to diary studies. In 2008, Kirstin Boehner and her colleagues defended the original intentions of the approach against these "misuses."[9] They noted that cultural probes originally aimed to subvert or undermine traditional HCI methods, not supplement them. For them, the hard core of

the probes lies in what they call the hermeneutic or interpretive methodology. The room for debate is in the details of probes, not in the basic approach.[10]

Cultural Probes

Cultural probes have become commonplace in European design research. Originally, they were developed at the Royal College of Art in the second half of the 1990s. A milestone article was published in 1999 by Bill Gaver, Tony Dunne, and Elena Pacenti.

As the name suggests, this method has a metaphoric basis. Quite simply, the idea is to send probes to culture, just as oceanographers send probes to the oceans or scientists send them to outer space. The probes gather samples from wherever they go, and send them back to researchers, whose job is to make sense of them.

A typical "probe" was a package of things like a disposable camera with instructions about what to shoot, postcards with provocative questions, diaries, metaphoric maps, and slightly later, all kinds of technological looking objects. Every package had instructions about how to do the tasks the researchers wanted (like photographing one's favorite place or the contents of the refrigerator) and about how to send the data back to researchers.

The social sciences have had a long and suspicious history of "diary studies." Researchers cannot control how and when people fill the diaries, which means that a sociologist or a psychologist does not know how to interpret these data.

Different from diary studies, from the beginning the probes were described as non-scientific instruments that did not collect representative and accurate data. This non-scientific tone extended even further; for example, to make sure that the probes were also interesting to the people who got them, researchers gave them to people personally. Also, the probes were to be projective and reflect the personality of the researcher rather than be a neutral instrument. Furthermore, the probes were built on artistic references. Finally, Gaver and others refused to give instructions about how to analyze the probes while vehemently denying that it is possible to analyze them scientifically since this was not their purpose.

The probes have gone through a long history of misunderstandings and misuses — some intentional, some unintentional. During the past decade, however, this methodology left a long mark on design research: it is playful and designers love its philosophy.

Gaver (1999).

Also, programs have a social organization. They have precursors, followers, and critics. When looking at empathic design in Helsinki, the precursors came from places like Palo Alto Research Center, the contextual inquiry of Hugh Beyer and Karen Holtzblatt, participatory design, SonicRim, IDEO, and Jodi Forlizzi's work on user experience.[11] However, theoretical work quickly took philosophical and sociological tones. Books like *Empathic Design* articulated the interpretive foundations of this work, but empathic design also built on pragmatist and ethnomethodological references.[12] Research methods were borrowed from other researchers and practice, but were used creatively. For instance, Tuuli Mattelmäki recast the cultural probes in interpretive terms.[13] Key

case studies were done in several projects, including Väinö, which focused on senior citizens, and Morphome, which focused on proactive information technology. This work has influenced research in Scandinavia and in Delft, Carnegie Mellon, and Milan.[14]

3.2 Imagination as a Step to Preferred Situations

When Herbert Simon famously defined design as an activity that tries to turn existing situations to preferred ones, he pointed out a crucial feature of design — it is future-oriented. Designers are people who are paid to produce visions of better futures and make those futures happen.

However, although constructive researchers share Simon's general aim of improving the future, the way in which they work is different from what he proposed. Writing in the science-optimistic and technocratic post-world America, he was able to build on a very particular version of science. This is hardly viable in recent, more skeptical times in which research is tied to society in far more ways than during the era of Big Science. As the failure of the design methods movement suggests, design and design research will fail if they are reduced to a formula.

Constructive design researchers do not try to analyze the material world as Simon suggested, nor do they see design as an exercise in rational problem solving. Rather, they imagine new realities and build them to see whether they work. The main criterion for successful work is whether it is imaginative in design terms. Theirs is a science of the imaginary (see Figure 3.2).

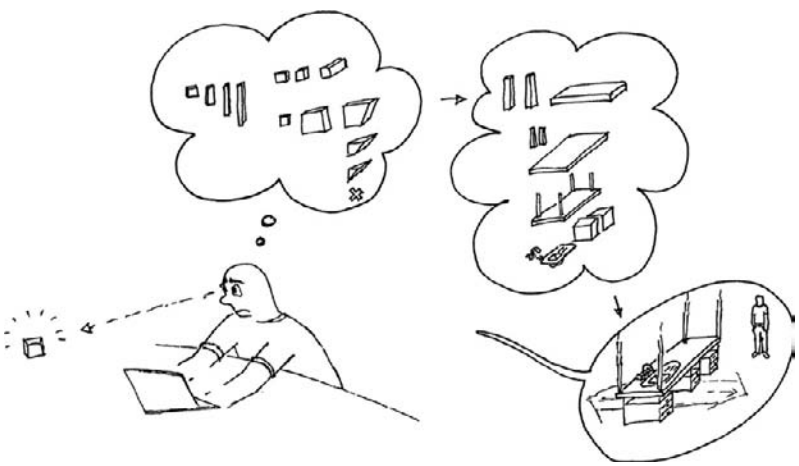

Figure 3.2 A path to preferred states goes through imagination.

For designers, imagination is methodic work rather than a mental activity. They do not produce those futures by themselves, but as a part of a larger community of practitioners ranging from engineers to many types of professionals and other actors. This work takes place in a cycle that begins with an objective of some kind, and continues to user studies. These studies lead to concept creation and building mock-ups and prototypes that are typically evaluated before the cycle begins again.[15]

There is also another way in which imagination characterizes constructive design research. The things produced by researchers are seldom produced. Making them into commercial products would require the resources of major international corporations, which is clearly beyond most researchers' powers.[16] Evaluating constructive design research by whether it leads to products is unfair, especially when researchers are faced with "wicked" issues that can hardly be solved by anyone.

3.3 Making Imagination Tangible: Workshops and Studios in Research

Another design-specific characteristic of constructive design research is that it builds things, which is reflected in its infrastructure. Typically, this infrastructure consists of comfortable studio-like places that house discussions and create concepts and goes all the way to workshops with heavy machinery as well as computer and electronics labs.

In these places, ideas are made tangible, first with cheap materials like scrap wood, scrap metal, or foam, or in the case of software, programs in some test environment. Just as in any sandbox, iteration goes on until something survives critique. In this work, analysis and reasoning are important, but equally important is design experience, whether it is based on emotions, feelings, or intuition.[17] This work may start from theories, methods, and fieldwork findings, and just as often it begins with playing with materials, technology, and design precedents.

Over time, this culture creates a stockpile of concepts, designs, technologies, platforms, and stories that carry the culture and give it a distinctive flair. Without this culture of doing, many things of interest to designers would go unnoticed.[18] What would specifically be lost are those visual, material, and cultural and historical sensitivities Sharon Poggenpohl sees as essential to design.[19] Designers have to worry about things like how some material feels, how some angle flows gracefully over an edge, or how interaction works.

In an extreme form, this kind of culture has existed in places like the MIT Media Lab. In its hacker culture, doing has always

been more important than reflection. This culture aims at pushing technologies to the extreme and finding ways to do things previously regarded to be impossible. However, the culture comes under various names such as innovation in Stanford's "d.school," the quality in interaction in Technische Universiteit Eindhoven, or simply education and teaching design skills in places like IO Studiolab at Technical University of Delft and Aalto University's Department of Design.[20]

Sometimes the culture is not bound to one place but to a regional network, as in Lombardy, where designers have explored design possibilities with industry through prototypes, one-offs, and limited editions.[21] Invariably, there is a "community of practitioners" with a variety of skills in doing, critique, and theory that keep the culture going (Figure 3.3).[22]

Workshops and studios are necessary, but are not the right condition for a healthy constructive design research program. A program may be successful for a few years if it hits the right technological or political gold mine. However, when returns from this mine get leaner, this model faces difficulties. For example, during research on tangible interaction the MIT Media Lab was followed globally, but now this following is far less extensive. Although researchers continue producing interesting prototypes, the Media Lab produces new thinking at a far slower pace.

3.4 How Constructive Design Research Produces Meaning

That constructive design research is grounded in imagination is also reflected in how researchers understand their contribution. Andrea Branzi wrote that the task of design research is to keep distance from the "pure practice of building."[23] For him, design in second modernity should offer alternatives rather than try to alter reality directly. No doubt, most constructive design researchers agreed with him when he wrote:

> *The architectural or design project today is no longer an act intended to alter reality, pushing it in the direction of order and logic. Instead the project is an act of invention that creates something to be added on to existing reality, increasing its depth and multiplying the number of choices available.*[24]

Here designers can learn from architecture. As Peter Hall notes following Cranbrook's Scott Klinker, architecture has a rich body of discourse based on hypothetical designs.[25] This is also the case with design, even though hypothetical products tend to

Figure 3.3 Downward: three pictures of studios; four of material-based workshops; three shops with industrial machinery. (Pictures from Helsinki, Bengaluuru, Borås, Pasadena, and Delft.)

play a less prominent role in it than in architecture, where most plans are never realized.[26] Plainly, if hypothetical designs are successful, they may change the ways in which people think about material and social reality. They can open up possibilities and prepare action.

Having a discourse based on hypothetical designs has several consequences: it enriches imagination and opens new ways of seeing and discussing opportunities.[27] It also provides exemplars and precedents that may be useful when new problems and opportunities emerge. This discourse may sound like art, but it may also provide important preparation for the future, much as a play prepares children for their later years.

Design has many types of hypothetical discourses, many of which have commercial roots. As Anthony Dunne and Fiona Raby wrote:

> *Critical design, or design that asks carefully crafted questions and makes us think, is just as difficult and just as important as design that solves problems or finds answers. Being provocative and challenging might seem like an obvious role for art, but art is far too removed from the world of mass consumption … to be effective…. There is a place for a form of design that pushes the cultural and aesthetic potential and role of electronic products and services to its limits…. Critical design is related to haute couture, concept cars, design propaganda, and visions of the future, but its purpose is not to present the dream of industry, attract new business, anticipate new trends or test the market. Its purpose is to stimulate discussion and debate amongst designers, industry, and the public.*[28]

Not only critical designers propose alternatives to the present. When Philips hired Stefano Marzano to lead its design team in the mid-1990s, one of his first initiatives was a visionary process called Vision of the Future (Philips Design, 1995). The aim of the project was to re-imagine products rather than create science fiction like new worlds. It was design fiction, based on the idea that it is important not to accept existing economic and technical constraints. The results were a book, a Web page, and a series of traveling exhibitions focusing on themes like the kitchen. The aims of the project were very different from those of Dunne and Raby's critical design: Vision of the Future and several other projects re-imagined better futures instead of trying to disrupt existing ones. Still, for a company like Philips, this was an exceptional move. Since then, many companies have done projects like these. Perhaps most famous of these is Alessi.[29]

Needless to say, there are many ways to construct and understand such alternative discourses (see Figure 3.4). Some of these discourses try to alter and redo existing products such as concept cars, haute couture, or *Droog Design*. Some discourses take

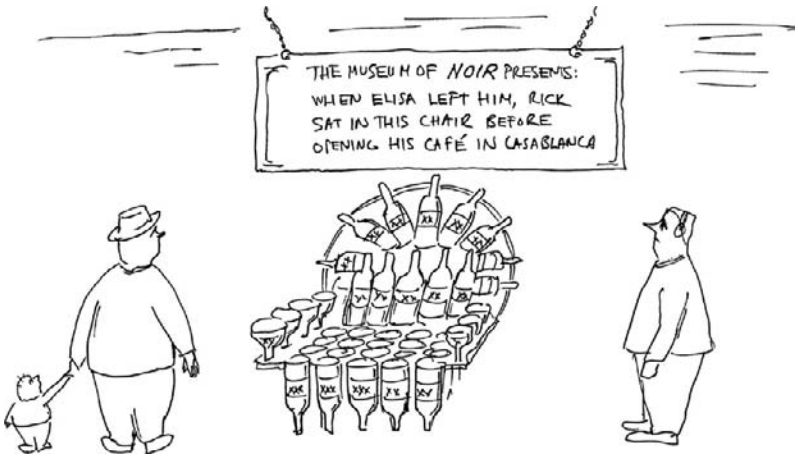

Figure 3.4 Why not design for tormented *film noir* characters?

more critical overtones, providing designers not only with a mandate to think differently but also a mandate to think about what deserves to be created and what does not.[30] At the more radical end, such discourses aim at creating utopias. Most designers obviously fall in the middle of this scale. They want to make a difference but are far humbler about their powers than they were in the 1960s.[31]

From a bird's eye perspective, these differences are less important than the goal, which is to provide alternatives to deeply ingrained habits of thinking. If we say that since people have certain goods and they use certain technologies then they have to use them in the future as well, we have committed an error in judgment. Following the Cambridge philosopher G.E. Moore, philosophers call this error the "naturalistic fallacy": inferring from what is to what ought to be. Its consequence can be called the "conservative fallacy": thinking that what exists today cannot be improved. Wake-up calls are occasionally needed.

3.5 Toward Socially Robust Knowledge

Constructive design researchers are not alone in thinking about knowledge as statements in social discourse. As the sociologists of science Helga Nowotny and James Gibbons have noted, contemporary research is linked to society in many ways and faces many kinds of public and private scrutiny. The key questions most institutions that fund research ask are what kinds of applications research produces and what are its social, economic, and ecological implications. Research has to survive discussions in those boardrooms in which politicians and captains of industry decide where to allocate resources.[32] Many things in research have their

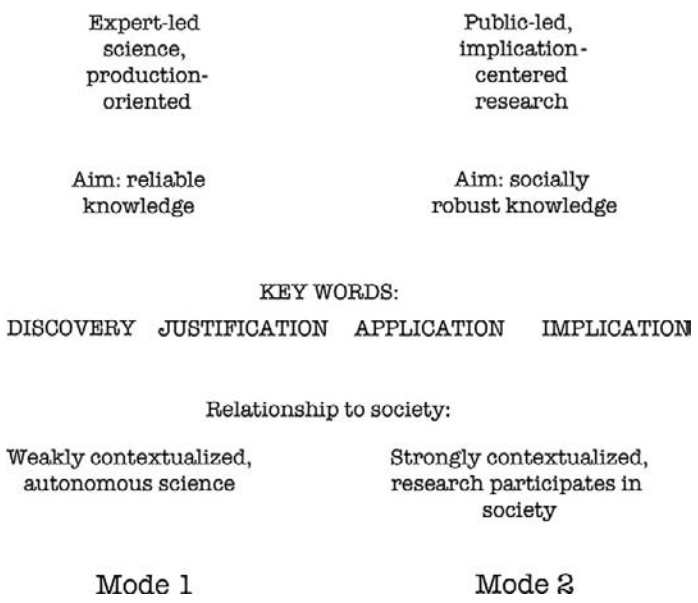

Figure 3.5 The sociologist of science, Helga Nowotny, and her colleagues distinguish two "modes" of science: Mode 1 and Mode 2. Mode 1 is typical to first modernity and Mode 2 research is typical to second modernity.

origins outside research programs; social forces shape research agendas, priorities, topics, and methods (see Figure 3.5).[33]

This is where we need to revisit the notion of the research program. Lakatos was mainly interested in understanding how physics works; however, we need to keep in mind that he wrote in the 1960s. Back then, science was able to maintain a high degree of autonomy because governments, public monopolies, and oligopolistic companies funded it. Scientists worried about making discoveries and reliable explanations rather than about applications or implications, that is, what knowledge does to society. The ideal was to produce unbiased, freely shared knowledge among the community of peers.[34] How scientific knowledge was applied was another story. This was an era of knowledge transfer: what science discovered, society adapted.

Few constructive design researchers believe in the more authoritarian version of science. For them, research programs have to be in dialog with society. This dialog makes research socially robust. Whether it raises debate is more important than facts and knowledge; these are understood as temporary constructs. This is certainly the case in most parts of the constructive design research community. A successful constructive program participates in public discourse and interprets society rather than acts as a legislator.[35]

End Notes

1. Lakatos (1970).
2. We are not the first ones who have introduced Lakatos to design research. See also Glanville (1999) van der Lugt and Stappers (2006). Binder and Redström (2006) used the term in an architectural sense. Peter Downton proposed to rate programs in terms of how much danger to existing thinking its core idea posed. At the extremes are ideas that are capable of affecting personal practice and ideas that have power to invert existing knowledge. However, as Downton noted, it is too much to expect too much: most research programs "only contain small dangers" (Downton, 2005, p. 9).
3. As Juhani Pallasmaa notes, "the great gift of tradition is that we can choose our collaborators; we can collaborate with Brunelleschi and Michelangelo if we are wise enough to do so" (Pallasmaa 2009, p. 146).
4. Wensveen (2004), Frens (2006a).
5. Forlizzi and Ford (2000), Battarbee (2004). For social ecology, see Forlizzi (2007). For designing for self, see Zimmerman et al. (2009).
6. In historical contexts, interaction design has to be used cautiously. IDEO's Bill Moggridge (2006) claimed to have invented the term "interaction design" and, historical research pending, may be right. Along with IDEO, he certainly made it popular. For important textbooks on interaction design, see Schneiderman (1998), Preece (1990), and Sharp and Preece (2007).
7. For example, Overbeeke (2007), Forlizzi (2007), Zimmerman (2009).
8. Gaver et al. (1999), *Presence Project* (2000), Debord (2002). As Jappe (1999, p. 4) noted, the situationist notion of "spectacle" is indebted to commodity fetishism, as Karl Marx called the confusion of exchange value of a product with its value in use.
9. Boehner et al. (2007).
10. Boehner et al. (2007, pp. 1083–1084. In fact, Boehner et al. used the wrong terminology here. If the probes build on hermeneutic and interpretive thinking, they become humanistic and social science instruments rather than artistic expressions. For a balanced account of how the probes have been used and how tensions exist in the probing community, see Keinonen (2009).
11. Suchman (1987), Beyer and Holtzblatt (1998), Ehn (1988a), Forlizzi and Ford (2000).
12. Koskinen et al. (2003), Battarbee (2004), Kurvinen (2007).
13. Mattelmäki (2006).
14. For example, Forlizzi and Battarbee (2005), Sleeswijk Visser (2009), Rizzo (2009).
15. For example, see Szymanski and Whalen (2011, p. 12).
16. See in particular Joep Frens's thoughts about prototyping in research in Chapter 4.
17. Stappers (2007; see also Chapter 4). There is a lot of sandbox culture in science too. Again, Herbert Simon provides an example. After learning elementary programming and meeting Allan Newell in 1952, Simon and Newell decided to build programs that could play chess and construct geometrical proofs. They worked on what became the Logic Theorist, which was able to construct proofs from Russell and Whitehead's *Principia Mathematics* in 1955–1956, first in a sort of simulated computer, then in RAND Corporation's computers. Simon's excitement in finding an environment in which he could test his mathematical theories of human action is easy to sense from Hunter Crowther-Heyck's biography (2005, pp. 217–232).
18. In this section, we are influenced by Julian Orr's (1996) work on the work culture of copy machine repair men.
19. Poggenpohl (2009a, p. 7). See also Chapter 1.
20. For how the sandbox culture is integrated into research through teaching at TU/Eindhoven, see Overbeeke et al. (2006).

21. See Branzi's (2009) *Serie Fuori Serie* exhibition catalog from Triennale di Milano and Lovell (2009).

22. The notion of community of practice is from Brown and Duguig (2000).

23. Branzi (2006, p. 16).

24. Branzi (1988, p. 17).

25. Hall (2007). As innovation-focused schools, he classified IIT in Chicago and Stanford, while in the humanities camp he placed Philadelphia and Parsons after Jamer Hunt. On the art school route are the Royal College of Art in London and Cranbrook Academy of Art, which "have reputations for critical thinking and producing sexy imagery of objects — often more hypothetical than manufacturable," as Hall noted in his essay.

However, some of the greatest revolutions in design have come from people like Ettore Sottsass, who described himself in a *Museo Alessi* interview in 2007 as a "theoretical designer; just as there are theoretical physicists who … don't make plans for getting to the moon [but] think about what sort of physical laws a person going to the moon may encounter." This is just a metaphor, but there is a point in it. Many followed Sottsass; in effect, he became a theorist of design (see Museo Alessi design interviews, Sottsass, 2007, p. 24).

26. Dunne and Raby (2001, p. 59).

27. Molotch (2003). Andrew Abbott, a leading sociologist of professions, noted that there are professions like the military whose work almost totally consists of such hypothetical discourses (Abbott, 1988). Scenarios prepare for possible action.

28. Dunne and Raby (2001, p. 58). This quote is important because it shows many connections to practice. Indeed, quite often the best design ideas never enter the market but remain in the conceptual practices of designers.

29. For *Vision of the Future,* see Philips Design (1995). For other projects by Philips Design, see Philips bookstore at design.philips.com/about/design/designnews/publications/books/ (Retrieved August 11, 2010). *The New Everyday* was published not by the company, but by 010, an art and design publisher based in Rotterdam (Aarts and Marzano, 2003).

Alessi's projects have been described by Robert Verganti (2009). Some examples done with design universities are *The Workshop* (Alessi and UIAH, 1995) and *Keittiössä: Taikkilaiset kokkaa Alessille — UIAH Students Cooking for Alessi* (Alessi and UIAH, 2002).

30. The quote about what deserves to be created is taken from the first paper written by Tomás Maldonado after he came to Ulm. This was the how he distinguished Ulm's education from that of Bauhaus. Bauhaus, he wrote, was "content … to produce people who can create and express themselves," while "the Ulm school intends to mark out the path to the highest level of creativeness, but at the same time, and to the same extent, to indicate the social aims of this creativeness, i.e., which forms *deserve* to be" (Höger 2010, p. xvi).

31. For a design-focused analysis of these utopians, see Maldonado (1972, pp. 21–29). For art, see Bourriaud (2002, pp. 45–46), who noted that contemporary art mostly seeks to construct concrete spaces instead of utopias.

32. Nowotny et al. (2008) talked about "agoras" rather than marketplaces, stressing the political character of public places like the square where free men of Athens convened to decide the affairs of the city-state.

33. Nowotny et al. (2008, p. 131).

34. As a sociologist of science, Robert K. Merton idealistically formulated that science was characterized by the values of communitarianism, universalism, disinterestedness, and organized skepticism (see Merton, 1968). This formulation is from the 1930s.

35. The metaphors of "interpreter" and "legislator" are from the Polish-British social critic Zygmunt Bauman (Bauman and May, 2000).

4

LAB: CAN YOU REALLY STUDY DESIGN IN THE LABORATORY?

The sociologist Morris Zelditch, Jr., once published a paper called "Can You Really Study the Army in the Laboratory?"[1] Under this provocative title, he wrote about the limitations of studying large institutions in a laboratory. Zelditch's answer was yes, if the study is done with care. This chapter shows that this is true in design as well.[2] It is impossible to study a phenomenon like design in the laboratory in its entirety; design has many faces, only some of which are appropriate for laboratory studies. The trick, however, is to see which ones are.[3]

The historical foundations of this methodology are in the natural sciences, but it usually comes to design through psychology. The aim is to identify relationships designers might find interesting; for example, how the limits of human cognitive processing capabilities affect error rates in using tablet computers. The design justification for this methodology is straightforward: if such relationships were found, they could be turned into mathematical formulas that would provide a solid ground for design.[4]

This chapter is about the logic of laboratory studies.[5] Actual research tends to be impure in terms of logic; in particular, early stage user studies aiming at inspiration tend to be done with probes and contextual inquiries. They are qualitative and inspiration-oriented and are typically combined with laboratory-style studies. For example, Stephan Wensveen used cultural probes for inspiration in the early stages of his research.[6] Experimental work typically happens in concept testing and selection and in the evaluation phase of the prototypes. Although the ethos of this tradition comes from experimental psychology, researchers borrow from other ways of doing to complement it.

4.1 Rich Interaction: Building a Tangible Camera

Our example is from Technische Universiteit Eindhoven, where Joep Frens designed a camera with a rich interaction user

Design Research through Practice.

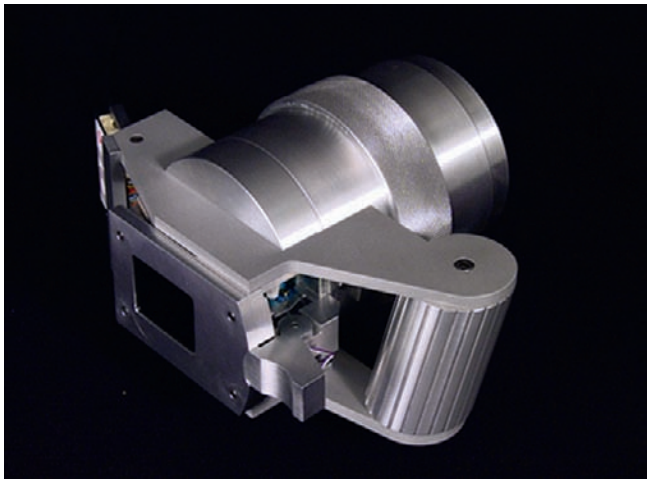

Figure 4.1 Joep Frens' rich interaction camera. (Picture by Joep Frens.)

interface and compared it to conventional cameras. The standard interaction approach in industry is based on a menu on a screen, which can be navigated with buttons. Frens aimed at creating an alternative to this standard approach.

While conventional digital cameras typically have controls based on buttons and menus on screen, rich interaction cameras had tangible controls. For example, with a rich interaction camera, the photographer could take a picture by pushing a trigger and save it by pushing the screen toward the memory card. To delete it, he had to push the screen back to the lens. Frens designed these unconventional forms, interactions, and functions so that the photographer could read the possibilities for action and function from the form (Figure 4.1).

Building on ecological psychology and literature on tangible interaction, Frens created a series of hypotheses for each camera variation to be able to compare user experience. Frens' main hypothesis was that a rich interaction camera is more intuitive to use than a conventional camera. Another hypothesis was that people think it is more beautiful. The cameras were stimuli in his study; measures for things like use and beauty came from Marc Hassenzahl, a German design psychologist.[7]

Frens' design process was driven by a wish to find alternatives for the prevalent industrial interaction paradigm for cameras. His inspiration came from his knowledge of trends in interaction design and from his background research, not from user studies. Research questions, hypotheses, and the rich interaction framework came after the first designs, and they were based on the insights gained during the design process (Figures 4.2 and 4.3).

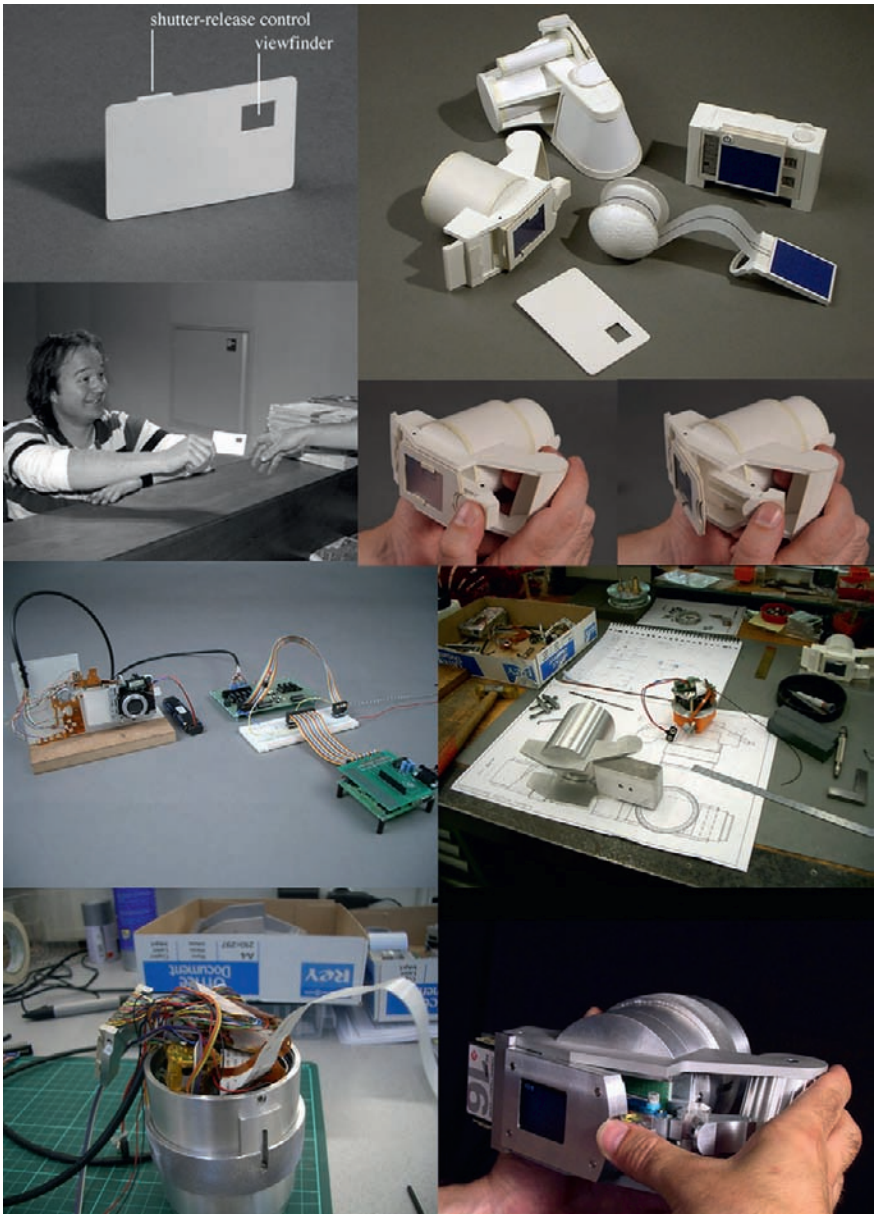

Figure 4.2 Joep Frens's approach to constructive design research. Building a rich interaction camera through mock-ups and prototypes. Top two left: details from a service scenario with a simple mock-up. Top three right: cardboard mock-ups from one camera variation. Below, clockwise from bottom left: fitting electronics into the cask, hacking existing technology; building a case, and final prototype of one camera.[8] (Pictures by Joep Frens.)

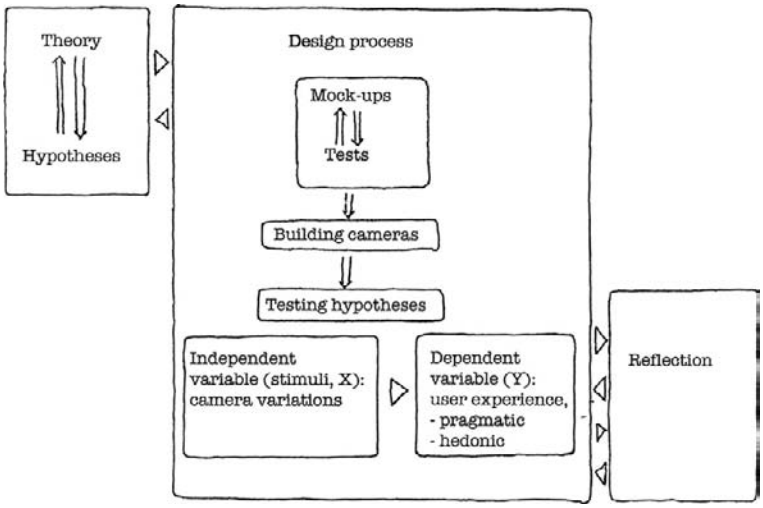

Figure 4.3 Joep Frens's research design.

Frens built several camera prototypes out of cardboard and tested these with students. Having a good idea of how to build a rich interaction camera, he built the body from aluminum. He also built several control modules that could be fitted to the body. The first module was with conventional controls; the second with light controls; the third with mixed controls; and the fourth with rich controls, all within the same form language. These designs formed a scale. At one end was an interface using conventional menus and buttons. At the other end was a radically reworked camera with tangible controls only.

He went on to test these cameras with 24 students of architecture in a laboratory setting. Each student received instructions, viewed the camera, and took photographs with it.[9] This study was repeated four times, once for each camera variation.[10] User experience was evaluated with a questionnaire. Afterward, the participants compared the cameras and completed a closing questionnaire.

From a cognitive psychology perspective one would expect that the rich interaction camera would do worse than a traditional one, as it breaks the user interface conventions of cameras. However, it did not, and it was appreciated by many of the participants. The rich interaction camera did not fare better than other cameras in aesthetic and practical terms. Still, Frens was able to say that his design was successful. At a more fine-grained level, the results were also positive. For example, saving images was found to be pleasing with the rich interaction camera, which participants also found more beautiful than other cameras.

4.2 Laboratory as a Site of Knowledge

Studying things in a laboratory means that something is taken out from its natural environment and brought into a controlled area where it can be subjected to experimentation. Almost anything can be studied in the laboratory: armies, design, chemical reactions, rich interaction, and so forth.

The trouble with studying a phenomenon in the real world is that usually many things shape it. This makes it difficult to find what causes something one sees; there are typically several possible explanations, and it is impossible to rule any of them out with a high degree of certainty. Research becomes an exercise in "what about if.…"

Studying a phenomenon in a laboratory helps with this problem. The laboratory gives the researchers an opportunity to focus on one thing at a time. Most typically, this "thing" is a relationship, such as the relationship of rich interaction and user experience in Joep Frens' study. The laboratory also helps researchers study alternative explanations and competing hypotheses; doing this is far more difficult in natural settings. After researchers have eliminated alternative explanations, they are able to confidently say things about how rich interaction improves user experience in camera design. It is possible that the results are wrong, but this is highly unlikely.

Causes, Effects, and Variables

Scientists do not talk about "things" but use more specialized terminology. Things that exist before the phenomenon to be studied takes place are called "independent variables," which explain the behavior of "dependent variables." In addition, there are intervening, background, and consequent variables.

Ideally, a researcher should be able to state his hypothesis as a function $y = f(x)$, where y represents the dependent variable and x the independent variable, although this function is usually far more complex.

A hypothesis is an explanation based on theory: it is researchers' best guess about how the function works before they do a study. The hypothesis is not true before empirical proof, but there are theoretical reasons to think it will receive such proof.

Notice that the aim of experimental research is not to capture everything in a causal system; the aim is to focus on the key relationships.

When specifying causal systems, there are a few useful rules of thumb, such as supposed causes always ought to precede effects, and things that come first in time should precede things that follow. Perhaps most important, as the word "variable" tells, things in the system have to be able to vary. Other than that, specification depends on theory: theory should tell how x impacts y and how to work with other variables.

An alternative way is to talk about causes and effects, but social scientists usually avoid the language of causality. Talking about variables avoids confusing theoretical language with things this language describes.

In the social sciences, it is also not conventional to talk about the "causes" of what people or their social organizations do. Most social scientists prefer to think that people make sense of situations and act accordingly; whether these products of sense-making can be thought of as causes is a philosophical question.

For example, when Joep Frens built his rich interaction camera to enhance user experience, his independent variables were his cameras (x), while his dependent variable (y) was user experience measured with Marc Hassenzahl's scales. Frens did not study possible background variables like gender, which other researchers might have found interesting. He also left out consequent variables like the effect of his camera on users' satisfaction of life.

Such exclusions belong to any laboratory research: instead of studying everything, researchers have to decide which variables are relevant enough to be included in the research design. Specifying causal systems is a matter of judgment (Figure 4.4).

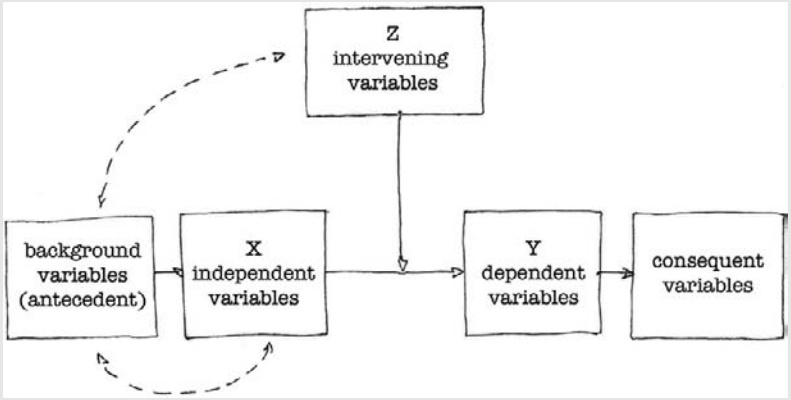

Figure 4.4 Specifying causal systems as systems of variables.

Working in a laboratory has many other benefits. For example, a laboratory can be equipped with instruments that help make detailed and accurate observations and measurements.

> *What is of the utmost importance, we think, when testing the variations, is that the user's actions on the prototype are recorded. We need a trace of the actual interaction, as it is done as soon as one stops to interact. The recordings of setting the alarm clock enabled us to reconstruct step by step how a, e.g., symmetrical pattern was constructed.*[11]

As the laboratory environment and experiments are typically documented in detail, it is also possible to replicate the study in other laboratories. This rules out errors coming from the setting and its research culture. This also applies to issues like "observer effects" — the researcher giving people cues about his intentions. If people understand a researcher's intentions, they may change their behavior to please or to confuse the researcher. There has to be a proper strategy to deal with these effects.[12] Most threats to validity are beyond this book. For example, to see how things

like user experience develop over time, researchers often study the same people several times in so-called time series analysis. However, over time, people in the study learn about the study and change their behavior. There are ways to minimize such threats, but this complicates research design.[13]

Analysis in Nutshell

There are many statistical techniques to study how independent and dependent variables "covary."

To study covariation, researchers typically use some kind of linear model. These range from cross-tabulations to correlations, analysis of variance (ANOVA), and regression analysis. Non-linear techniques like logit and probit regressions are rare in design. Multivariate techniques like factor and discriminant analysis are normally used for pattern-finding rather than for testing hypotheses; they are non-linear and also rare.

For example, in studying whether there is a link between his cameras and user experience, Frens used the camera variations he built as his independent variable. Since he built four user interface variations, his independent variable got four values.

He hypothesized that as these cameras were different, people would experience (which was his dependent variable) them differently in ways that the theory of rich interaction can foresee. His null hypothesis predicted no change or a change so small that it could have been produced by chance.

Frens used several statistical techniques in his study but mostly relied on ANOVA to decide whether his camera variations led to predicted changes in user experience.

Statistical methods do not have to be complex and sophisticated. More attention should be placed on theory and identifying the underlying causal model. If there is no variation in data, it is impossible to find it even with the best statistical tools. As Ernest Rutherford — a physicist with several groundbreaking findings on his list of conquests — reputedly noted, "if your experiment needs statistics, you ought to have done a better experiment."

It is also good to keep in mind that even experienced researchers struggle to find the right model to describe the data. They routinely do dozens of analyses before they are happy with the results; patience is a virtue in statistical analysis.

Similarly, it is good to know that there are differences between methods preferred in different disciplines. For example, psychologists usually prefer some form of ANOVA.

4.3 Experimental Control

The crux of any laboratory study is experimentation.[14] The researcher manipulates the thing of interest in the lab to learn how people react to it while holding other things constant. Typically, he assumes a new design will improve things like user experience when compared to older designs. In research language, the null hypothesis predicting no change is rejected. Having established the basic relationship, researchers study other explanations to see whether they somehow modify results. Ideally, researchers vary one additional variable at a time to see whether it alters the basic relationship.[15]

For example, Frens studied user experience first by varying his camera designs and learned that a rich interaction interface improved user experience. He could have gone further; for example, he could have studied men and women separately to see whether gender somehow was relevant in explaining the link between rich interaction and user experience. However, he chose not to do these additional analyses, keeping his focus on the basic relationship only (Figure 4.5).

Research is successful when the basic relationship exists and the most important competing explanations are ruled out. Thus, if a rich interaction camera functions as expected and there are no serious alternative explanations, the theory about rich interaction ought to be accepted until a better theory comes along. If the first rich interaction camera of its sort is already about as good as conventional cameras, even though cognitive theory would predict otherwise, something must have gone right in the design process.

Selecting what to study and what to leave out is ideally a matter of theory, but equally often, it is also a matter of judgment. Many things influence human behavior, and it is impossible to study everything carefully. What is included is a theoretical question; for example, when Philip Ross selected people for studying his lamp designs, he selected university students with a similar value system in mind (see Chapter 8).[16] This limited his ability to generalize but also made his analyses easier. He would have gained little from knowing how people with different medical conditions would have reacted to his lamps. This might be an interesting question for another study but not for his.

There are also methodic ways to make research designs simpler. The most popular technique is randomized trial, in which

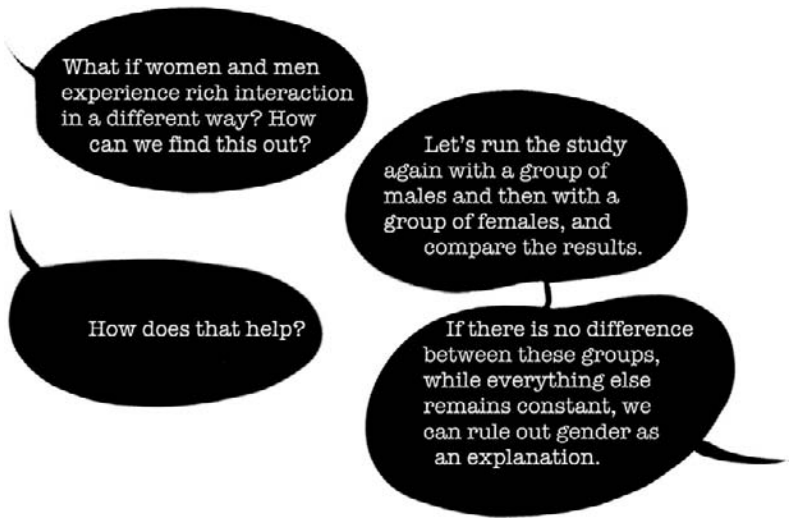

Figure 4.5 Ruling out alternative explanations.

researchers take one group of typically randomly selected people. Then they repeat the study with another randomly selected group. One of the groups is given a "treatment," for example, they have to use a rich interaction camera. The other group gets a placebo, for example, a conventional camera. Researchers measure things like user experience before and after the treatment in both groups, with the expectation that satisfaction has increased more in the treatment group than in the control group. Randomization does not eliminate variables like gender or horoscope sign, but in large enough groups the impact of such variables evens out.

Randomized Trials

The most typical research design, especially in medicine, is a randomized trial. In this research design, two groups of people are drawn randomly and allocated into a study group and a control group.

The study group gets a treatment; for example, in design research, they use the prototype. The control group does not receive this treatment.

A study begins with a measurement in which both groups fill out a questionnaire or do some other test. After the treatment, both groups are measured again. The thing to be measured can be almost anything, but typically it is user experience.

The hypothesis is that the treatment improves the study group's user experience, while the control group does not experience similar improvement. This set of expectations can be written more formally, for example:

1. $m^1_1 = m^1_2$
2. $m^2_1 > m^1_1$
3. $m^2_2 = m^1_2$

All of these conditions should to be compared with appropriate statistics, most typically with t-test or ANOVA.

The smart thing about this design is that it eliminates the need to conduct a new study for each possible alternative explanation, like gender or cognitive style. The number of observations, however, needs to be large enough (Figure 4.6).

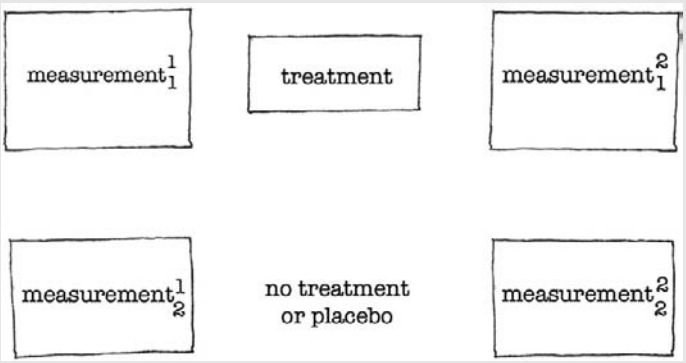

Figure 4.6 Simple randomized trial makes it possible to test whether a treatment leads to change.

4.4 Physical Hypotheses and Design

In constructive design research, the epitome of analysis is an expression such as a prototype. It crystallizes theoretical work, and becomes a hypothesis to be tested in the laboratory. For Stephan Wensveen, it was the alarm clock he built. For Ianus Keller, it was a cabinet for interacting with visual material. For Andres Lucero, it was a space he called the "funky-design-space" meant to support moodboard construction and browsing.[17] For Joep Frens, his camera variations are considered physical hypotheses.

However, adding the design phase to research also adds an important new ingredient to the soup — the designer's skill and intuition.

Stappers recently described some of the complexities involved in treating prototypes as hypotheses. In the design process, a prototype integrates many types of information. Theory is one component in the prototype, but not the only one. For example, ecological psychology tells us to build tangible controls that use human sensory motor skills to accomplish tasks like taking photos or setting the time for the alarm. However, it says little about many of the sensual issues so important for designers, including shape, colors, sound, feel, surfacing, and so on. Ideas for these come from the designer and the design process. As Stappers said:

> *Prototypes and other types of expressions such as sketches, diagrams and scenarios, are the core means by which the designer builds the connection between fields of knowledge and progresses toward a product. Prototypes serve to instantiate hypotheses from contributing disciplines, and to communicate principles, facts and considerations between disciplines. They speak the language of experience, which unites us in the world. Moreover, by training (and selection), designers can develop ideas and concepts by realizing prototypes and evaluating them….*
>
> *The designing act of creating prototypes is in itself a potential generator of knowledge (if only its insights do not disappear into the prototype, but are fed back into the disciplinary and cross-disciplinary platforms that can fit these insights into the growth of theory).*[18]

Elsewhere, Stappers listed some uses of prototypes. They can be used to test a theory, in which case they become embodiments of theory or "physical hypothesis."[19] However, they also confront theories: researchers, whose prototypes cannot hide in abstractions, have to face many types of complexities that working designers face. Similarly, they confront the world. When building a prototype, the researcher has to face the opinions of other people.

Figure 4.7 How a physical hypothesis emerges from various types of knowledge expressed as sheets on the floor. As understanding grows, more knowledge from other disciplines is drawn into the spiral. (Drawing by Pieter Jan Stappers.)[21]

Furthermore, they serve as demonstrations, provocations, and criticisms, especially to outsiders who have not seen their development from within (Figure 4.7).[20]

4.5 Design, Theory, and Real-World Relevance

As Stappers points out, prototyping is more than theory testing, it is also a design act. A design process may be inspired by theory, but it goes beyond it. A prototype is an embodiment of design practice, but it also goes beyond theory. For this reason, design prototypes are also tests of design, not just theory. Indeed, one of the most attractive things in research in Eindhoven has been the quality of craftsmanship. These designs can be evaluated as design statements. They are good enough to please a professional designer aesthetically, structurally, and conceptually.

Research sets some requirements for prototypes at odds with doing good design. Researchers almost invariably aim at simplification; for example, people bring in many types of aesthetic opinions to the laboratory and are barely aware of most of them. The way to control this is to eliminate clutter by keeping design simple. When the subjects' mind does not wander, changes in their behavior can be attributed to the designs. As Overbeeke wrote with his colleagues:

> *Design research resembles research in, e.g., psychology in that it has a minimum of controls built in when exploring the solution when testing variations of solutions. Therefore … "we have kept the*

> *devices simple, pure and with resembling aesthetic appearance." This makes it possible, to a certain degree, to isolate and even manipulate systematically critical variables.*[22]

This is where there is tension. As Stappers noted, research prototypes are not pure expressions of theory; they also embody design values. The more they do, the more difficult it becomes to say with confidence that the theory that inspired design actually works. The secret of success, quite simply, may be design.

This is a catch-22. On the one hand, the more seriously researchers take design, the more difficult it becomes to draw unambiguous theoretical conclusions. On the other hand, when the theoretical frame and the aims of the study guide prototyping,[23] a good amount of design relevance is sacrificed. Ultimately, the way in which prototyping is done is a matter of the researcher's personal criteria for quality and taste. Most design researchers think design quality is more important than theoretical purity, but opinions differ.

Most design researchers, however, find it easy to agree that research prototypes differ from industrial prototypes. As Joep Frens noted, his cameras are finished enough for research but not production ready.

> *Moreover, the prototypes that are presented in this thesis are not products ready for production. The prototypes are elaborated to a highly experiential level so that they can be used in real life experiments to answer the research question … The prototypes can be seen as "physical hypotheses" that have sufficient product qualities to draw valid and relevant conclusions from.*[24]

As Frens related, prototypes are done to see where theoretically informed design leads. Issues like durability, electric safety, and the quality of computer code are in the background. In the foreground are things that serve knowledge creation; it is better to leave concern for production to industry.

4.6 From Lab to Society: The Price of Decontextualization

When things are taken from society to a laboratory, many things are decontextualized; however, this comes with a price. A laboratory is a very special place, and things that happen in the laboratory may not happen in society or may happen in a different way, as conditions are different. Do results of laboratory studies tell anything about real world?

There are several ways to answer this question, and sometimes this question is not relevant. Researchers may want to show that a certain outcome is possible by building upon it, and there is no need to produce definitive proof beyond the construct. This is called "existence proof."[25] This proof is well known in mathematics and is common in engineering but almost non-existent in empirical research. Sometimes, generalization happens to theory, and this is typical in many natural sciences — a piece of pure tin melts at the same temperature whether it is in Chicago or Patagonia.

Usually the jump from the laboratory to the real world builds on statistics. Many things in ergonomics may be universal enough for theoretical analysis, but it is more difficult to argue this in, say, aesthetics or design.[26] Researchers can calculate statistics like averages and deviations for those people they studied. They cannot, however, use these figures only as estimates of what happens in larger populations: it is always possible to err. The basic rule is that as sample size increases, confidence in estimates increases.

Finally, proof goes beyond one study. As Lakatos argued, there is no instant rationality in research.[27] Generalizing from individual studies is risky. However, if a program repeatedly leads to interesting results, it should be taken seriously. It was only after hundreds of studies that the world came to believe that asbestos and tobacco caused life-threatening illnesses. This logic also applies in constructive design research (Figure 4.8).

In actual research practice, these proofs coexist. Again, Frens provided a good example. In terms of an existence proof, his camera shows that it is possible to build rich interaction cameras. In terms of generalizing to theory, his research framework can be applied in many different circumstances. In statistical terms, his empirical results apply to people with a high level of aesthetic

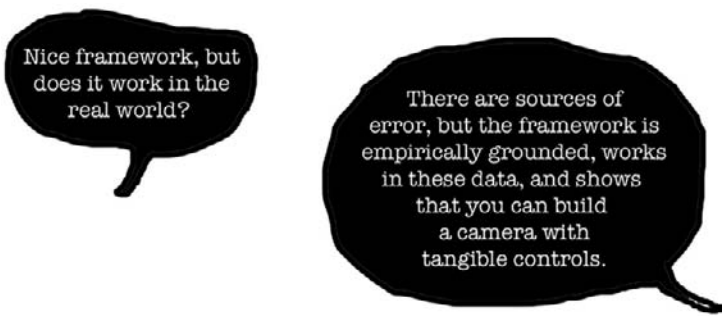

Figure 4.8 From laboratory to real world.

abilities and a great deal of experience in photography. Finally, by now dozens of designs coming out from the Netherlands show that ecological psychology can be fruitfully applied to designing interaction. The burden of proof does not lie on Frens only.

There is a margin of error in even the best of studies; however, after reading Frens, we know more about rich interaction in smart products than before. Researchers are skeptics and do not easily accept anything, but when they accept something, they stand behind it. Proving that a good study is wrong requires a careful study that shows in detail what was wrong.

4.7 Program at the Junction

Recent work in Eindhoven has taken a significant step away from its basis in ecological psychology. Earlier work built on J.J. Gibson's ecological psychology and aimed at formulating conditional laws and constructing mathematical models of actual interaction.[28] Since Kees Overbeeke's inauguration in 2007, however, research has turned to phenomenological and pragmatic philosophy.[29] Ecological psychology worked marvelously well when creating systems that can be used with one's body instead of cognition, but it gave few tools to see how things like social interaction and culture shape conduct. It remained limited in its ability to conceptualize reflection, thinking, and discourse, and these are just the things in the center of the most recent work coming out of the program.

For people trained in philosophy, this may sound risky. Phenomenology makes few claims about explaining human conduct. However, there is a tradition of experimental psychological phenomenology, and Maurice Merleau-Ponty, the key philosopher of psychological phenomenology, built many of his theories on reinterpretations of clinical and experimental studies.[30] Also, there are ways to combine careful measurement and phenomenologically informed theory.[31] William James, one of the founding fathers of the pragmatists, had a background in medicine, making him no stranger to experimental research. Here the line between philosophical thinking and experimental research is fine, but as long as a researcher keeps in mind that experiments are aids to imagination, he is on safe ground.[32]

The push came from Paris where philosopher Charles Lenay and his colleagues recently studied how we perceive other people's perception with our bodies. It is one thing to be alone somewhere and to see things; it is another thing to be there when others see me seeing things. I have to take into account other viewpoints and how they change as time goes by.[33] With his colleagues, Lenay studied Tactile Vision Sensory Substitution, a system developed

by Paul Bach y Rita. This system transforms images captured by a camera into three-dimensional "tactile image," which is applied to the skin or tongue. It is meant to give blind people a three-dimensional perception of their surroundings. For Lenay and his colleagues, this commercial and prosthetic failure provided an opportunity to study how technology mediates perception. They showed what people are able to say when they interact with another person through the system. We give a body image to others, and others respond to this image. We can recognize this response. We know we do not deal with a machine.

This may sound like hairsplitting, but it has important implications for understanding many technologies that are specifically built on social assumptions. People do think about the image they give others because they know that others act on this image and that way affects them. Many "presence" technologies build on similar assumptions, and such considerations certainly shape behavior on social networks on the Web. This question is relevant in traditional design as well. For example, we dress differently for Midtown than we do for the neighborhood bar in Brooklyn because we know people will look at us differently in those places. It is much like looking into a mirror: you become more self-conscious.

This work has recently been picked up in Eindhoven. For example, in her master's thesis, Eva Deckers weaved a carpet that responds to movement of the hand, giving it the ability to perceive and react to people's perception. In her doctoral work, she focused on situations with multiple users.[34] Work like this is bringing the Eindhoven program to a junction. These studies promise a better understanding of many kinds of interactive technologies but also make research more difficult. Importantly, this new direction creates links to twentieth century Continental thinking in the humanities and the social sciences. Recent work is also bringing work in Eindhoven closer to interpretive sociology, ethnomethodology, and discourse analysis. This shift has certainly paved the way for more sophisticated research programs that may fill the promise of providing knowledge of "la condition humaine" — what makes humans tick.[35]

End Notes

1. Zelditch (1969).
2. For example, see Stanley Milgram's (1974) famous studies of obedience, which illustrated how easy it is to make people act against their will and ethics simply by giving them orders. Milgram's studies have been criticized for many problems, but his experiments provide a clear illustration of how one can take a key element of a place like the army — obedience to authority — and study it in isolation in a laboratory.

3. Thanks to Pieter Jan Stappers for some of the formulations in this paragraph, as well as pointing out the relevance of Milgram's work in this context.
4. See Overbeeke et al. (2006, pp. 63–64).
5. Lee (2001). There are many extensions of this methodology, like quasi-experimental studies and living labs, and many other methodologies emulate this model, including surveys based on questionnaires.

   For quasi-experiments, see Cook and Campbell (1979), and for living labs, see De Ruyter and Aarts (2010). Neither methodology has caught on. Quasi-experiments try to vary things like political programs, but as they take place in the open, not in a lab, control is barely more than a metaphor, and this needs to be taken into account. The problem with living labs like smart homes is that despite much of the rhetoric, they seldom combine the best of experimental laboratory work and working in real context, but tend to remain technological showcases or technical proofs of concepts (for a thorough study of smart homes, see Harper, 2003). An excellent introduction to survey methodology is De Vaus (2002).
6. Wensveen (2004).
7. Hassenzahl (2003, 2004).
8. Frens (2006a,b).
9. Technically speaking, these were not cameras but a body containing different interaction modules.
10. The order in which the cameras were given to the participants was varied to make sure that the order in which they were shown did not cause error.
11. Overbeeke et al. (2006, pp. 64–65). The reference to an alarm clock is from Wensveen (2004). Note that this is not always true. Ethnomethodologists have proven that one can use extremely fine-tuned audio- and videotapes for research (see Szymanski and Whalen, 2011). Importantly, this accuracy has a cost: compared to studies in natural environments, laboratory research is far less rich in terms of context. Accurate measurements may mean inaccurate rendering of the context.
12. There is practically a science on observer effects and how they can be controlled, starting from Robert Rosenthal's (1966) classic treatment of the topic. His work is still a standard reference and highly recommended reading.
13. The classic treatment of validity threats in psychological research — and, by implication, any work that involves experimenting and people — is referenced in Campbell and Stanley (1973). The main problem with this book is that it degraded non-experimental research unjustifiably; in particular, Donald Campbell revised his argumentation considerably in the early 1970s. In design research, the most comprehensive effort to minimize such threats is again done by Joep Frens (2006a, pp. 152–153), who showed statistically that the order in which he presented his cameras to participants did not affect the results.
14. As Pieter Jan Stappers noted in private, this is also why the lab is useful for validation studies of already fixed hypotheses but less suited for exploratory/generative studies where research questions evolve.
15. These additional studies help to elaborate analysis and rule out alternative explanations and competing hypotheses. These studies make the initial result more robust and defensible. They may also show that the basic relationship exists only for one group, or even remove the basic relationship altogether, in which case the original relationship is said to be spurious.
16. As Ross (2008, p. 196) wrote, "All participants were students at TU/e, from several departments or Fontys College in Eindhoven. None of these people had experience in interaction design. The advantage of having participants from the same social group (students) was that the factors other than values were more constant than they would be in a heterogeneous participant group."

17. Respectively, Frens (2006a), Wensveen (2004), Keller (2005), and Lucero (2009, pp. 17, 217).

18. Stappers (2007, p. 87). It is important to make a distinction between the prototype and the theoretical work that led into it. Occasionally, design researchers build marvelous prototypes even though their research shows that the reasoning behind the prototype is probably wrong. This was the case in Philip Ross' work, which produced marvelous lamps, but fairly inconsistent theoretical results. That his results were inconclusive and designs attractive suggest that the problem was not in the design process, but in the theoretical framework he used. More typically, researchers do solid theoretical work that leads to fairly awkward designs, at least when judged by professional standards. The reasons for this have been dealt with earlier in this chapter. Most constructive design researchers would probably side with Ross, and sacrifice some theoretical elegance to guarantee enough resources for design. Again, this is common in research: empirical researchers typically sacrifice theoretical sophistication if data so requires. Why not designers?

19. "… we use methods we borrow, mostly, from social sciences. The prototypes are *physical hypotheses* …" (Overbeeke et al., 2006, pp. 65–66, italics in original).

20. Stappers, workshop Jump Start in Research in Delft, June 29, 2010. An updated list will reappear in 2011 in the PROTO:type 2010 Symposium held in Dundee, Scotland (Stappers, 2011).

21. Stappers (2007, p. 12). See also Horvath (2007).

22. Overbeeke et al. (2006, pp. 64–65, *italics* ours).

23. Overbeeke et al. (2006, pp. 64–65).

24. Frens (2006a, pp. 29, 185).

25. Our thanks go to Pieter Jan Stappers for pointing this out.

26. A researcher cannot take a result and say that he proved the theory at work behind the study without first checking his work. The main elements to check include things missing in theory, reliance on only one set of measures, overly simple measurements, the fact that people learn to respond "the right way," and the researchers' own expectations.

27. For Lakatos (1970), see Chapter 3.

28. Overbeeke et al. (2006, pp. 63–64). Caroline Hummels (2000, p. 1.27) talked about conditional laws in her thesis.

29. See Overbeeke 2007.

30. Merleau-Ponty's seminal works that continue to inspire psychological research are *The Phenomenology of Perception* (2002) and *The Structure of Behavior* (1963). Other key figures in phenomenological psychology include Albert Michotte. Also, many late Gestalt theorists like Kurt Koffka were influenced by Husserl's phenomenological philosophy.

31. The best recent example is probably Oscar Tomico's doctoral thesis in Barcelona, which built a method of measuring experience based on Kelly's (1955) personal construct theory. Tomico's thesis was a conscious attempt to combine elements from the empathic tradition of Helsinki with ecological tradition in Eindhoven. Today, Tomico works in Eindhoven.

32. As Overbeeke et al. (2006, pp. 65–66) wrote, their long-time hope is to discover conditional laws of human-machine interaction. However, they also tell that "the level of abstraction in our work is low. We almost argue by case. This is done by necessity; otherwise we would lose the rich human experience."

33. Lenay et al. (2007), Lenay (2010).

34. Deckers et al. (2009, 2010, 2011). See w3.id.tue.nl/en/research/designing_quality_in_interaction/projects/perceptive_qualities/.

35. These are words from Overbeeke et al.'s (2006, pp. 65–66) programmatic paper.

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5

FIELD: HOW TO FOLLOW DESIGN THROUGH SOCIETY

Many design researchers have borrowed their methods from interpretive social science rather than experimental research. If there is one keyword to describe the field approach to design, it must be "context."[1] Field researchers work with context in an opposite way from researchers in a lab. Rather than bringing things of interest into the lab for experimental studies, field researchers go after these things in natural settings, that is, in a place where some part of a design is supposed to be used. Researchers follow what happens to design in that context. They are interested in how people and communities understand things around designs, make sense of them, talk about them, and live with them. The lab decontextualizes; the field contextualizes.

Field researchers believe that to study humans and their use of design they need to understand their system of meanings. Studying humans and studying nature differ in a crucial way because of these meanings. Simply, people make sense of things and their meaning and act accordingly. An apple falling from the tree does not care about the concept of gravity and cannot choose what to do. When the president declares war, he certainly knows what he is doing with his words and knows he has alternatives.[2] Even when people do something out of habit, they are selecting from alternatives and may always change their ways.[3] If researchers see society in these terms, they also think that searching laws that could explain human activity and society is misguided. Instead, they take even the goofiest ideas seriously if they shape human activities.

Design ethnography differs from corporate ethnography, an heir of studies in organizational culture, which focused on issues like management and how symbols integrate organizations. Design ethnography works with product design and is a way to handle cultural risks in industry.[4] Sometimes it is a separate front-end activity, and sometimes it is closely integrated into product development. Design ethnographers typically work in teams and use

Design Research through Practice.

prototypes during fieldwork to create dialog with the people in the study. They communicate through formats accessible to engineers, and their fieldwork is measured in days or weeks, not months. For them, first-hand experience of context is typically more important than fact finding or even careful theoretically informed interpretation.[5] In this chapter, we use "design ethnography" and "field work" interchangeably.

5.1 Vila Rosário: Reframing Public Health in a Favela

Vila Rosário is a design project in a former village that is now a part of the vast metropolis of Rio de Janeiro. It is located about 15 kilometers north of the famous towns Corcovado, Ipanema, and Copacabana. Even though it is not among the poorest of Rio's areas, Vila Rosário is still a world apart from the glory of these famous neighborhoods (Figure 5.1). Its illiteracy rate is around 50%, sanitation is poor, and the poverty level is high. It suffers from high infant mortality and a high incidence of diarrhea, tuberculosis, and many tropical diseases, including yellow fever.

This was the playing field of two designers, Marcelo and Andrea Júdice, who set out to study the neighborhood and create

Figure 5.1 Views from Vila Rosário: (a) a health agent with one family, (b) the backyard of a poor home, (c) the clinic, and (d) the street in front of the clinic. (Photographers: Leila Deolinda, Figures (a) and (b), and Ilpo Koskinen, Figures (c) and (d).)

designs that would improve the town's public health. Initially, they were to introduce information technology into the village to improve the general living conditions of the inhabitants. However, after the first field studies, it became clear that it would not be a solution without considerable rethinking of the context. How could information technology help people who cannot read in a place where it is common to steal electricity?

The study began with cultural probes consisting of cameras, letters, diaries, and several tasks for volunteer health agents working in Vila Rosário.[6] After seeing the probe returns, the researchers realized that any attempt to make sense of Vila Rosário without visiting it would compromise a study aimed at improving health. So the researchers went to the village to do fieldwork and conduct a series of workshops with the locals to make sure they understood the probe results.

The study results identified hygiene and early diagnosis of tuberculosis as the main targets of design. Since it was beyond the means of the project to improve hygiene, the Júdices focused on improving awareness about the significance of hygiene, especially among children. The design hypothesis that evolved was based on this result. It became a combination of an IT-based information system and a low-tech approach. The aims were to raise awareness of how health and behavior are linked and to induce behavioral change among children and teenagers.

Design was started by creating a *telenovela*-like make-believe world with characters recognizable to the inhabitants in Vila Rosário. It was thought that these characters and their actions would stay in the minds of people better than mere health-related information. This world of characters had various types of individuals and families. Also, it had various types of professionals significant in terms of health, including doctors, nurses, nuns, and health agents. It did not, however, have characters like politicians, police, and gang leaders. The world reflected everyday life in Vila Rosário rather than its institutions, which locals did not trust (except the church and doctors).

Computers were pushed into the background. Essentially, IT became a Web connection helping nuns and local health agents (who are like paramedics, with some training in health care) to contact medical experts. Computers were placed in a local health clinic, Institute Vila Rosário, run by the church, which became the hub of the study.

The main effort was to put low-tech designs like comics describing safe ways to use water and cooking utensils (Figure 5.2). Other designs were posters pointing out key facts about hygiene, such as the importance of cleaning fingernails and kitchen knives, and there were also stories for children. The characters in these stories showed what happens to people who do not practice

Figure 5.2 (a) A tuberculosis booklet stressing the importance of paying proper attention to even mild symptoms, (b) an example of the characters created for the booklet, and (c) a poster linking hygiene to health and the logo created for the Institute Vila Rosário. (Artwork by Nestablo Ramos Neto.)

proper hygiene and do not see a doctor when they have symptoms of illnesses like tuberculosis. In addition, researchers created an identity for the program consisting of a series of accessories and company gift-like designs, such as folders, bags, and T-shirts. These were created to make the design program easy to identify and remember.

All these designs were cheap, colorful, relatively easy to produce, and did not produce anything valuable that could be stolen and sold on the black market. Furthermore, these designs fit into the social structure and cultural understandings of Vila Rosário. They were based on the probe returns as well as on ethnographic

Figure 5.3 Pictures from design tests: (a) evaluation in Vila Rosário, (b) studying designs in Helsinki, and (c) evaluation of designs in Namibia. (Pictures of Figures (a) and (b) by Marcelo Júdice and Figure (c) by Andrea Júdice.)

understanding. These sources provided the designers with a necessary understanding of themes important in Vila Rosário, which provided the information to create a local look and feel to the designs. The materials were produced locally, and distributed in Vila Rosário through health agents.

The designs were evaluated in three ways. In Vila Rosário, all of the main designs were evaluated with a variety of local participants in workshops. The focus was on whether people understood the design and whether they were enticing enough to produce. In Helsinki, a Brazilian expert specializing in public health in the tropics evaluated the design proposals. In this evaluation, the focus was on factual content and understanding the health care structure of the village. Finally, the design process was replicated in a two-week workshop in Namibia. Here, the question was whether it is possible to scale down the method developed in the study so that it could be used outside Rio de Janeiro (Figure 5.3).

The Vila Rosário study showed how a serious commitment to context may lead to a major redefinition of a design effort and how this commitment changed design from a technical exercise to a low-tech one. It also showed the importance of understanding the context in detail. The designs generated knowledge about the visible and material culture of the Vila as well as about its habits, beliefs, and social structures. When it comes to design ethics, the study showed serious commitment to poor people who do not usually get to enjoy good design. In terms of design research, it also led to questioning many first-world assumptions; for example, how can probe studies be done when people cannot read?

5.2 Understanding as the Basis of Design

Field research entered industry in the late 1970s and early 1980s mostly as a response to changes in computing.[7] In essence, it was a response to a failed case. When computers moved from

universities, research institutes, and major corporations to homes and offices, users could not understand how these machines worked. The failure was obvious, but prevailing systems design methods were not able to explain why.

In response, researchers started to do fieldwork to see how computers were used in ordinary circumstances. This orientation primarily took place in countries with strong computer industries, with Silicon Valley leading the way. Field research proved to be especially useful for industry in the early phases of product design when requirements are specified. As design anthropologist Christine Wasson noted, "by 1997, every major design firm claimed to include ethnography as one of its approaches."[8]

This was certainly the case in Silicon Valley.[9] In the Valley's IT industries, ethnographic research was a response to the need to understand not only how people could use computers but also what they wanted from computing. Contextual design, in particular, became a business success.[10]

Silicon Valley also gave birth to a more design-led approach to fieldwork. Researchers like Jane Fulton Suri and Alison Black at IDEO and Liz Sanders at Richardson/Smith pushed designers out into the field to see what people do in real life.[11] The idea was to get designers out of the studio to bond with people and to focus on what they do rather than on what they say.[12] For skilled designers, insights drawn from observations are based on years of experience. Fulton Suri discussed about how a few successful designers do fieldwork:

> *Certainly ethnographic-style observation can provide inspiration and grounding for innovation and design. It increases our confidence that ideas will be culturally relevant, respond to real needs and hence be more likely to have the desired social or market impact. But for design and designers there's much more to observation than that.… Successful designers are keenly sensitive to particular aspects of what's going on around them and these observations inform and inspire their work, often in subtle ways. Firsthand exposure to people, places, and things seems to be key, but there is no formulaic method for observation of this very personal kind.…*

But their approach was certainly not without discipline or rigor. Each case involved a similar pattern: a focused curiosity coupled with exposure to relevant contexts, attention to elements that invited intrigue, visual documentation and revisiting these records later, percolation and talking about what was significant with team members and clients, and storytelling and exploration of design choices and details.[13]

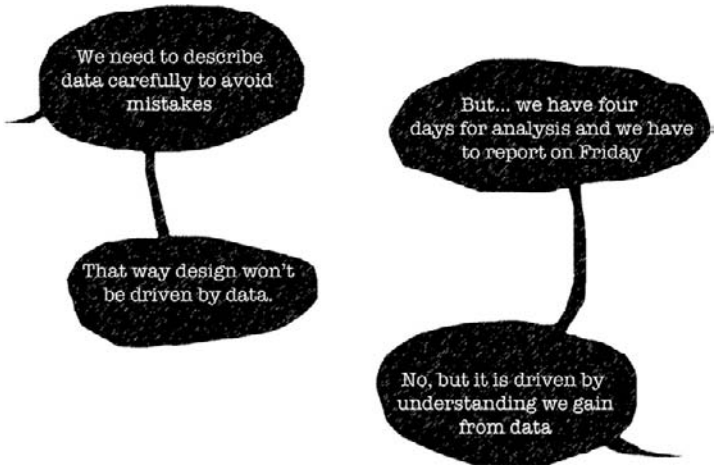

Figure 5.4 Two realities of fieldwork.

This kind of research goes far beyond tourist-like observation; it gains understanding of what goes on in people's minds in some instances. It also goes beyond mere analysis. Making a systematic description of data is a step in the process of gaining an empathic grasp, but research does not stop there. Good design research is driven by understanding rather than data (Figure 5.4).

Somewhere between these orientations were other earlier practices, such as in the Doblin group and later E-Lab.[14] Participatory design was a Scandinavian amalgam of computer science, design, sociology, and labor union politics.[15] It sought to battle deskilling, which the Marxist labor theorist Harry Braverman saw as the main aim of management in his book *Labor and Monopoly Capital*.[16] Instead of making workers replaceable by machines, participatory designers sought to empower workers.[17]

5.3 Exploring Context with Props

Field research methods in design are immediately recognizable to professional social scientists. They are also often taught to designers by social scientists. Still, design ethnography differs from ethnography as it is practiced in anthropology and its sister disciplines.[18] If there is something specific in design fieldwork, it is probably the focus on products and things and the use of mock-ups and prototypes.[19] Even more differences exist when design begins. Designers' analytic methods range from brainstorming techniques and future workshops to such co-design

tools as "magic things," design games, video sketching, and using Legos to simulate products, interactions, and organizations.[20]

> *We put a large number of components together into "toolkits." People select from the components in order to create "artifacts" that express their thoughts, feelings and/or ideas. The resulting artifacts may be in the form of collages, maps, stories, plans, and/or memories. The stuff that dreams are made of is often difficult to express in words but may be imaginable as pictures in your head.*[21]

The aim is to turn fieldwork into an exercise of imagination rather than mere data gathering. In the tough time lines of design, it is hard to view "dreams" by observation alone. If researchers want to learn about things like dreams, people have to be invited to the dream during fieldwork. Sensitizers like Dream Kits are useful for this reason as they function to elicit people's projective fantasies.

For example, from 2008 to 2010, researchers from the Danish School of Design built a model to show how anthropology could be used in design. This model was developed in a book focusing on reducing garbage incineration in Copenhagen. The editor, Joachim Halse, opens the book by calling it a manifesto, stressing its political nature. For him, the book offers a participatory approach for creating design opportunities that evolve around life experiences. The spirit of the study was to lower the line between anthropological fieldwork and design, but there were other drivers as well. One driver was developed to get more and more diverse people involved in the process. In DAIM, shorthand for Design Anthropology Innovation Model, the researchers used mock-ups, acted out scenes, organized design games and workshops, and rehearsed service scenarios with people (Figure 5.5).

5.4 Generating Concepts as Analysis

One problem spot in fieldwork has been explaining synthesis — how design ideas emerge from fieldwork. Synthesis is a creative mash of common sense and research and stresses design opportunities rather than theory. This argument, however, puzzles non-designers, to whom this sounds mystical, to say the least. However, even though most designers avoid references to the social sciences, their methods are systematic.

Broadly speaking, there are two types of approaches that deal with synthesis. Some researchers borrow heavily from the social sciences. They search models from analytic induction, grounded theory, and thick description in symbolic anthropology.[22] Christine Wasson tells how at E-Lab ethnographic data were analyzed from

Figure 5.5 Rehearsing new practices at DAIM. In this project, many stakeholders are brought together to design and rehearse new relationships.

instances of data into patterns. These patterns were then turned into a model that interpreted ethnographic materials and envisioned a solution for the client.

> *The model offered a coherent narrative about the world of user-product interactions: how a product was incorporated into consumers' daily routines and what symbolic meanings it held for them. These insights, in turn, were framed to have clear implications for the client's product development and marketing efforts.*[23]

Most design researchers, however, avoid social science models altogether. They build on well-tried methods from design practice, including well-known models such as the workplace models and

Figure 5.6 (a) How affinity walls generate abstractions.[24] (b) Using affinity diagrams to analyze data to generate design ideas. (c) personas in an exhibition in Kone Corporation, a lift and elevator maker.[25]

affinity diagrams in contextual inquiry and personas in software development (Figure 5.6).

It is easy to add analysis to both procedures. If it is important to study gender, researchers simply analyze males and females separately and compare the results to see what kinds of differences exist. Adding age to this is also easy; researchers simply break the male and female groups into older and younger categories.

There are many overlaps between these two families; for example, working through data using affinity diagrams shares its underlying logic with analytic induction. Still, analytic induction is not always easy. Reflecting on her experiences on teaching ethnography in corporate settings, Brigitte Jordan noted how teaching data collection is easy, but the lack of tradition in analysis complicates analysis in design firms. Social scientists learn the craft of analysis through years of education and fieldwork that are almost impossible to convey "to non-anthropologists during a brief training period."[26] Seen from the other side of the fence, social scientists also fail: designers need more than verbal data and references from social science literature. When designers work with data, they make references to products, conceptual designs, and other pieces of design research rather than theoretical work in the social sciences.[27]

As Wasson noted, the association between ethnography and anthropology is little recognized in design, and the word "anthropology" is almost never heard.[29]An obvious exception is academic research carried out in universities, where it occasionally infiltrates into industrial practice. In particular, ethnomethodology has

Creating an Interpretation[28]

Most field researchers explicate patterns from fieldwork observations rather than analyze them statistically. This process does not have a mathematical basis but is systematic, and outsiders can inspect it to spot problems.

Practice

Practical designers have several terms for this process. The best known term is probably "affinity diagram." These diagrams cluster similar observations into groups, whereas other observations are in different groups. These clusters are then named. Analysis proceeds by grouping these clusters into still more abstract clusters. This process generates an abstract interpretation of data, and it is used as a starting point for design. This is done with Post-it® notes and whiteboards.

Analytic Induction

Social scientists call this kind of process "analytic induction." Just like affinity diagrams, analytic induction begins with observations with more abstract interpretation. The difference is that in analytic induction, researchers make sure that there are no negative cases that would question the interpretation. This interpretation may apply to other data; however, it is best treated as a separate question.

Parsimony

To provide clarity, researchers usually prefer interpretations that consist of only a few concepts. A good interpretation is parsimonious. This is known as "Occam's Razor," named after medieval philosopher Willem Occam. An interpretation that consists of 10 or 20 concepts is difficult to understand, remember, and communicate. Keeping Occam's Razor in mind helps to control this problem. Affinity diagrams and analytic induction lead to parsimony.

found its way into many types of software, design, and interaction design conferences, journals, and books.[30]

5.5 Evaluation Turns into Research: Following Imaginations in the Field

As the design anthropologist Dori Tunstall noted, any anthropologist studies the material world.[31] Constructive design researchers do this too; however, their interest is in a very special kind of make-believe world, which is partially their own creation. They introduce their design imaginations into the lives of people to be able to follow how these imaginations shape the activities, thoughts, and beliefs of these people. These imaginations are not treated as physical hypotheses like in laboratory studies; instead they are treated as a thing to be followed in context.[32]

These imaginations can be almost anything, such as a bottle refunding machine made of cardboard, but typically they are prototypes[33] as with Ianus Keller's attempt to build a tangible system for creating and browsing collections of pictures.[34] This was also the case in the project Morphome, which took a critical look at the idea of proactive technology — of using data from sensors to predict where human action is heading and adjusting things such as light and room temperature. Since there was no such technology on the market in 2002 when the project started, Morphome built proactive systems and devices, installed these systems into homes, and interviewed and observed people who used them.[35] These imaginations can also go beyond prototypes. For example, Andres Lucero simulated interactive spaces with design games by using objects like Legos as a tangible means to make people imagine what it would be to work and live in such spaces.[36]

Sometimes complex technological systems are needed to study designers' imaginations, as in two early studies of mobile multimedia phones, Mobile Image and Mobile Multimedia. In these studies, researchers in Helsinki followed how people sent multimedia messages by recording real messages.[37] A more recent example comes from Pittsburgh, where researchers have taken a service design approach to investigate service innovation for public services, in this case a transit service. Fieldwork with transit riders revealed that their greatest desire is to know when a bus will arrive at a stop. Commercial systems that provide this service cost tens of millions of dollars. So the researchers have taken a very literal approach to the idea of co-production of value. They have designed Tiramisu (means pick me up in Italian), a smart phone application that allows transit riders to share GPS traces while riding the bus. By combining the schedule from the transit service and GPS traces from a handful of riders, Tiramisu can generate real-time arrival predictions and make this available to riders over mobile phones or the web. In this design the riders literally make the service they desire. The researchers built a working system and initial field study indicates that riders will share traces and that these traces can produce accurate real-time predictions (Zimmerman et al., 2011).

To create proper conditions for using prototypes in research, some methodological decisions are needed. Esko Kurvinen argued with his colleagues that designers should place their imaginations into an ordinary social setting. They should also follow it in this setting using naturalistic research design and methods over a sufficient time span to allow social processes to develop. Kurvinen and his colleagues developed four guidelines for properly analyzing prototypes and other expressions as social objects.

1. *Ordinary social setting*. More than one person has to be involved in a unit of study to create the conditions for social

interaction. Social interaction has to take place in a real context to overcome studio-based contemplation.

2. *Naturalistic research design and methods*. People have to be the authors of their own experiences. They are involved as creative actors who can and will engage with available products that support them in their interests, their social interaction, and meaningful experiences. Data must be gathered and treated using empirical and up-to-date research methods.
3. *Openness*. The prototype should not be thought of as a laboratory experiment. The designer's task is to observe and interpret how people use and explore the technology, not to force them to use it in predefined ways.
4. *Sufficient time span*. The prototype ought to be followed for at least a few weeks. If the study period is shorter, it is impossible to get an idea of how people explore and redefine it.[38]

Designers usually prefer to work with rough models in order to not direct attention prematurely to design details. The last thing any designer wants is feedback focusing on surface features of the expression rather than the thinking behind it. Paradoxically, being too hi-tech and true to design leads to bad research and design.

5.6 Interpretations as Precedents

Field research has its roots in industry, where it primarily informs design. It has provided a solution to an important problem, understanding, and exploring social context. It has been useful, and it has turned into a standard operating procedure. Plainly, it is useful to know how people make sense of what they see and hear and how they choose what they do.

However, field researchers produce "local" understanding that describes the context that cannot be applied uncritically to other cases. It is also temporary rather than something long-standing.[39] This specificity makes it useful in industry, but it also raises the question of generalization, how to apply his knowledge to other cases.

There are several ways to respond to the question of generalization. Often generalization is irrelevant. Every designer studies the masters, whose works are always unique. Benchmarking looks at the top, not the average. At the top, the number of cases is by definition small. Also, studying a negative case may teach a lot; for example, even the best designers and companies fail occasionally, and these failures may be just as informative as the successes. Often, research generalizes through a program; instead of trying to describe

Figure 5.7 Field aims at precedents rather than knowledge.

universally applicable knowledge, it is often more useful to study one culture at a time. Finally, focusing on unique cases encourages creativity. Methods like cultural probes, experience prototypes, bodystorming, Magic Things, and role-plays came from individual projects.[40] Cultural probes would not have been seen if researchers in London had relied on well-proven scientific methods.

There is also a bigger picture. There are well-known and respected fields of learning that build on case studies. These include history and the humanities, clinical medicine, law, case-based business schools, and many natural sciences. Most good designers, design firms, and design schools work through precedents.[41] Whenever designers are faced with new problems, they study patents and existing designs to learn their logic. As a designer's stock of precedents grows, he is better able to respond to various demands, put problems quickly into context, and foresee problems.[42] Experienced designers know how to spot opportunities, because they know so much about existing products, materials, production techniques, trends, and human beings[43] (Figure 5.7).

5.7 Co-Design and New Objects

Field research has been an industrial success, and it is also alive and well academically. It flourishes in several niches and is done throughout the design industries in both big and small markets. There are people who build on the social sciences, collecting data carefully and processing it into "thick descriptions."[44] There are also people who stress the value of merely diving into society to gain an understanding of people for design. At advanced levels in design universities, it has become a default methodology: it is a conscious choice not to do any field-style research.

Over the past two years, some researchers in Northern Europe have started to talk about their craft as co-design or co-creation.[45] What is new here is that the design process is increasingly opened

to people, whether stakeholders or users. When designers work as facilitators rather than detached observers, the last remnants of the idea that researchers ought to be detached, impartial observers — "flies on the wall" — disappear. What comes about is the idea that design is supposed to be an exploration people do together, and the design process should reflect that. Many designers doing fieldwork have taken this model to heart, sometimes making it increasingly difficult to draw a line between designers and non-designers.[46]

During the past few years, several researchers have also turned to action research, where the goal is to use knowledge gained by studying a group or community in order to change it. Particularly significant work has been done in Milan in conjunction with companies and communities in Lombardy. The Milanese approach to research is characteristically locally rooted and action-oriented, aiming to change local communities rather than creating new products. Around 2000, researchers were trying to improve service systems and concepts.[47] A few years later, this research evolved into studying how service design could be used to dematerialize society to make it ecologically and socially sustainable.[48] In terms of attitude, current Italian researchers are well in line with the ethos that drove their teachers' work but work far more methodically.[49] Also, researchers in Milan are learning from other parts of the world; for example, the best book about co-design is written in Italian.[50]

Prototyping Services: Nutrire Milano[51]

Figure 5.8 Shoppers in a sustainable service prototype at Largo Marinai d'Italia in Milan, Italy. Here people enjoy food they have just bought in the market "convivium." The market is a place to buy food but also a place to enjoy it, to meet friends, and to have a good time. (Picture undated, courtesy of INDACO, Politecnico di Milano.)

Maybe the best example of design tackling issues far larger than a product comes from Milan, Italy.

Under the leadership of Ezio Manzini and Anna Meroni at Politecnico di Milano, a service design group specializing in sustainability, studied the relationship between the city of Milan and Parco Sud, a vast agricultural area south of the city, for almost a decade. Combining three interests — sustainability, service design, and the Slow Food values (Slow Food is the main project promoter) — the group tried to create a business model that would keep alive small-scale food production in Parco Sud.

Manzini calls this approach "action research." The researchers worked with people trying to understand their hopes, needs, and worries. This research-based understanding was turned into projects that support the Parco Sud community. The aim has always been a permanent change to a common good.

This research illustrates the importance of fieldwork for design. Researchers have gone into Parco Sud and Milan, studying things like supply chains. They have ventured into co-designing business models through visual service design techniques. They also created a service prototype. There is a lively market every third Saturday of the month in Milan. The hope is that this prototype lives on and can be replicated elsewhere. Researchers have also built digital services to support their concept and continued designing new services for food production, provision, and consumption.

Key researchers in the group have mostly been trained in engineering, usability, and user studies. It is clear that in this study researchers had to work in the real world with people who have real problems and agendas. In trying to design viable business models, researchers do not have the luxury of going into a laboratory to build a model of research.

Through these developments, the designer's interest is shifting from individuals and systems to groups and communities. There is also a trend away from products, experiences, and even services toward communities and large-scale urban problems. Although field methodology has proved its value in product development, it is still expanding and finding new uses and opening up new kinds of design opportunities.

End Notes

1. See Wasson (2000, pp. 377–378).
2. Winch (2008, p. 119).
3. Winch (2008, pp. 86–87).
4. Salvador et al. (1999).
5. For some of these research practices, see Nafus and Anderson (2010). This synopsis is based on Koskinen's discussion with Ken Anderson, a veteran of design ethnography and the founder of the EPIC conference, Hillsboro, Oregon, August 19, 2010.
6. For cultural probes, see Chapters 2 and 6.
7. For example, see Hackos and Redish (1998).
8. Wasson (2000, p. 382).
9. For example, see Wixon and Ramey's (1996) collection. See Tunstall (2008). The *Ethnographic Praxis in Industry* conference occurred in 2005, providing a meeting point for the community. See Wasson (2000, pp. 384–385), Jordan and Yamauchi (2008), Jordan and Lambert (2009), Squires and Byrne (2002), and Cefkin (2010).

10. See Beyer and Holtzblatt (1998). For a guide to fieldwork based loosely on ethnomethodology, see Randall et al. (2007).
11. Fulton Suri still works at IDEO, but Black has her own agency in Reading, near London. Richardson/Smith was bought by Fitch, which Sanders left to set up SonicRim in 1999.
12. Segal and Fulton Suri (1997) and Black (1998). Perhaps the best example of such work is Fulton Suri's book *Thoughtless Acts? Observations on Intuitive Design* (Fulton Suri and IDEO, 2005), which consists of photographs of people's own design solutions without captions, and a short text that explains the intentions of the book. This text is at the end of the book and is meant to be read after watching the images because, as Fulton Suri noted, life comes without captions.
13. Fulton Suri (2011).
14. E-Lab was bought by Sapient in 1999.
15. See especially Ehn (1988a) who offers a first-hand account of participatory design, although years after the work was done. Also Greenbaum and Kyng (1991) and Schuler and Namioka (2009).
16. Braverman (1974). For example, Ehn (1988a) and Greenbaum and Kyng (1991). Some participatory designers flirted with activity theory, but this movement has no shared theoretical basis. See Kuutti (1996), Bødker (1987), Bødker and Greenbaum (1988), and Kaptelinin and Nardi (2009).
17. See especially Ehn (1998a).
18. Good and practical descriptions of fieldwork in design are Blomberg et al. (2009) and, for contextual inquiry, Holtzblatt and Jones (2009).
19. For a good example of systematic attention to products in fieldwork, see Jodi Forlizzi's (2007) work on the Roomba in senior citizens' homes.
20. For generative tools, see Sanders (2000), Stappers and Sanders (2003), and Sleeswijk Visser (2009). Magic Things are the brainchild of Iacucci et al. (2000), a good source for designing games is Brandt (2001), and a place to look at using video in design is Ylirisku and Buur (2007). A future workshop is from Jungk and Müllert (1983).
21. Sanders (2000).
22. For analytic induction, see Seale (1999), and for its application in design, see Koskinen (2003) and Koskinen et al. (2006).

"Thick description" is how Clifford Geertz, the dean of American anthropologists, described how anthropologists try to unravel "complex conceptual structures … knotted into one another … that are at once strange, irregular, and inexplicit." Society is spaghetti, and the researcher's job is to do "thick descriptions" to make it understandable (Geertz, 1973).

There is no shortage of good books on ethnography and fieldwork in the social sciences. To list a few, one can mention Lofland (1976) for fieldwork, Emerson et al. (1995) for writing field notes, Becker (1970) for a wide-ranging discussion on fieldwork and its problems, and Seale (1999) for analysis and quality control. The so-called Grounded Theory by Barney Glaser and Anselm Strauss has found its way into design more slowly than into fields like education (Glaser and Strauss, 1967; Strauss, 1987). If one builds on this "theory," one gets instructions on how to build an abstract framework from observations, but there is a price. Unwary reliance on it leads to theoretical commitments: the process relies heavily on symbolic interactionism (see Blumer, 1969). This same remark also applies to contextual inquiry, where the commitments go to work flow models rather than theory (Beyer and Holtzblatt, 1998).

23. Wasson (2000, pp. 383–384).
24. Holtzblatt and Jones (1990, p. 204).
25. Mattelmäki et al. (2010).
26. Jordan and Yamauchi (2008).
27. Aalto (1997), quoted in Pallasmaa (2009, p. 73).
28. See Koskinen (2003, pp. 62–64).

29. Wasson (2000, p. 385). As design ethnography mainly contributes to design rather than theory, the mother disciplines in the social sciences question its value. For example, as Tunstall (2007) related, the American Anthropological Association was then debating whether design anthropology is a worthy cause, or whether such a profit-seeking enterprise should be excluded from the scientific community.

30. In addition to researchers from Palo Alto Research Center, the most consistent ethnomethodologists writing about design have been former EuroPARC researchers Graham Button and Wes Sharrock and, later, Andy Crabtree (see Crabtree, 2004; Kurvinen, 2007). The Palo Alto Research Center has scaled down on ethnomethodology, but this work continues in several universities, mostly in the United Kingdom.

31. Tunstall (2008). However, there is a line here, which is well illustrated by Shove et al. (2007), who argued that designers should buy into "practice theory," as they called their approach. Their study shows how social scientists understand design: they focused on studying things that exist at homes and were content with it. Their study had no projective features, even though one of the editors of the book was a designer.

32. From a systems perspective, Keiichi Sato usefully talks about the knowledge cycle between artifact development and user. In his model, artifact development process, use and context of use are in a loop in which knowledge of use and use context feed the design of the artifact, and the artifact (or service) and design knowledge embedded in the artifact feed use and shape context of use (Sato, 2009, pp. 30–31).

33. See Säde (2001).

34. Keller (2005).

35. Koskinen et al. (2006), Mäyrä et al. (2006).

36. Lucero (2009).

37. Koskinen et al. (2002), Battarbee (2004), Kurvinen (2007), Koskinen (2007).

38. Kurvinen et al. (2008).

39. The expression of local knowledge is from the anthropologist Clifford Geertz (1983).

40. See Buchenau and Fulton Suri (2000), Iacucci et al. (2000), and the IDEO Card Pack.

41. Note that comparison to law cannot be taken literally. In law, precedents are not just aids to thinking but are binding. This is not the case in design, in which precedents in fact *have to* be surpassed. For this reason, Goldschmidt (1998) argued for discarding the notion of precedent and resorted to "reference" in her work on IT-based reasoning systems for architecture. However, as Lawson (2004, p. 96) noted, designers often refer to "whole or partial pieces of designs that the designer is aware of" as precedents. Like Lawson, we prefer to work with designers' own language but remind the reader about not taking the legal analogy too seriously.

42. Similar to Brian Lawson, a student of design cognition who notes about architecture, "one of the key objectives of design education is to expose young students to a veritable barrage of images and experiences upon which they can draw later for precedent" (Lawson, 2004, p. 96). For a discussion on references and precedents, see Goldschmidt (1998) and Lawson (2004).

43. Fulton Suri (2011).

44. Geertz (1973).

45. See Koskinen et al. (2003). Mattelmäki et al. (2010).

46. Speed dating is a technique to quickly decide which design concept works best: Davidoff et al. (2007), Park and Zimmerman (2010), and Yoo et al. (2010). This technique was first invented in a project reported by Zimmerman et al. (2003). Dream Kits are from Liz Sanders. Bodystorming and experience prototyping are from IDEO; cf. Buchenau and Fulton Suri (2000).

47. Pacenti and Sangiorgi (2010). For doctoral-level work coming from this work, see Pacenti (1998), Sangiorgi (2004), and Morelli (2006).

48. For system-oriented work, see in particular Manzini et al. (2004) and Jégou and Joore, (2004); also Manzini and Jégou (2003). For a shift in unit of analysis, see Meroni (2007) and Meroni and Sangiorgi (2011).

49. In particular, this goes for Ettore Sottsass, Jr. Penny Sparke (2006, p. 17) described his philosophy as a conscious antithesis to post-war modernism, which "in Sottsass' view, ignored the 'user.' His emphasis of the role of the user as an active participant in the design process, rather than a passive consumer, lay at the core of his renewal of Modernism. To this end, he experimented with a number of ways of bringing users into the picture while avoiding transforming them into 'consumers.'"

50. Meroni (2007), Rizzo (2009).

51. Thanks to Anna Meroni, Giulia Simeone, and Francesca Rizzo who helped to write this inset. For philosophy behind Nutrire Milano, see Manzini (2008).

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6

SHOWROOM: RESEARCH MEETS DESIGN AND ART

The program we call 'Showroom' builds on art and design rather than on science or on the social sciences. When reading the early texts about research programs regarding showrooms, we were struck by critical references to scientific methodology. There is little respect for notions such as data and analysis, and it is possible to encounter outright hostility toward many scientific practices. Research is presented in shop windows, exhibitions, and galleries rather than in books or conference papers. Still, a good deal of the early work was published at scientific venues, most notably human–computer interaction (HCI). This work was aimed at reforming research, which it did to an extent.

Contemporary artistic practice is beyond the limits of this book, but it is worth noting that art went through many radical changes in the past century. While traditionally, art largely respected boundaries between painting and plastic arts, performing arts, and architecture, the twentieth century broke most of these boundaries. Contemporary art has also broken boundaries between art and institutions like politics, science, and technology. Although painting still dominates the media and the commercial art market, art has increasingly become immaterial, first exploring action under notions like happenings and performances, and then turning human relations into material.[1] With predictable counter-movements calling forth the return to, say, painting, art has moved out from the gallery and into the world at large (see Figure 6.1).[2]

Design has had its own radical movements.[3] Radical Italian designers of the 1960s and 1970s turned to art to create a contemporary interpretation of society. Thus, the Florentine group of Superstudio proposed cubic spaces that allowed the youth to wander in the city and claim possession of the city space.[4] Similarly, the Memphis movement from Milan changed design by turning to the suburbs for inspiration. They found traditional furniture, cheap materials, neon colors, and cheesy patterns and

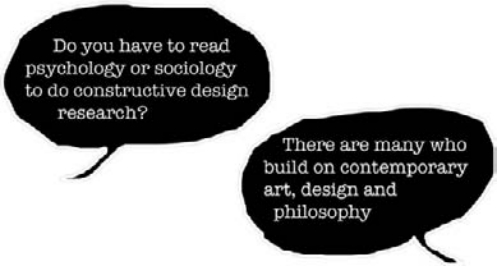

Figure 6.1 Research can build on a non-scientific premise.

built designs that challenged the high-brow aesthetic of modernism.[5] Designers like Jurgen Bey and Martí Guixé,[6] and groups like Droog carry the spirit to the present.[7]

For design researchers, contemporary art and design provide a rich intellectual resource. It links research to historically important artistic movements like Russian constructivism, surrealism, and pop art. It also links research to Beat literature, architecture, and music.[8] It certainly created links to radical writers and theater directors like Luigi Pirandello, Bertolt Brecht, and Antonin Artaud, who broke the line between the artists and their audience. Through these artistic references, design research also makes connections to some of the most important intellectual movements of the twentieth century.

6.1 The Origins of Showroom

The most influential program in Showroom is critical design, which has its origins in the 1990s in the Computer-Related Design program of the Royal College of Art (RCA) in London. Collaborations with Stanford's Interval Research and European Union pushed this famed art school into research. Key figures were Anthony Dunne and Fiona Raby, who coined the term "critical design" to describe their work. Above all, critical design was indebted to critical theory, but its debt to Italian radical design and radical architecture groups of the 1960s–1980s is also clear. These groups challenged the modernistic credo of post-war architecture and design with non-commercial conceptual and behavioral designs.[9] Building on this heritage, critical design tried to make people aware of the dangers of commercial design. The aim was to help people discover their true interests rather than accept things in shops as such.[10]

Early studies in critical design focused on people's relationships to electromagnetic radiation, building on those few artistic and design projects that had questioned commercial approaches to designing electronic devices.[11] Later, this work turned to exploring

the impact of science on society. The main impetus was the debate on genetically modified food (GM), which came to the market from laboratories and agribusiness practically without debate, and raised a public outcry so loud that several European countries imposed limitations on GM products.[12] To avoid this mistrust and polarization of debate, critical designers today work with cutting-edge science, opening up science to debate before mistrust steps in.[13] Recent work has explored biotechnology, robotics, and nanotechnology. By building on science, critical design can look at the distant future rather than technology, which has a far shorter future horizon.[14]

Another track also came from RCA's Computer-Related Design program. Its main inspirations can be found in avant-garde artistic movements in post-war Europe rather than design. As the key early publication, the *Presence Project*, related, "we drew inspiration from the tactics used by Dada and the Surrealists, and especially, from those of the Situationists, whose goals seemed close to our own."[15] The situationists tried to create situations that lead people to places and thoughts that they do not visit habitually through *dérive* (roughly, drift) and *détournement* (roughly, turnabout).[16] In London, media embedded in ordinary objects like tablecloths provided these passageways.[17] Other artistic sources have been conceptual art, Krzysztof Wodiczko's "interrogative design," and relational aesthetics, in which the subject matter is human relations rather than situations.[18]

The turning point was the Presence Project, an EU-funded study that developed media designs for three communities: Bijlmer in Amsterdam, Majorstua in Oslo, and Peccioli in Italy. While its designs were typical media designs of the era, including things like "Slogan Bench" and "Image Bank," each was installed for brief field trials in Bijlmer. The main legacy of this project was the "cultural probes" that by now have become a routine part of design research in Europe.[19] Later, this line of work produced a constant stream of media-oriented design work, like Drift Table, History Tablecloth, and Home Health Horoscope.[20]

These prototypes became so robust that they could be field tested for months. The aim is to develop technology and find ways to create a "deep conceptual appropriation of the artifact."[21] Still, at the heart of this work is the situationist spirit. The task of design is to create drifts and detours, just like the Web does in making it easy to jump from one subject to the next.

6.2 Agnostic Science

Showroom had an agnostic attitude toward science in the very beginning. The sharpest formulation of the ethos can be found

from the Presence Project, which studied three communities in Europe with cultural probes and then went on to do design for these communities. The project book provides a detailed description of the design process with a great deal of detail about the cultural probes, concept development, and how people in these communities made sense of the design proposals. In one of the project's key statements, Bill Gaver tells how "each step of the process, from the materials to our presentation, was designed to disrupt expectations about user research and allow new possibilities to emerge."[22]

The final section of the book draws a line between epistemological and aesthetic accountability. The former tries to produce causal explanations of the world and is epistemologically accountable. For example, "scientific methods must be articulated and precise … [allowing] the chains of inference used to posit facts or theories to be examined and verified by independent researchers." Facts at the bottom of science also have to be objective and replicable, not dependent on any given person's perception or beliefs. By implication, these requirements severely constrain what kinds of investigations can be pursued.

Against this, the Presence Project constructs the notion of "aesthetical accountability." Success in design lies in whether a piece of design works, not in whether it was produced by a reliable and replicable process (as in science). Hence, designers are not accountable for the methods: anything goes. They do not need to articulate the grounds for their design decisions. The ability to articulate ideas through design and evaluate them aesthetically "allows designers to approach topics that seem inaccessible to science — topics such as aesthetic pleasure on the one hand, and cultural implications on the other."[23] Surrealism, Dada, and situationism provided ways to get into dream-like, barely worded aspects of human existence. Field research gives access to the routines and habits, but these art traditions focus on associations, metaphors, and poetic aspects of life.

There are many problems with this distinction. "Science" is characterized narrowly, and it sounds more like a textbook version of philosophy than a serious discussion. If one reads any contemporary philosopher or sociologist of science and technology, this description faces difficulties. For this reason alone, it is important to understand its polemic and provocative intent. For the philosophically unaware, it underestimates the power of science and overestimates the power of art and design to change the world. Another troublesome claim is the idea that science cannot access cultural implications. Believing this would delete the possibility of learning from the humanities and the social sciences, which are an important source of knowledge of culture and society. After all, design ethnographers do just that: study culture for design.

6.3 Reworking Research

The agnostic ethos is also reflected in the language used to talk about research. For example, instead of talking about "conclusions," researchers talk about disruptions and dialog. Also, the Presence Project talked about "returns" rather than data. Cultural probes were specifically developed for inspiration, and they were described as an alternative to the then prevailing methods of user research. These visual methods were inspired by psychogeography and surrealism, and they were described as "projective" in the sense of projective psychology.

Researchers have reworked research practices to reflect these beliefs. The purpose of the Presence Project was not about comprehensive or even systematic analysis. The project was happy to get "glimpses" into the lives of people from probe returns and use these glimpses as beacons for imagination.[24] Instead of analysis, "design proposals" are arrived at through a series of tactics rather than systematic analysis. Bill Gaver explained these tactics in the following manner.

Tactics for using returns to inspire designs

1. *Find an idiosyncratic detail. Look for seemingly insignificant statements or images.*
2. *Exaggerate it. Turn interest into obsession, preference to love, and dislike to terror.*
3. *Design for it. Imagine devices and systems to serve as props for the stories you tell.*
4. *Find an artefact or location.*
   - *Deny its original meaning. What else might it be?*
   - *Add an aerial. What is it?*
   - *Juxtapose it with another. What if they communicate?*[25]

As probe returns were mailed to London from research sites, they were spread out on a table. Researchers who came by simply discussed pieces people had sent them, trying to be like gossipers: creating a coherent story of what they saw, with some touches of reality, but only some. The instrument was the researcher, who neither analyzed nor explicated data as an outside expert. Instead, he filtered things he saw through his own associations and emotions.[26] As long as we accept the idea that people encounter the world with dreams, fable-like allegories, and moralities, this approach to analysis is justified. If parts of the human world are non-rational, methods should be too. It is difficult to select a word stronger than "gossip" to create distance to science.

It is also easy to imagine that "field testing" of the prototypes has artistic overtones. Ever since *Design Noir*, the Presence Project, and Static!, designs have been made public for longer

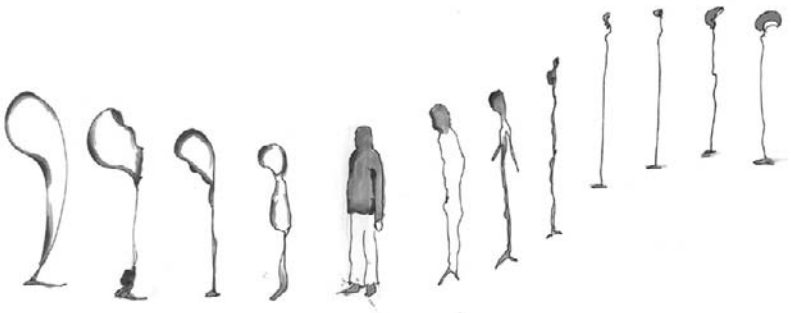

Figure 6.2 Interesting results build on humble beginnings.

and longer time periods; these are tests only in a nominal sense of the term. The aim of this fieldwork is to provide stories, some of which are highlighted as "beacons" that tell about how people experience the designs and what trains of thought they elicited. These stories are food for debate; they are not meant to become facts (see Figure 6.2).[27]

This research lives on in books, patents, and doctoral theses, as well as in exhibition catalogs and critical discussions in art journals, galleries, and universities. The outreach can be substantial, like in the case of the Design and the Elastic Mind exhibition in the Museum of Modern Art (MoMA).[28] As Dunne stated in *Objectified*, a documentary by Gary Hustwit, by going into places like MoMA, one can reach

> *hundreds of thousands of people, more than I think if we made a few arty and expensive prototypes. So I think it depends. I think we're interested maybe in mass communication more than mass production.*[29]

Still, one reason for why Showroom has a research following is because critical designers write about their work in ways recognizable to researchers. They tell the whole story from initial ideas to prototypes and how people understand them. The prototypes may be forgotten, but their message lives on in books.

6.4 Beyond Knowledge: Design for Debate

To go beyond individual projects, Showroom relies on debate rather than statistics, like Lab, or precedents and replication, like Field. It questions the way in which people see and experience the material world and elicits change through debate.

This goes back to the critical and artistic roots of these approaches. Design provides a "script" that people are assumed to follow, and they usually do.[30] If people follow these scripts, they become actors of industry and its silent ideologies. Design structures everyday life in ways people barely notice. Usually, these scripts give people simple and impoverished roles, like those of the user and the consumer.[31]

To give design more value, designers can adopt a critical attitude to make the public aware of their true interests. Critical designers look to shake up the routines of everyday life. Dunne summarized the primary purpose of critical design:

> *to make people think.... For us, the interesting thing is to explore an issue, to figure out how to turn it into a project, how to turn the project into some design ideas, how to materialize those design ideas as prototypes, and finally, how to disseminate them through exhibitions or publications.*[32]

The methods for making people think borrow heavily from art. The designs and the way in which they are explained lean toward *Verfremdung*, as in "estrangement," similar to critical theater by the German playwright Bertolt Brecht. For example, by adding inconvenient nooks into a chair, designers create distance from what people normally take for granted. Debate is a precondition to being critical toward the ideologies of design as usual as well as seeing poetry in ordinary things like Zebra crossings (see Figure 6.5).[33] Researchers get engaged with the world, taking a stance against its dominant ideologies. With hypothetical designs, research can explore technological possibilities before they happen.[34] Design works like an inkblot test on which people can project their questions and worries.[35]

6.5 Enriching Communication: Exhibitions

For many researchers in Showroom, exhibiting objects such as prototypes, photographs, and video are as important as writing books and articles. The exhibition format encourages high-quality finishing of designs over theory and explanation. At times, exhibitions may take the role of a publication. As Tobie Kerridge noted following Bruno Latour, exhibitions at best are *Gedankenausstellungen*, thought experiments that offer curators more freedom than academic writing.[36]

In research exhibitions, designs are exhibited in the middle of theoretical frameworks rather than as stand-alone artworks. Also, design researchers typically want to create distance from the art

gallery format. They connect their work to the commercial roots of design with references to furniture shops and car shows. Tony Dunne wrote:

> *The space in which the artifacts are shown becomes a "showroom" rather than a gallery, encouraging a form of conceptual consumerism via critical "advertisements" and "products"…. New ideas are tried out in the imagination of visitors, who are encouraged to draw on their already well-developed skills as window-shopper and high-street showroom-frequenter. The designer becomes an applied conceptual artist, socializing art practice by mobbing it into a larger and more accessible context while retaining its potential to provoke people to reflect on the way electronic products shape their experiences of everyday life.*[37]

Exhibiting in places like shops and showrooms also connects critical work to everyday life. In projects like Placebo and Evidence Dolls, Dunne and Raby gave their products to ordinary people[38] As encounters with everyday life become more important, this approach gets closer to field research.[39] The idea, however, is to use people's stories to create a rich understanding of the prototypes, not to gather detailed data for scientific research. Field studies and writing become a part of the Showroom format, but the aims are conceptual.

6.6 Curators and Researchers

There are also problems when research takes place in the exhibition context. Often, exhibitions are not solo shows but compilations of many projects collected under an umbrella envisioned by a curator.[40]

Typically, the curator places the work into a new framework by juxtaposing things that were not necessarily included in the original research projects. Some research concerns and knowledge might be present in the exhibition, but many are not, and yet others are typically rephrased or substituted. Further, most designs are ambiguous and often designed to prompt imaginative interpretation and interrogation.[41] This explanatory framework reflects the curator's interpretation of the research, which may differ significantly from the original goals of the researchers (Figure 6.3).

For example, the Energy Curtain from the Swedish Static! project has been used and showcased in diverse settings. Energy Curtain has been studied in several Finnish homes, it has been at energy fairs to represent a national research program, and it

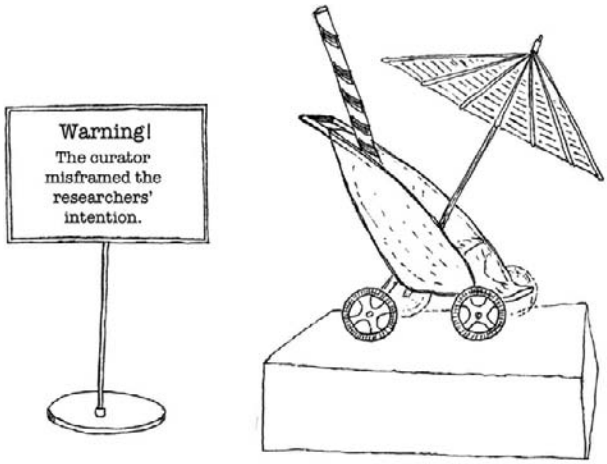

Figure 6.3 Research is exhibited in many frameworks.

has been in the touring exhibition Visual Voltage commissioned by the Swedish Institute. The exhibition has been in places as diverse as the Swedish Embassy in Washington, design exhibitions, expos and museums, and a luxurious shopping mall in Shanghai. It would be naive to think that the original research intent shapes how people look at design and read meaning into it in all of these places. When researchers' prototypes travel the world without the original theoretical context, they may even be treated like products. Approval is expressed through the question: Where can we buy this?[42]

Although exhibitions create many possibilities for communicating design research, they also create a need to carefully consider how other events, writings, and publications can be used to complement them to keep researchers' intentions alive. It is important to engage locally in staging further discussions and debate. For researchers, the attempt to control these meaning-making processes around design means extra work and traveling, which also makes research expensive.[43]

6.7 How Not to Be an Artist

When techniques and practices are borrowed from art, research may be labeled as art and treated accordingly — as political or social statements rather than serious design research. There are plenty of developments that push design to art. For example, curators find it easy to integrate conceptual design into art exhibitions, as in Hasselt, Belgium, where the art museum Z33

organized the 2010 exhibition Design as Performance as a sequel to its Designing Critical Design exhibition in 2008. Despite its name, the 2010 exhibition was framed explicitly as art, and most of the participants were artists.[44]

It is critical that designers fight being labeled as artists. Anthony Dunne explained how he draws the line:

> *What we do is definitely not art. It might borrow heavily from art in terms of methods and approaches but that's it. Art is expected to be shocking and extreme. Design needs to be closer to the everyday life, that's where its power to disturb comes from. Too weird and it will be dismissed as art…. If it is regarded as art it is easier to deal with, but if it remains as design … it suggests that the everyday as we know it could be different, that things could change.*[45]

One way to distance design from art is to take discourse out into the real world. Much of the early work focused on changing design, but recently designers are getting engaged in larger societal issues.[46] We have already described how critical design has shifted its attention upstream from criticizing design to making science debatable.[47] The Stockholm-based project Design Act is another example. It discusses "contemporary design practices that engage with political and societal issues" by examining "tendencies towards design as a critical practice," which is ideologically and practically engaged in these issues.[48] If designers participate in dialog about the meaning of their work, it is not only curators, critics, and media who define it. A degree of control can be gained this way.

The main challenge of this tactic is to take debate to places where it matters. If researchers stay within the art world, it only strengthens the art label. To make debate meaningful, it ought to be organized in companies, government offices, malls, and community meetings, and face the questions contemporary artists face when they have turned human relationships into art. As the British critic Claire Bishop noted, the question for art is whether it ought to be judged by its political intentions or also by its aesthetic merits.[49] Is serious social content enough to justify a piece of design research, or should it also be judged on its aesthetic merits? Mere disturbance is easy, but is it enough (Figure 6.4)?[50]

Another tactic is to do design at a high professional level. This catches the attention of professional designers, who do not get to label researchers' designs as art, bad design, or simply not design. If researchers succeed in being taken seriously as designers, they may be able to direct attention to the intention behind the work.

The most eloquent articulation of this tactic comes again from Dunne and Raby. They stress that their conceptual products

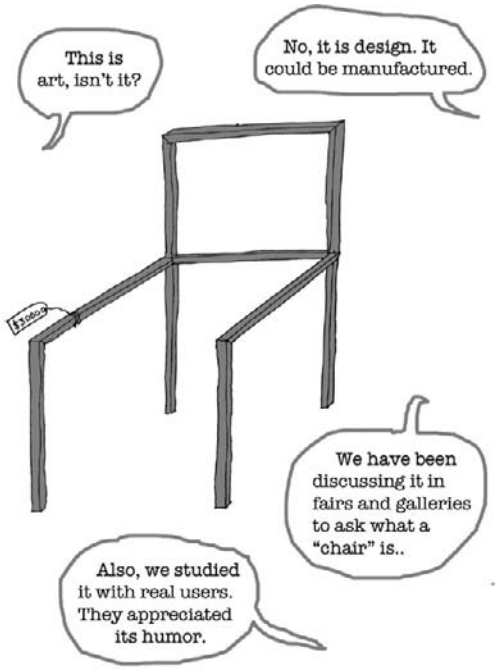

Figure 6.4 Responding to the art label.

could be turned into products because they result from a design process, are precisely made, require advanced design skills, and project a professional aura. Fiona Raby, in an interview to the Z33 gallery in Belgium, said:

> *By emphasizing that this is design, we make our point more strongly. Though the shock effect of art may be greater, it is also more abstract and it doesn't move me that much. The concept of design, however, implies that things can be used and that we ask questions — questions about the here and now. What is more: all our works could actually be manufacturable. No one will of course, but as a matter of principle, it would be possible.*[51]

Here critical designers meet post-critical architects and many contemporary artists. The aim is to create ideologically committed but good, honest, and serious design work to make sure that attention focuses on design rather than labeling.[52] This is how many design revolutions have come about; for example, Memphis designs were mostly theoretical, but no one could blame them for bad design. They were taken seriously and, ultimately, conquered the world.

A third tactic is to study prototypes in real life. An early example of following what happens to design prototypes in society

is Dunne and Raby's *Design Noir,* and another is the Finnish domestication study of two prototypes done by the Interactive Institute, Energy Curtain and Erratic Radio.[53] In London, Bill Gaver's group at Goldsmiths is also working on longer and more complex studies that move beyond notions of evaluation.[54]

Empirical research turns even very explorative designs into research objects. However, for Showroom researchers, fieldwork is typically not about issues around use but about issues like form. For instance, they may ask how static and visual notions of form are moving toward the performative and relational definitions. They also gather material that helps them to build better stories and concepts for their exhibitions.

6.8 Toward Post-Critical Design

Recent work at the Interactive Institute in Sweden shows how researchers can deal with these problems. This work has built on design, philosophical investigation, and more recently, critical discourse in architecture.[55] This work has explored computational technology from an aesthetic perspective and combined traditional materials with new technologies.[56] Its topic is how sustainable design may challenge thinking about energy and technology. Static! explored ways of making people aware of energy consumption through design. Switch! explored energy use in public life and architecture.[57]

Static! and Switch! consisted of several projects. Design examples were reinterpretations of familiar things. Throughout, the idea was to build new behaviors and interactions into old, familiar forms like radios and curtains.[58] The purpose was to create tension between familiar forms and unexpected behaviors to elicit new perceptions, discussion, and debate.

For example, one of the subprojects in Static! was Erratic Appliances — kitchen appliances that responded to increasing energy consumption by malfunctioning and breaking down. One prototype was Erratic Radio.[59] It listened to normal radio frequencies and frequencies emitted by active electronic appliances around the 50 Hz band. When the radio sensed increasing energy consumption in its environment, it started to tune out unpredictably. To continue listening, the user had to turn some things off. Erratic Radio has an iconic Modernist shape with a hint of classic Braun design, which gave it a persuasive and usable quality and underlined that the difference with normal radio was behavioral. Its inspiration was John Cage's Radio Music, but it

took an opposite approach to Daniel Weil's Bag Radio, which broke the form of the radio but not its function. Prototypes like Erratic Radio were done in the spirit of the philosopher Ludwig Wittgenstein's thought experiments: they were aimed at questioning things we take as necessities even though they result from industrial processes.

Symbiots from the Switch! project at the Interactive Institute showed some artistic tactics at work. Inspired by notions such as symbiosis and parasitism in biology, Symbiots explored how these natural processes could be used to change ordinary forms into new ones. In Symbiots, graphical patterns, architectural configurations, and electrical infrastructure were turned into a photo series in the genre of hyper-real art photography. The intervention started with neighborhood studies. Residents participated in making the photographs, distributing posters, and discussions. The photo series were done in two different formats, art photographs and posters, to emphasize that there is more than one way to construct design objects.

This kind of work faces several problems. Most of this work is reported in scientific conferences and exhibited in contemporary design galleries. While it also may have some presence at expos and fairs and other venues closer to a commercial context, it is still clearly placed outside the market. If researchers want to show how design can make the world a better place, they have to go where people are. This does not happen through intellectual debates in galleries.

The pros of this step over the boundaries of the design world are obvious, but so are the cons. While fellow designers and critics may be able to pick up the intention behind the work and respect it, this cannot be taken for granted in a place like a shopping mall. Shopping malls place the work in a commercial frame in the original spirit of the Showroom metaphor, while an embassy places it into a political and national frame. This is unavoidable: design does not exist in a void. However, the key question is how to make sure that the research intention is not hijacked to serve someone else's interests (see Figure 6.5).

There are no easy answers to this question. Engagement and commitment have come to stay in constructive design research, but it is far more difficult today than it was in the 1960s and requires elaborate tactics. It is hardly possible to be counted as an avant-garde artist by emptying a glass of water into the North Sea, as Wim T. Schippers did in the 1960s, and shocking the audience has gone to such extremes that it has become very hard to continue like this.[60] Design has had its own share of failures, such as claims to solve the refugee crisis by building better tents.

Figure 6.5 Zebra crossings are graphical elements that become benches when they get a third dimension. Concept from Symbiots. Project team Jenny Bergström, Ramia Mazé, Johan Redström, and Anna Vallgårda. Pictures by Interactive Institute, photographs by Olivia Jeczmyk and Bildinstitutet.

In this case, anything does *not* go.[61] It pays to be careful with this type of claim or risk being dismissed as art.[62] Like artists and architects, designers today tend to make local rather than global commitments and exhibit doubts and controversies in their work. Showroom is about exposing, debating, and reinterpreting problems and issues. Ambiguity and controversy belong to it, just as they belong to contemporary art.[63]

End Notes

1. For a definition, see Bourriaud (2002). For an influential review, see Kester (2004). Bishop (2004, p. 62) lists as key sources Walter Benjamin's "Author as Producer," Roland Barthes' "Death of the Author," and Umberto Eco's *The Open Work*.
2. For example, see O'Doherty (1986).
3. John Thackara (1988, p. 21) once argued that "because product design is thoroughly integrated in capitalist production, it is bereft of an independent critical tradition on which to base an alternative." Design has had more than a few critical phases that have gained quite a following, including Victor Papanek's writings about ecology in the 1960s, and Italian radical design movements. Anti-commercial comments have been voiced even in the commercial heartland of design by people like Georg Nelson, who lamented Henry Dreyfuss for his commercialism after the 1950s; cf. Flinchum (1997, pp. 138–139).
4. Darò (2003). For Superstudio, see Lang and Menking (2003).
5. Radice (1985), Darò (2003).
6. See DAM (2007).
7. Betsky in Blauvelt (2003, p. 51). In another essay, he has characterized Droog as a "collection of detritus of our culture, reassembled, rearranged and repurposed … they have institutionalized political and social criticism of a lifestyle into design and thus into at least some small part of our daily lives" (Betsky, 2006, pp. 14–15). Interestingly, most design researchers do create original designs rather than redo or remake things, even though this has been routine in the art world, especially in the 1990s (Foster, 2007, pp. 73–74).
8. Barbara Radice (1993) discussed at length Ettore Sottsass Jr.'s contacts to Beat poets and novelists in San Francisco, and how he introduced their work to Milan and Milanese designers.
9. See Parsons (2009, p. 143). For radical design, see Celant (1972, pp. 382–383); also quoted in Menking (2003, p. 63).
10. Dunne's quote is in Parsons (2009, p. 145). For another definition, see Dunne and Raby (2001, p. 58).
11. For example, Weil (1985); Dunne's (2005) *Hertzian Tales* is a virtual cornucopia on this work.
12. See Parsons (2009, pp. 146–147).
13. Dunne (2007, p. 8) and Kerridge (2009).
14. See especially Material Beliefs, a project in which Goldsmiths and the Royal College of Art collaborated. The best document is Beaver et al. (2009).
15. *Presence Project* (2001, p. 23). For situationism, see especially Debord (1955). Situationism shares a curious historical link to the Bauhaus (or more correctly, Ulm), which has been recently analyzed by Jörn Etzold (2009). The Danish artist Asger Jorn was a pivotal figure in early situationism. He was a founding member of the group CoBrA (Copenhagen, Brussels, Amsterdam). When he heard that Max Bill, a former student of Bauhaus, was building a

new design school in Ulm in continuation of the Bauhaus, he contacted him, arguing against Bill that the Bauhaus is not a doctrine with a place, teaching, and heritage, but artistic inspiration. Jorn founded a competing organization he called the Imaginary Bauhaus, which soon became the International Movement for an Imaginist Bauhaus (IMIB).

After learning about the Lettrists in Paris and establishing contact with Michèle Bernstein and Guy Debord, the two groups joined forces. One of its name proposals was IMIB, but it was discarded for the Situationist International, probably due to Deboard's negotiation skills. As years went on, Debord became the main figure. For him, the father to be murdered was Sartre rather than Gropius.

The connections of the situationists and design in Bauhaus style are distant. For Walter Benjamin, the sparse aesthetic of Bauhaus spaces opened materials for experience in ways in which there was no correct use anymore. The situationists tried to achieve something similar by opening the city with their *dérives* and *dépaysements* (disorientations). In this sense, the latter group shares a modernist credo, even though its materials, situation-changing aims and techniques could hardly be more different from the material and specific practice of the Bauhaus. Still, important differences remained:

> "*…whereas Bill's HfG in Ulm emphasized inheritance [from Bauhaus], doctrine, and continuity, Jorn and Debord's counter-effort was aimed above all at the intensification and consummation of disinheritance, as well as the affirmation of that absence of experience that Benjamin had identified as the impetus of modernity in the Bauhaus.*" (Etzold, 2009, p. 160).

16. Guy Debord's situationist notion of spectacle, from which he wanted to save people, is indebted to Marx's notion of commodity fetishism, and in particular, Georg Lukacs' Hegelian interpretation of Marx, which gave humans an important role in changing history instead of reducing human action to economic relationships alone. Other important sources of situationism were French existentialism, surrealism, and Antonin Artaud's theater; cf. Jappe (1999). See also Debord (1958).

17. See Debord and Wolman (1956). The situationists urged artists to place artistic work into everyday settings, where it matters to ordinary people. Nicholas Bourriaud (2002, pp. 85–86) noted that what is missing from this notion are other people: constructed situations derail people as individuals, but not direct them to see through those social relationships that define their habits. As such, the situationists were one group in a long list of twentieth century avant-gardists, including Dada and surrealism, but also Allan Kaprow's happenings, the Fluxus movement, Joseph Beyus' performance art, and Yves Klein's hard-to-classify work; cf. Bourriaud (2002, p. 95).

18. The notion of relational aesthetics is from Nicholas Bourriaud (2002), the French critic and curator. Gaver et al. (1999), Hofmeester and Saint Germain (1999, p. 22), Gaver et al. (2004). The reference to Calle and Wearing is from Gaver (2002). The *Presence Project* (2001, pp. 23, 82–83) also lists artists like photographer John Baldessari and filmmaker Cindy Sherman as sources of inspiration. For discussions on Calle's (2010) work, see *Sophie Calle: The Reader*. A good introduction to Wearing's work is Ferguson et al. (1999).

19. Cultural probes were introduced for the first time to an international audience in Gaver et al. (1999).

20. For Drift Table, see Boucher and Gaver (2007), History Tablecloth is from Gaver et al. (2006), and Home Health Horoscope is reported in Gaver et al. (2007).

21. Gaver et al. (2003, pp. 233, 235–236).

22. *Presence Project* (2001, pp. 22–23).

23. *Presence Project* (2001, p. 203).

24. *Presence Project* (2001, p. 24).

25. Gaver (2002, slides 78-79).

26. This tactic is reminiscent of psychoanalysis, where the analyst listens to the feelings that animate the patient's talk, and uses his own feelings to make sense of the patient's free associations. For a famously clear exposition of psychoanalytic technique, especially the interplay of "transference" (the patient's emotions) and "countertransference" (the analyst's feelings that respond to the patient's feelings), and how they are used in deciphering the patient's psyche, see Gaver et al. (2007).

27. For example, Gaver et al. (2007, pp. 538–541). There are precursors to all of this. In the humanities, this approach is called *explication du texte* or close reading. The difference is in the means: design is a material practice that aims at changing behavior through this material practice. Thus, rather than descriptive, the method is projective, done through design proposals.

28. Design and the Elastic Mind exhibit, 2008.

29. *Objectified*, 1 hour, 09 minutes, and 35 seconds – 1 hour, 10 minutes, and 03 seconds.

30. Akrich (1992) talks about the scripting and descripting that technology imposes on people.

31. As Dunne told to Parsons (2009, pp. 145–146). There are many ways to formulate this impoverishment in literature cited in this chapter. For example, existentialists like Jean-Paul Sartre would talk about bad faith, Nietzsche about slave morality, Marx about false consciousness, and Freud about neuroses. These concepts surface once in a while in design. For example, *Quali Cosi Siamo* — The Things We Are, an exhibition of Italian design curated by Alessandro Mendini for Triennale di Milano in Summer 2010, was partly based on psychoanalytic metaphors.

32. Parsons (2009, p. 145).

33. Bergström et al. (2009).

34. Seago and Dunne (1999, pp. 15–16), Dunne in *Design Interactions Yearbook* (2007, p. 8).

35. Beaver et al. (2009, pp. 110–111). The problem with staying within design and thus trivializing is pointed out by Jimmy Loizeau on p. 111.

36. Kerridge (2009, pp. 220–221). Design has been exhibited for decades. The past decade saw two developments: design was turned into art, which drove the prices of prototypes and one-offs sky high. As expected, there are already exhibitions mocking such ideology by celebrating ordinary industrial things, while simultaneously treating them as ready-mades (see Design Real, Grcic, 2010).

37. Dunne (2005) and Dunne (2005, p. 100).

38. Dunne and Raby (2001, p. 75).

39. See Dunne and Raby (2001); Routarinne and Redström (2007), Sengers and Gaver (2006), Gaver et al. (2007).

40. MoMA's exhibition Design and the Elastic Mind is a good example of the power of the curators. Critical design was only part of the exhibition, which also showed works from artists and scientists specializing in visualization and digital art.

There are curators and critics who know the difference between art and design and take designers' reluctance to be labeled as artists seriously. The best recent example comes from Berlin's Helmrinderknecht gallery focusing on contemporary design. Sophie Lovell curated an exhibition called Freak Show: Strategies for (Dis)engagement in Design that ran in this gallery from November 13, 2010, and January 15, 2011. Exhibited was work from ten groups of designers, two of them coming from critical design. Each group challenged the prevailing ideas of design as usual, and explored ways in which design could become a life-serving force. These ways consisted of using bioengineering in James Auger and Jimmy Loizeau's work coming from Material Beliefs, and El Ultimo Grito's animalistic tables made of cardboard and artistic resin. The exhibition was a mélange of concepts, one-offs, small series products, and to-be production pieces.

41. See in particular Gaver et al. (2003, 2004).

42. Indeed, there is a market for prototypes by star designers like Philippe Starck and Ron Arad, whose prototypes may be valued at hundreds of thousands of dollars. This market is significant enough to have its own chronicler (see Lovell, 2009). To our knowledge, there is no market for design researchers' prototypes, but after institutions like MoMA have exhibited design research, the day will come when we will see research prototypes in auction houses.

43. For example, when Visual Voltage went to Berlin, the exhibition was expanded with local designers. There were events and a design research workshop around the themes of the project. See www.visualvoltage.se/.

44. For Design as Performance, see Z33 (2010); for one-offs and prototypes as art objects, see Lovell (2009); and for art exhibitions showing that industrial products are not art (*sic*), see Grcic's (2010) Design Real.

45. Anthony Dunne in *Design Interactions Yearbook* (2007, p. 10).

46. Redström (2009), pp. 10–11.

47. See Design and the Elastic Mind, *Design Interactions Yearbooks* after 2007, what Timothy Parsons (2009) says about design for debate, and Ericson et al. (2009).

48. See www.design-act.se/.

49. Bishop (2007, pp. 64–67) raised this question, suggesting that its history can be traced back to "Dada-Season" in Paris in 1921. She also suggested that relational art should somehow try to create "highly authored situations that fuse social reality with carefully calculated artifice" (p. 67). Art and by implication, design, can and perhaps even should disturb viewers, and learn from earlier avant-gardes like Dada, surrealism, or in America, Beat poetry. To promote change, one should not accuse art of mastery and egocentrism if it seeks to disturb rather than only something that emerges through consensual collaboration.

The difficulty lies in negotiating the line between constructing a disturbance that evokes new thought models and shocking. As Grant Kester (2004, p. 12) noted in his study of dialog in art, much of the twentieth century avant-garde built on the idea that art should not so much try to communicate with the viewers, but rather seek to challenge their faith to initiate thinking. The premise was that the shared discursive systems (linguistic, visual, etc.) on which we rely for our knowledge of the world are dangerously abstract and violently objectifying. Art's role is to shock us out of this perceptual complacency, to force us to see the world anew. This shock has borne many names over the years: the sublime, alienation, effect, *l'amour fou*, and so on. In each case, the result is a kind of epiphany that lifts viewers outside the familiar boundaries of common language, existing modes of representation, and even their own sense of self. As Kester noted, recently many artists have become considerably sophisticated in defining how they work with the audience. Rather than shocking, they aim to create work that encourages people to question fixed identities and stereotypes through dialog rather than trauma. Prevailing aesthetics in such work is durational rather than immediate.

Of course, this is the stance held by critical designers, as well as other representatives of Showroom, even though they have not been less vocal about their design tactics. The aim is to lead people to see that there are ways of thinking and being beyond what exists in the marketplace, but the way to lead people away from their habits is gentler and far less ambitious than in earlier avant-gardes that came from rougher times.

Another problem with shocking is that contemporary art has gone to such extremes that it is increasingly difficult to shock. Shocking also leads to the problem of trivialization — something is shocking so it must be art and hence inconsequential. For good reason, critical designers try to avoid this tactic in their work as well as their discourse. A good discussion of the problems of shocking is den Hartog Jager (2003).

50. With the exception of critical designers, there are few debates in which designers study these questions. Andy Crabtree's (2003) advice is to think of technology as breaching experiments (see also Chapter 8), and Bell et al.'s (2005) argument is that designers need to make things strange to see things that are grounded in various "ethnomovements" of the 1960s, not contemporary art.

These movements argued for studying people from within, through their meanings, rather than using researchers' categories. One way to make the routine noticeable, unquestioned, and moral is to disturb and breach those routines. The reader can try this at the workplace by doing one of Harold Garfinkel's (1967) breaching experiments. Take any word people routinely use and press them to define it. Calculate how many turns it takes before people get angry at their friends, who should know what words like "day" or "flat tire" mean.

In critical design, as in contemporary art, disturbance is usually an opening into critical reflection rather than into studying the routine activities of everyday life. The difference may sound subtle, but it is essential.

51. Raby (2008, p. 65).

52. For post-critical architecture, see Mazé (2007, p. 215); for contemporary art, see Bourriaud (2002, pp. 45–46).

53. Routarinne and Redström (2007).

54. See Sengers and Gaver (2006), Gaver et al. (2007, 2008).

55. Mazé and Redström (2007), Mazé (2007).

56. See projects Slow Technology and IT + Textiles.

57. Mazé and Redström (2008, pp. 55–56).

58. See Ernevi et al. (2005).

59. First reported in Ernevi et al. (2005).

60. For Wim T. Schippers, see Boomkens (2003, p. 20).

61. For this example, and for discussion on designers using artistic tactics for photo ops, see Staal (2003, p. 144).

62. Dunne (2007, p. 10).

63. For a note on these doubts and commentaries on architect Rem Koolhaas' work, see Heynen (2003, p. 43).

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7

HOW TO WORK WITH THEORY

This chapter looks at the theoretical background of constructive design research. When we look beyond individual studies, we find a few recurring theoretical sources. When we look at what inspired the selection of these sources, we see how most constructive design researchers have roots in twentieth century Continental philosophy, social science, and art. This chapter elaborates on the three methodological approaches outlined in Chapters 4–6. At the surface, the three approaches may seem like independent silos; if we go beyond the surface, we find a more common core. This shared core also explains why constructive design research differs from the rationalistic design methodologies discussed in Chapter 2.

Interaction design has inherited its methodological premises from computer science. Before that time, computers were in the hands of experts trained in rational systems development methodologies. When computers entered workplaces and homes in the 1980s, systems failed because people could not effectively use their new computers. Systems designers had a very different conceptual model of the system from the workers who used these systems to complete tasks.[1] Software developers turned to cognitive psychology for a solution: the driving design mantras became "ease of use" and "user friendly."

However, many products failed because they did not do what the users wanted or even needed them to do: no amount of massaging the details of the interface could address the fact that computers were often doing the wrong thing. First, the key notion of "task" tied it to behaviors and practices that exist but did not assist designers in imagining what should be. Second, there was a false universalistic belief that all people are the same, and it would be possible to find an optimal interaction solution that would persist forever. Third, this theoretical perspective implied that theory should guide design, which was a hard sell to designers.[2]

For reasons like these, new ways to bring research into design were needed.[3] There was a need to bring experimentation and "craft" into design research to more effectively imagine what could and should be. Researchers in the emerging field of

Design Research through Practice.

interaction design turned away from cognition to post-Cartesian thinking: phenomenology, pragmatism, interactionism, and many strands of avant-garde art that connected designers to things like psychoanalysis and existentialism. These philosophies provided consistency and direction but encouraged exploration rather than prediction.[4] They encouraged using judgment and non-symbolic forms of intelligence. They also placed design in the center of research and saw theory as explication that comes after design. Finally, this turn connected design to the human and social sciences that had gone though a "linguistic turn" and "interpretive turn" two decades earlier.[5]

7.1 Acting in the World

In his inaugural lecture at Technische Universiteit Eindhoven, Kees Overbeeke, leader of the Designing Quality Interaction research group, argued that design researchers overrate cognitive skills. His lecture told how dissatisfaction with cognitive psychology drove him to J.J. Gibson's ecological psychology and more recently to phenomenological psychology and pragmatic philosophy.[6] His change of mind brought about an interest in people's perceptual-motor, emotional, and social skills.

> *Meaning … emerges in interaction. Gibson's theory resulted from a long line of "new" thinking in Western philosophy, i.e., Phenomenology (Merleau-Ponty, Heidegger) and American Pragmatism (James, Dewey)…. All these authors stress the importance of "acting-in-the-world," or reflection being essentially reflection-in-action.*[7]

In Overbeeke's vision, engineering and design join theorists in the humanities and the social and behavioral sciences. In these fields, researchers have grown disillusioned with studying people as mechanisms that can be manipulated and measured.

Showroom has followed a similar course, but it draws from a still wider swath of theory. In addition to philosophy, psychology, and the social sciences, Showroom also builds on art and design. Anthony Dunne's *Hertzian Tales* can be seen as a primary text for Showroom.[8] It offers a mesh of intersecting theories that is similar to the humanities of the 1990s. This text borrows from theories of post-modern consumption, phenomenology, French epistemology and semiotics, and product semantics. It also borrows from pragmatist philosophy, critical theory, and studies of material culture.[9] Italian *controdesign*, another important inspiration to critical design, built on post-war political sociology, urban studies, semiotics, and philosophy, as well as on futurists,

Dada, surrealism, and pop art. There are few scattered references to scientific psychology in *Hertzian Tales*, but scientific literature is simply yet another inspiration for design.

Field has arrived at the same destination by following a different route. Field researchers typically build on symbolic interactionism, symbolic anthropology, ethnomethodology, and Bruno Latour's actor-network theory rather than philosophy. However, when seen in the context of twentieth century thinking, there are significant affinities to Lab and Showroom. For example, the symbolic interactionism movements came to Chicago in the first part of the twentieth century, and its founding fathers listened to the lectures of pragmatists like John Dewey and George Herbert Mead. These two movements have clearly been conceived in the same intellectual climate.[10] A similar argument applies to ethnomethodology. It has roots in sociological theory, not philosophy, but it shares many similarities with phenomenology.[11]

These post-Cartesian philosophies gained more currency in the last three decades of the twentieth century; first in the humanities, then in the social sciences, and more recently in technical fields. By building on these traditions, designers are able to respond to more design challenges than by building on rationalistic and cognitive models only. These traditions have led constructive design researchers to see cognitive psychology and rationalistic design methodologies as special cases of a far larger palette of human existence. Seen through this prism, an attempt to see humans as information processing machines is not wrong, only a small part of the story. Research has become interdisciplinary, with ingredients from design and technology, and also psychology, the social sciences, and the humanities.[12]

7.2 Lab: From Semantic Perception to Direct Action

As the earlier quote from Overbeeke's inaugural lecture showed, recent work in Lab is interested in action and the body rather than thinking and knowing. Thinking and knowing are studied but from within action. Cognitive psychology has been pushed to the background; in the foreground are Gibson's ecological psychology and recently, phenomenological philosophy.[13] Eindhoven's Philip Ross makes a useful contrast between cognitive and ecological psychology and explains how they lead to different design approaches:

> *The semantic approach relies on the basic idea that we use our knowledge and experience to interpret the symbols and signs of*

> *products…. Products use metaphors in which the functionality and expression of the new product is compared to an existing concept or product that the user is familiar with. Emoticons in instant messenger applications are examples of emotionally expressive semantic interaction in the domain of on screen interaction.*
>
> *The direct approach is action based. It is inspired by Gibson's perception theory, which states that meaning is created through the interaction between person and the world…. Perception is action, which reminds us of the phenomenological concept of technological mediation…. It seems plausible that a device designed from the direct approach, which allows a person to actively create his own expression, would allow more emotional involvement. This approach would thus more likely allow a person to be meaningfully engaged with the activity of emotional self-expression and evoke an enchanting experience rather than a device that offers pre-created expressions.*[14]

While traditional user interface design works with symbols and proceeds to use through knowledge, research on tangible interaction focuses on how people interact with physical objects. The direct approach begins with action and proceeds to use through tangible interfaces and seeks design inspiration from action. Designers need to identify patterns of action that feed users forward naturally without a need to stop and think, which requires cognitive effort (Figure 7.1).

Philip Ross' work illustrates how the direct approach can be turned into a design tool. While ethics is usually the realm of the clergy and philosophers, Ross turned ethics into a source of inspiration. Nine designer/researchers from industry and academia convened around this challenge for a one-day workshop at the Technische Universiteit Eindhoven in the Netherlands.[16] The participants first learned about five ethical systems, Confucianism, Kantian rationalism, vitalism, romanticism, and

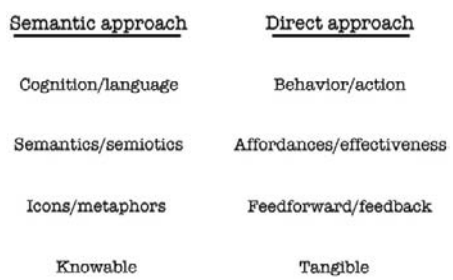

Figure 7.1 Two approaches used to create meaning in interaction design.[15]

Nietzschean ethics. They were then broken into three groups, and each group was given the task of building two functionally similar products that had to be based on two different ethical perspectives.

For example, one team was assigned the challenge of making two candy vending machines, one embodying Kantian ethics and the other embodying romanticism. They describe the "Kantian" machine in the following way:

> *The "Kantian" machine presents itself through a split panel with buttons and sliders…. On the left side of the panel, a person "constitutes" candy by setting parameters like for example the amount of protein, carbon and fat…. After adjusting the parameters, the machine advises a person to proceed or not, depending on his or her fat index…. After weighing the advice, the person proceeds to the right side of the panel. The machine asks for a credit card and determines whether the buyer's financial situation allows the purchase. If so, the machine deposits a round piece of candy with the requested constitution in the slot on the bottom right.*[17]

The Romantic machine, in contrast, displays dramatic emotions and incorporates elegant, grand gestures to treat people as sensuous beings. Its form language was non-utilitarian, it unleashed sugary aromas, it built anticipation through a slowed delivery of the desired product while using dramatic movements, and it required dramatic gestures before it accepted payment. While it is easy to see connections to the Kantian machine in many of the products and services people interact with every day, traces of the Romantic machine are harder to find. These romantic interactions, however, flourish in luxury spas, cruise ships, restaurants, and amusement parks (Figure 7.2).

As these workshops demonstrate, lab researchers in Eindhoven have turned away from semantics and symbols to direct action and beyond. They showed how design researchers can draw on highly abstract philosophy to spot design opportunities and process them into systems and objects. This work also asks a number of questions about implicit values in design, such as the hidden Kantian assumptions in so many products.

7.3 Field: You Cannot Live Alone

The approach of researchers in the field builds on theories of social interaction from psychology, sociology, and anthropology. This shift leads to a significant change in design. Cognitive psychology focused on the thinking process of an individual, and

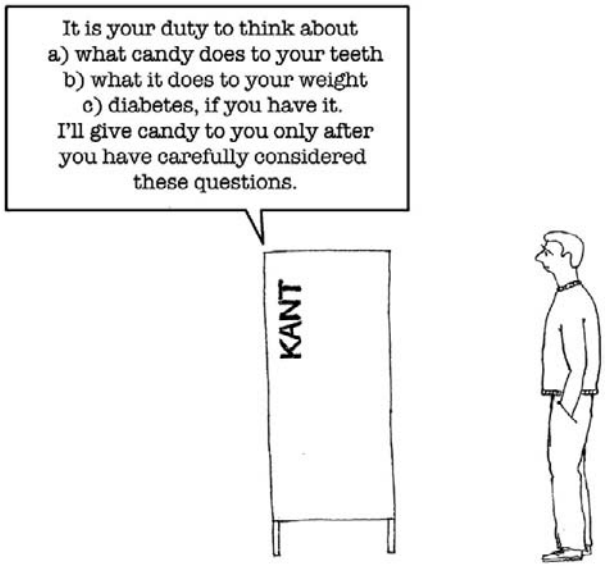

Figure 7.2 Duty-conscious candy machine, inspired by Philip Ross.

this was also true of Gibson's ecological psychology and Merleau-Ponty's phenomenology.[18] When field researchers began to study social action, they provided an important remedy for this individualistic tendency. People listen to other people, influence them, pay attention to things others see as important, and mold their opinions on things like ethics based on these social influences. Neglecting this social substratum is a risk for any ambitious researcher.

Designers and design researchers have always been able to bring social context into design. Many work with scenarios and storyboards that bring the context and the stories of people back into the ideation process. Interaction designers, in particular, have always worked this way. Their goal is to define the behavior of a product — generally a sequence of action and reaction that can best be captured in a narrative structure. They create characters who live in the context of use, and then they generate many stories about these characters in order to imagine new products and product behaviors that improve the characters' lives. Over the past few years, interaction design has increasingly focused on the social aspects of interaction: how products and services mediate communication between people.[19] However, unless these narrative methods are grounded in real data, they easily reflect only the wants and preferences of researchers. At worst, they become just devices of persuasion.

In contrast, field researchers have built on many kinds of sociological and anthropological theories to study people properly.

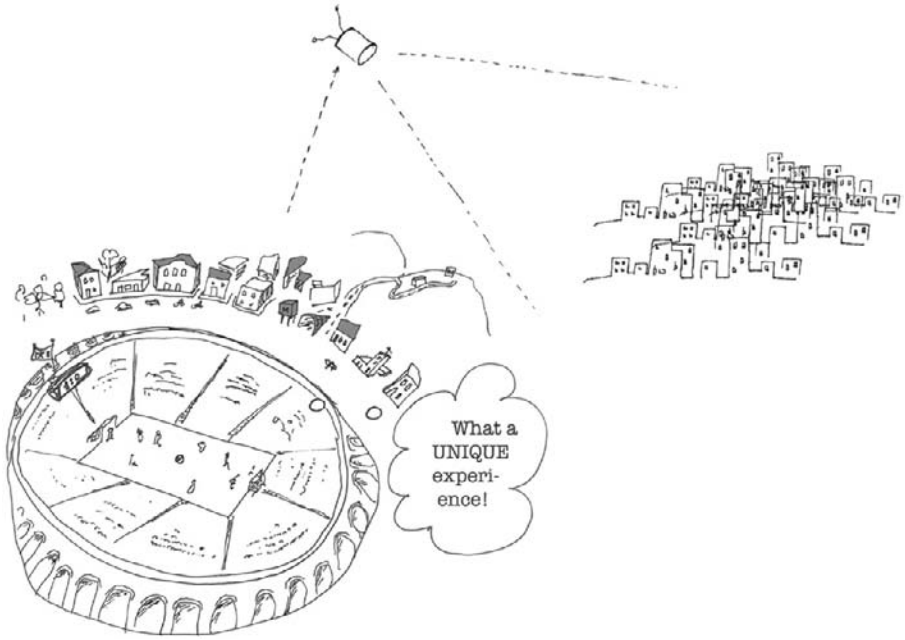

Figure 7.3 People experience things together.

The most popular theories in the field approach have come from symbolic interactionism, ethnomethodology, and symbolic anthropology. Interactionists describe how people define situations in order to take action, while ethnomethodologists describe "folk methods" (ingrained scripts of social behaviors) people use in organizing their activities.[20] Symbolic anthropologists, on the other hand, study how large systems of meaning play a part in what people do and how they think. Examples of such large systems are religion and beliefs about family (Figure 7.3).

One example of interactionist thinking is Battarbee's work on user experience as a social process.[21] Her work builds on the pragmatist look (from Jodi Forlizzi and Shannon Ford) on how some things become noticeable and memorable. People bring emotions, values, and cognitive models into hearing, seeing, touching, and interpreting the influence of artifacts. Social, cultural, and organizational behavior patterns shape how things are picked up from "subconscious" experience.[22] In contrast to the work of Forlizzi and Ford, for Battarbee, experience is a social process — hence, "co-experience" — for Battarbee. When people interact, they bring attention to issues, insights, and observations. In paying attention to things, and people make these things noticeable and sometimes memorable. Some things, on the other hand, are forgotten and pushed into the background.

Battarbee constructed her thinking during research on mobile multimedia. The path from a mere background possibility to an experience is social. She showed how communication technology can mediate this process. She investigated mobile multimedia in a real social context, focused on actual messages, and observed how people together pick up things and push them away from attention. Her work linked field observations with social theory. She also showed how designers can use these theories to generate design insights for new multimedia services.

Symbolic interactionism and ethnomethodology have their roots in sociology, but both traditions are distant relatives to the same philosophical traditions from which Lab seeks inspiration. Namely, symbolic interactionism came of age in the years between the World Wars in Chicago where an intellectual milieu shaped by the pragmatist John Dewey and the social behaviorist George Herbert Mead was created, and ethnomethodology had many affinities with phenomenology. It is important to understand, however, that these writers are not forefathers of these sociological traditions, which built on many other strands of thinking.

7.4 Showroom: Design and Culture Under Attack

Critical design focuses its attention on even larger things in society than field researchers. Its target of criticism is the way in which design supports consumer culture. Critical designers do not specify who they specifically blame and do not offer an alternative lifestyle. In this sense, research artifacts produced by critical designers are laden with many kinds of assumptions; viewers have to rely on their own background of culture, arts, and design to understand it. They have to make connections between the many theoretical perspectives at play to construct a rich understanding of this work.

In the preface to *Hertzian Tales*, Anthony Dunne told how "design can be used as a critical medium for reflecting on the cultural, social, and ethical impact of technology."[23] The basic objects of criticism are commercially motivated and human factor driven approaches at work in electronics; it is these electronics most people assimilate into their lives without thinking about how these objects shape their lives. In the preface to the 2004 edition of *Hertzian Tales*, Dunne looks back at 1999 when the book first appeared in print. He noted that little had changed in the design of electronics despite many calls for more creativity:

> *It is interesting to look back and think about the technological developments since [1999]. Bluetooth, 3G phones, and wi-fi are*

> *now part of everyday life. The dot-com boom has come and gone…. Yet very little has changed in the world of design. Electronic technologies are still dealt with on a purely aesthetic level. There are some exceptions, of course … but still, something is missing. Design is not engaging with the social, cultural, and ethical implications of the technologies it makes so sexy and consumable.*[24]

The critical design method builds prototypes and other artifacts based on "familiar images and clichés rather than stretching design language."[25] These designers investigate the metaphysics, poetry, and aesthetics of everyday objects to create designs that are strange and invite people to reflect on these qualities.[26]

> *The most difficult challenges for designers of electronic objects now lie not in technical and semiotic functionality, where optimal levels of performance are already attainable, but in the realms of metaphysics, poetry and aesthetics, where little research has been carried out.*[27]

Clearly, this is an attack against the prevailing culture of design. But who are the "designers" under attack?

The answer lies in the theoretical background of critical design. As noted earlier, critical design builds on a wide array of sources. The main theoretical roots of critical design, however, can be found from twentieth century philosophy, humanities, and the social sciences. The original formulations of critical design borrowed heavily from post-structuralism, critical theory, post-Marxist interpretations of the material world, Italian radical design, and many kinds of avant-garde and contemporary art.[28] Some of the key targets of these writers were consumption, art, and everyday life. In particular, the all-pervasive media continually bombards people with images of art for commercial and political purposes. This seemingly endless cascade of images and sounds re-shapes people's desires, and it changes the processes and motives for the products and services that are made.[29] If designers build on this language of consumptive desire without trying to redirect it, they function like Hollywood film studios, looking for blockbusters and lucrative product tie-ins (Figure 7.4).

Such a culture of design goes beyond individuals and design institutions. For this reason, it makes little sense to directly criticize individual designers, design schools, or design firms. The proper place for criticism is language and visual culture, not any particular designer. To make critique meaningful, it has to be directed at what makes this culture possible — otherwise it becomes trapped within the same discourse. As always, stepping out of this culture is impossible. However, it is possible to work from within and create designs that extend the clichés and easy seductions into mainstream design.

Figure 7.4 Against men in brown suits doing design-as-usual.

There is considerable theoretical depth in critical design. The target of criticism is the very culture of design-as-usual. No one in particular is to blame: it is the background that makes this culture possible that needs to be questioned. Again, this is a premise that comes from Continental thinking.[30] Post-structuralists like Jean Baudrillard taught critical designers to focus on gaps in design practice, to seek ways to break it one small piece at a time. Practices like design are human achievements, but we tend to take them for granted, regardless of their historical character. Indeed, why not treat design the same way as philosophers Jacques Derrida treated literature and Michel Foucault treated the history of sexuality? Although theoretical references have largely dropped from critical design over its 15 years of existence, this background is still evident in its practices, aims, and critical ethos.

7.5 Frameworks and Theories

A rich array of theory gives constructive design research plenty of depth. It helps to raise interesting questions about ethics in design. It helps to see things like social interaction. It creates connections to other disciplines and forms of culture, deepening research and design. Finally, it also gives research consistency and a possibility to argue.

The question, then, is not whether theory is useful, but how should it be used. Design is not a theoretical discipline. Designers are trained to do things and are held accountable for producing stuff, to paraphrase the title of Harvey Molotch's book on

design.[31] Designers are not trained to do product concepts and theories, nor are they held accountable for producing these abstract things. With few possible exceptions, design researchers have produced little theory that is used in other disciplines.[32]

To see how constructive design researchers use theory, it is useful to start from the frontline of research. The first frontline is design. In this book, we have seen several designs from product-like designs Home Health Horoscope and Erratic Radio. We have also seen artistic works like Symbiots. There are also service prototypes like Nutrire Milano and public interest prototypes like Vila Rosário. Researchers put most of their effort into developing designs and prototypes.

Also frontline are the frameworks that are generalized from these designs, such as Jodi Forlizzi's product ecology, Caroline Hummels' resonant interaction, and Katja Battarbee's co-experience.[33] Typically, these frameworks are reflections that come after designs. Their ingredients are theories, debates, and the design process. If design researchers want to contribute to theory, this is where they place their effort. Also, this is where constructive design researchers contribute to human knowledge at large. The best way to learn about how people interact with tangible technology is to read research coming from places like Eindhoven, Delft, and Carnegie Mellon University. The best way to see how to design large-scale services is to read work coming from Milan.

Even more abstract theoretical thinking keeps research programs going for years, creating consistency behind designs and frameworks. For example, J.J. Gibson's ecological psychology has been a constant source of inspiration in Eindhoven. To see how Tom Djajadiningrat's cubby, Stephan Wensveen's interaction frogger, Joep Frens' rich interaction, and Andres Lucero's intuitive interaction are related, it is necessary to read Gibson.[34] Symbolic interactionism has played a similar role in Helsinki, and situationism and *controdesign* in London. These references are abstract and as such, difficult to turn into design. Typically, they appear only in theoretical sections of doctoral theses and occasionally in conference papers. Constructive design researchers build on them but practically never hope to add to this knowledge. Martin Ludvigsen's collective action framework is built on Erving Goffman's sociology, but Goffman's theory is in no way tested by Ludvigsen.[35]

Explicit references to theory typically stop here. However, people like Gibson and the situationists have had their predecessors. Tracing back to these predecessors connects constructive design research with the most important philosophical and artistic movements of the twentieth century. These movements include phenomenology, pragmatism, Ludwig Wittgenstein's late philosophy, and also several artistic movements like Dada and surrealism, and through these, to existentialism and psychoanalysis. For

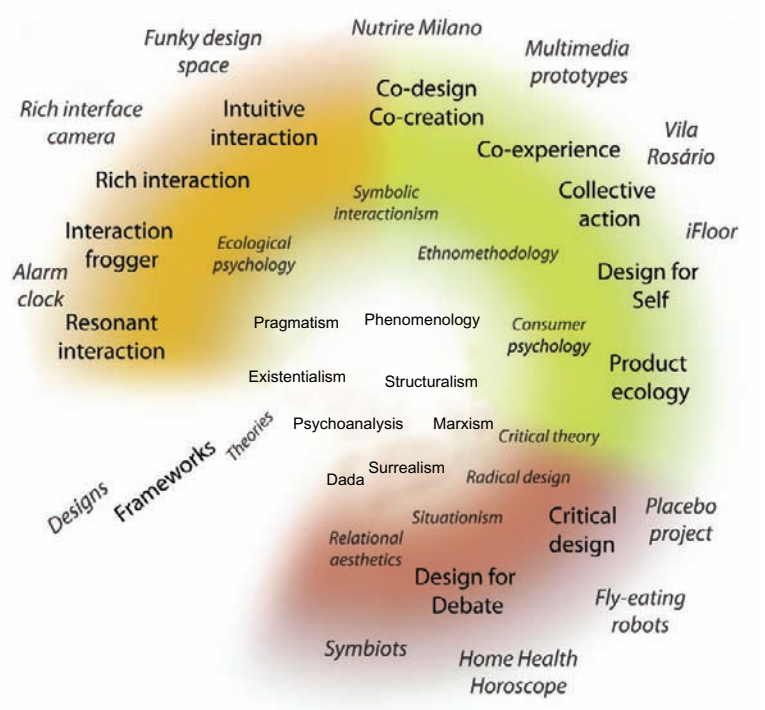

Figure 7.5 Designs, frameworks, theories, and philosophies.

example, in Field, these movements go back to pragmatism and phenomenology, and in Showroom to psychoanalysis, structuralism, and phenomenology (Figure 7.5).

In actual research, these philosophies and artistic movements remain in the background. Typically, only senior professors know the whole gamut. Even they seldom go to theoretical and philosophical discussions, and always cautiously, when rethinking something at the very foundation of the program. Knowing that some issues can be left to senior researchers makes life easier for younger researchers. Also, there are few direct links between philosophical and artistic thinking and actual designs. Going all the way to philosophy may even distract researchers. If a researcher wakes up every morning thinking that he must make a theoretical breakthrough, he fails, daily. There is no specificity in design research if it only focuses on philosophy: theoretical work is valuable but so is design and the creation of frameworks.

Although it may seem that constructive design researchers all have their own agenda, they converge at many points. Post-Cartesian philosophical and artistic approaches provide space for investigating materials, issues, and topics.[36] Among these issues and topics are things like the body, social action, or

those unquestioned assumptions about "normality" that critical designers question.[37] Perhaps most important, these background philosophies and artistic traditions open doors for putting design into the center of research. Theory has a role in explicating why design works, but it does not tell how to create good design. This background, finally, explains why current constructive research looks so different from the rationalism of the 1960s — it comes from a different mental landscape.

End Notes

1. One of the most important voices in design at this time was the cognitive psychologist Don Norman, one of the early user interface researchers at Apple. In his view, human action proceeds in a cycle where people set goals, transform these goals into intentions and plans, and then execute these plans against a system. Following an action, people observe feedback from the system to assess how their actions change the circumstances; they evaluate whether their action advanced them toward their goal. In this classic feedback model, with a basis in information theory and cybernetics, humans functioned as information processors. To operationalize this model, interface designers needed to think about how a system could communicate its capabilities in a way that helps users generate appropriate plans, and they needed to provide feedback that clearly communicated how an action advanced a user toward a goal (Norman, 1988, pp. 46–49).
2. However, as John Carroll noted, this is not how human–computer interaction (HCI) or interaction design actually works. He described how the *thing* often precedes the theory (Carroll and Kellogg, 1989). Direct manipulation interfaces, as an advance to command line interfaces, appeared roughly 20 years before Schneiderman (1983) detailed the cognitive theory describing why this works. Xerox created the mouse as a pointing device before Stu Card performed the cognitive experiments that demonstrated this as an optimal pointing solution (Card et al., 1978). Bill Moggridge (2006, p. 39) relates that:

   > *Stu joined Xerox PARC in 1974, with probably the first-ever degree in human-computer interaction. Doug Engelbart and Bill English had brought the mouse to PARC from SRI, and Stu was assigned to help with the experiments that allowed them to understand the underlying science of the performance of input devices.*

   Examples of earlier direct manipulation interfaces were NLS (oNLine System), which was an experimental workstation design including a mouse and standard keyboard, and a five-key control box used to control information presentation. On December 9, 1968, Douglas C. Engelbart and the group of 17 researchers working with him in the Augmentation Research Center at Stanford Research Institute in Menlo Park, CA, presented a 90-minute live public demonstration of the online system, NLS, they had been working on since 1962. An earlier example is Ivan Sutherland's Sketchpad, which was one of the first CAD-like programs. It laid out the idea of objects and object-oriented programming. It was about touching "things" on the screen and motivated the development of NLS. As this history tells, theory came after the fact.

   Finally, it was increasingly clear that social aspects of work, including context and culture, play a significant role in how people use technology.

3. These frameworks, sometimes referred to as Design Languages (Rheinfrank and Evenson, 1996), attempted to explicitly document interaction conventions so other designers could more easily pick up and apply to their own designs. While similar to Christopher Alexander's (1968) concept of pattern languages, these were intentionally constructed conventions, not conventions arising from the longer process of social discourse between designers and users. They were similar to corporate style guides for printed/branded materials found in communication design, but they needed considerably more flexibility to allow for unanticipated future actions. Probably the best known of these frameworks was Apple's Macintosh Human Interface Guidelines. This was an early type of intentional design theory to emerge from the process of making new products and services.
4. The most important historical precursors came from the 1980s. Key writers in America were philosopher Hubert Dreyfus (1992), computer scientist Terry Winograd (Winograd and Flores, 1987; Winograd, 1996), and the social psychologist Donald Schön. In Europe, a similar push came from participatory designers (see Ehn, 1988a) and from Italians like Carlo Cipolla. For more contemporary criticisms and accounts, see Dorst (1997), Gedenryd (1998), and Dourish (2002).
5. Rorty (1967), Rabinow and Sullivan (1979). It is interesting to note that for many main proponents of rationalism like Simon, this philosophical critique was barely more than a form of religion, and therefore not worth replying to. Hunter Crowther-Heyck (2005, pp. 28–29 and 342, note 54) wrote in her biography of Herbert Simon how Simon, always eager to defend his views, had a prophet's difficulty in understanding why some people did not get his message: "He wrote many a reply to his critics within political science, economics, and psychology, but he never directly addressed humanist critics of artificial intelligence, such as Hubert Dreyfus and Joseph Weizenbaum because 'You don't get very far arguing with a man about his religion, and these are essentially religious issues to the Dreyfuses and Weizenbaums of the world,'" as he wrote in his private letters.
6. Interestingly, Norman sits in a pivotal position when it comes to the post-Cartesian turn. His scientific reputation was based in cognitive science, but he also popularized the notion of "affordance" from Gibson's ecological psychology through his 1988 book on design. Admittedly, he interpreted Gibson through cognition, talking about "perceived affordances" rather than direct perception, as Djajadiningrat (1998, p. 32) and Djajadiningrat et al. (2002) have argued.
7. Overbeeke (2007, p. 7).
8. Dunne (2005).
9. The main theorists were Jean Baudrillard in post-modernism and consumption, Paul Virilio in phenomenology, Gaston Bachelard in epistemology, Roland Barthes in semiotics, Klaus Krippendorff in product semantics, George Herbert Mead and John Dewey in pragmatism, Herbert Marcuse and Theodor Adorno in critical theory, and Arjun Appadurai and Daniel Miller in empirical research on material culture.
10. Joas (1983).
11. Dourish (2002); for ethnomethodology, see Lynch (1993).
12. Dourish (2002).
13. Djajadiningrat (1998); Djajadiningrat et al. (2002).
14. Ross et al. (2008, p. 361).
15. Djajadiningrat et al. (2002, p. 286).
16. Ross et al. (2008).

17. Ross et al. (2008, pp. 364–365). This simple workshop shows that many of the systems we engage in today channel Kant's strict, protestant, rationalistic ethic based on the idea of duty. Today you can even witness an increasing number of mobile applications that follow this line of thinking, helping people to track the details of their consumption including fat, carbohydrates, protein, etc. You can also see mobile tools like www.mint.com, which monitors electronic purchases, tracks personal finances, and visualizes how this impacts a user's explicitly set saving goals. It is not hard to then imagine a machine that begins to integrate these two streams and functions as a decision support tool in the way the workshop designers imagined.
18. For example, Lynch (1993, pp. 128–129).
19. Forlizzi (2007).
20. Ethnomethodologists talk about "ethnomethods," meaning those methodic procedures people use to organize their ordinary activities. The classic statement is Garfinkel (1967); a particularly clear exposition is Livingston (1987).
21. Battarbee (2004); Battarbee and Koskinen (2004).
22. Forlizzi and Ford (2000, p. 420).
23. Forlizzi and Ford (2000, p. 420).
24. Dunne (2004, p. xi).
25. Dunne (2005, p. 30).
26. *Hertzian Tales* distinguishes several classes of objects. "Post-optimal objects" provide people with new experiences of everyday life; "parafunctional" questions the link between prevailing aesthetics and functionality; while "infra-ordinary" objects to change concepts and probes how designers could author new behavioral and narrative opportunities. See Dunne (2005, p. 20).
27. Dunne (2005, p. 20).
28. This is not to imply that critical design is somehow Marxist. Dunne (2005, p. 83) distanced himself from Marxism and wrote: "Many issues touched on here, such as … the need for art to resist easy assimilation, overlap with those already addressed by the Frankfurt School and others…. The similarities between these issues and those addressed by Marxist approaches to aesthetics do not imply an identification with Marxism but are the result of seeing design as having value outside the marketplace — an alternative to fine art."
29. As the situationists noted, this mediascape is pervasive enough to be taken for reality (Debord, 2002). This was later one of the pet ideas of French philosopher Jean Baudrillard. As Chapter 6 showed, the situationists are particularly relevant to design through the early days of critical design and also to HCI through Bill Gaver's work.
30. In particular, Roland Barthes and Michel Foucault. This book is not a place to open conversation about their *oeuvre*. Readers are encouraged to read their original work.
31. Molotch (2003).
32. Leading candidates for such theorists are Tomás Maldonado and Klaus Krippendorff.
33. Forlizzi (2007), Hummels (2000), Battarbee (2004).
34. Djajadiningrat (1998), Wensveen (2004), Frens (2006a), Lucero (2009).
35. Ludvigsen (2006).
36. Including the leading writers from Ulm, like Otl Aicher (2009) and Tomás Maldonado (1972).
37. For example, see Overbeeke and Wensveen (2003, p. 96).

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8

DESIGN THINGS: MODELS, SCENARIOS, PROTOTYPES

The Swedish computer scientist Pelle Ehn recently argued that design is "thinging."[1] This sounds mysterious, but the bottom line is that he describes a down-to-earth approach to design. It is his latest attempt to explain why designers get far better results with rough cardboard computers than using sophisticated systematic methods like flowcharts and simultaneous equations. In Ehn's opinion, the reason for the success of these rough "things" was that they brought people to the same table and created a language everyone could share.[2] Design things populate design studios and fieldwork. They range from quick black-and-white sketches on any piece of paper all the way to those skillfully finished prototypes that researchers construct in places like Eindhoven and London.[3]

The key point Ehn makes is that these things play an important role in keeping people focused on design. His argument is etymological. The English word "thing" has Germanic roots. This root is the word *ting*, which in Scandinavian languages still means an "assembly," where people gather to make decisions about the future of the community. If we accept an etymological argument like this, design things are like town hall meetings: places where people gather to decide collectively where to go.[4]

Design things are indispensable tools for transforming designers' intuitions, hunches, and small discoveries into something that stays — for instance, a prototype, product, or system.[5] They provide the means for sketching, analyzing, and clarifying ideas as well as for mediating ideas and persuading others.[6] In Bruno Latour's philosophical language, design things turn weak hunches into stronger claims. They also translate many types of interests into joined strongholds and provide tools that take design from short to long networks.[7] This ability to gather people to talk and debate without any command of special skills is what is needed to work with systems design methods. Flow diagrams and other rationalistic tools cut too many parties out from design, creating a caste system. Understanding these forms requires training, and the mere use of these tools tells non-experts to stay away (Figure 8.1).[8]

Design Research through Practice.

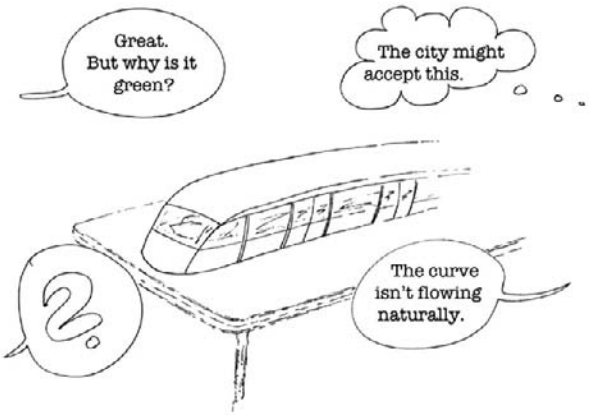

Figure 8.1 Design things bring people together and make conversation concrete.

Most writing about modeling and prototyping in design has been about the construction, technical qualities, and functions of prototypes and has typically tried to classify prototypes and other expressions by their function, technology, or place in the design process.[9] In contrast, writers like Ehn give a theoretical and philosophical grounding on design things and shift attention to what designers do with them.[10] To understand design properly, we need to look at design things in research practice.

8.1 User Research with Imagination

Many methods in constructive design research are immediately familiar to any social scientist, psychologist, or engineer. Researchers collect data at various phases of the design research process by doing interviews, making observations, administering questionnaires, and collecting many types of documents using textbooks from more established disciplines.[11] If there is something specific in how designers gather data, it is their frequent reliance on cameras and videos for data collection.[12] Another difference is that designers are not usually afraid of influencing people they study; they do not try to be flies on the wall.

More significant differences, however, go back to the imaginary nature of design. Designers are expected to imagine new things, not to study what exists today. In ordinary life, people are inventive but within the bounds of everyday life.[13] To get people into a more creative mood, constructive design researchers use several techniques that differentiate them from the social sciences. One technique is vocabulary, which often fails at crucial moments. Few people have an extensive vocabulary for describing things such as materials, colors, shapes, spaces, and other

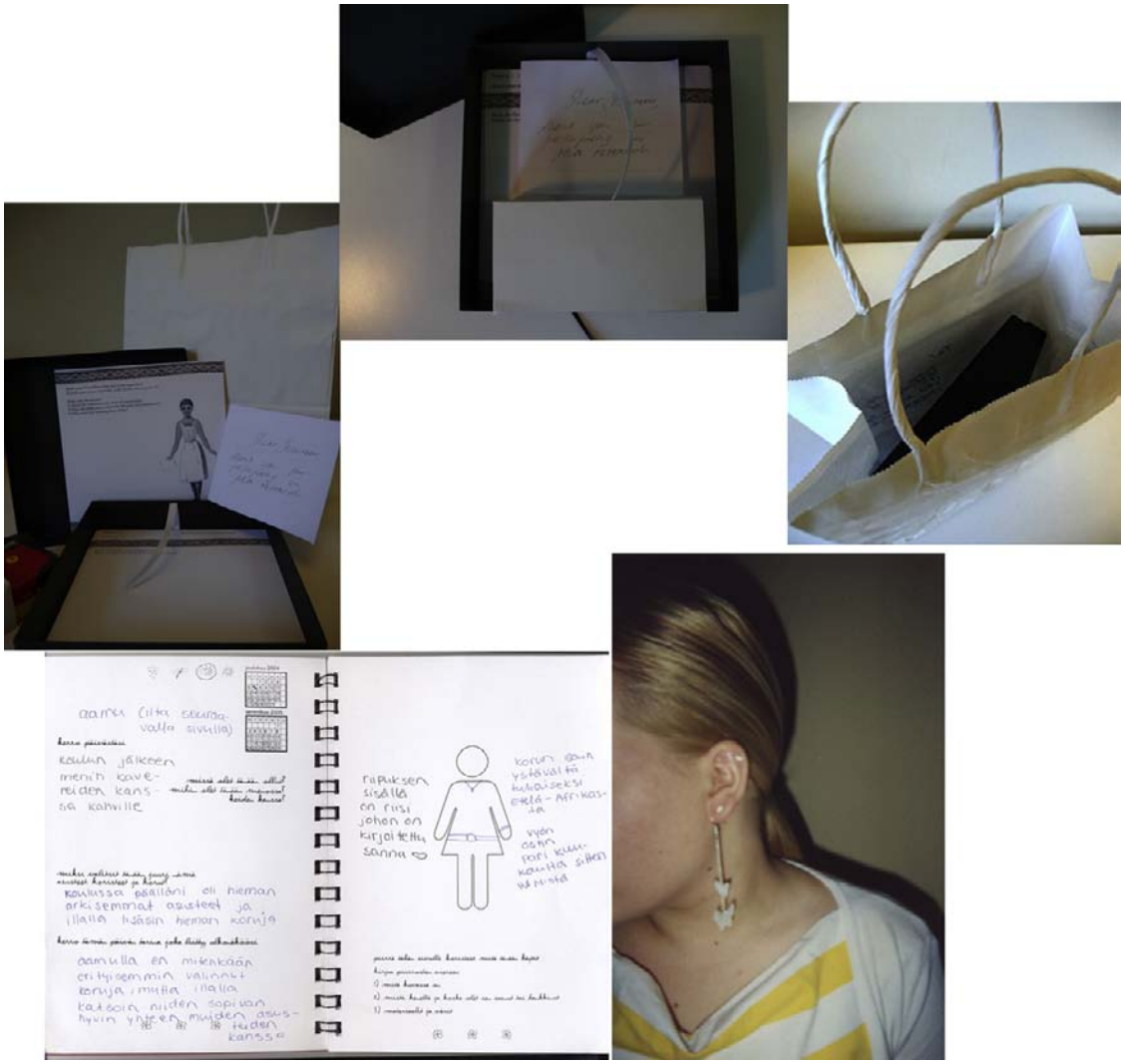

Figure 8.2 Probes and probe returns from a study of women's jewelry in Chicago (2009) and girl's jewelry in Helsinki (2006). (Pictures courtesy of Petra Ahde-Deal.)

things of immediate interest to designers. Designers have to find ways to make people imagine.

These inventive methods are heavily indebted to design practice; they try "stretching" the context rather than describing it in detail. With these methods, researchers try to get at "poetic" aspects of life: things that exist in imagination only or are unique. Among well-known examples are cultural probes and Make Tools that are routinely used in constructive design research (Figures 8.2 and 8.3).[14]

Figure 8.3 "Globe": this is a probe returned to Super Studio at Art Center College of Design, Pasadena, CA. This one collects adult and teen interpretations of what Earth would say to humans, if it could talk. Students: Yee Chan and Serra Semi. (Picture courtesy of Ilpo Koskinen).

For example, in a probe study in Pasadena in 2006, people were given empty globes and were asked questions like what Earth would say if it could talk. They did this by gluing clips from the *New York Times* on the globe.[15] Make Tools, on the other hand, were developed to capture people's imagination about how they make things rather than what they say or do. Make Tools were created to complement marketing research based on what people say in interviews and ethnography based on observations of what people do.[16] This logic also applies to many other methodologies, such as "magic things," which are used to capture sparks of imagination in those fleeting moments of life that usually disappear before anything valuable emerges (Figure 8.4).[17]

Also, designers regularly use things that force them to experience firsthand what it means to, say, have blurred vision, problems in hearing, or arthritis.[18] In the most extreme cases, researchers may even "go into a role" to see how people respond to old age, disease, and sickness. Here they follow the example of designers like Patricia Moore. Such firsthand knowledge is a way to gain empathy, sensitivity, and the ability to spot problems and identify opportunities.

Figure 8.4 Make Tools in design research. The toolkit is shown in the upper left corner. Then two seniors and one child are shown using Make Tools and imagining design solutions together with one user. (Pictures courtesy of Salu Ylirisku and Tuuli Mattelmäki.)

8.2 Gaining Firsthand Insights in the Studio

This lively imagined world has to be brought into the studio. The aim is to get firsthand insights into how people experience their environment.[19] Things like space, proportions, distances, weight, and proximity need to be made concrete so they can be discussed within the design group. For design researchers, this context has to be at their fingertips, not just in their minds: they have to be able to touch it and play with it.[20]

Studios are built to function as knowledge environments—a phrase designer Lisa Nugent used to describe research-oriented studio spaces.[21] There are several reasons for building knowledge environments and doing interpretation in workshops in these environments. First, they test ideas. Things that survive

Figure 8.5 Working in a knowledge environment in Pasadena. Here Yee Chan, Sean Donahue, and Lisa Nugent discuss observations about Angelinos' relationship to nature. (Picture courtesy of Ilpo Koskinen, 2006.)

these workshops are certainly robust because they are tested not only in talk but also through more rich bodily, social, and playful imagination. Second, they help to create joint understanding. They have an intensity that drives curiosity and creates a sense of accomplishment. This work often leads to rewriting research questions. Informed by field data, researchers are able to spot opportunities far better than before. In this early phase, researchers typically also start to create first design concepts (Figures 8.5 and 8.6).

Researchers typically play with these design concepts to gain insight into how people would experience them. Well-known practices are bodystorms, acting out scenarios, and role-plays in which participants switch roles to understand data from many points of view.

An iconic example comes from IDEO, in which bodystorming — the name refers to brainstorming — was once used to study the idea of placing sleeping facilities in airplanes under the seats. This idea might be economically viable but might not feel particularly good. There was a need to know what it would feel like to sit under other people in a small closed space and how it would feel to sit above people who are sleeping under the seat. No complex technology was needed for this exercise. The only props needed were chairs put into

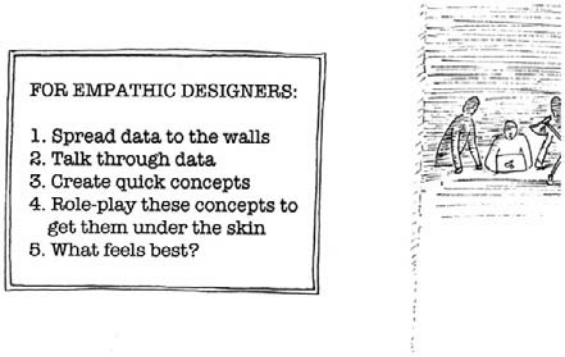

Figure 8.6 Kitchen rules for empathic analysis.

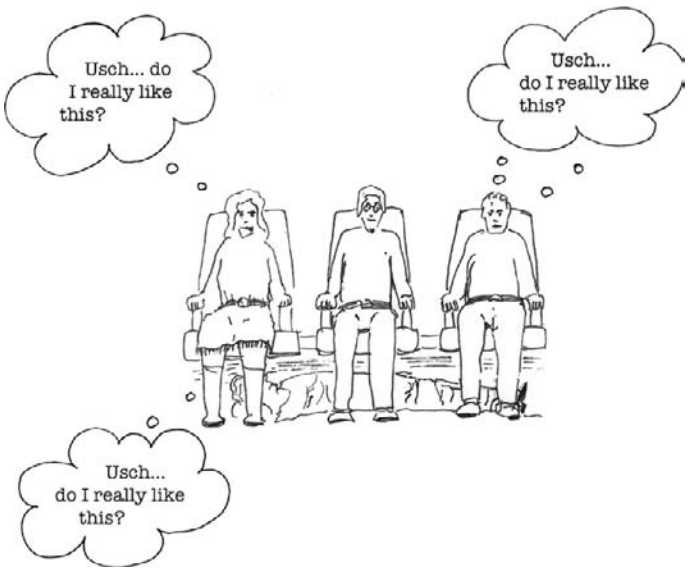

Figure 8.7 Maybe people would like to sleep under airplane seats? Bodystorming the idea.

a row and a few pillows and blankets. Some people sat on the chairs, while others tried to sleep under them (Figure 8.7).[22]

Even organizational simulations can be done this way. Researchers sometimes use humble things like matchboxes, paper cups, and Legos to stage organizational structures and processes. Again, these props are simple, but they generate a genuine feeling of excitement when they are used (Figure 8.8).

Like designers, design researchers prefer to work in multidisciplinary and multicultural workshops to quickly expose themselves to multiple perspectives. Usually, these workshops begin with presentations of data and go on in the classical

Figure 8.8 Snapshot from a design workshop in Design Factory, Helsinki, September 19, 2008. (Picture courtesy of Aalto University's Department of Design.)

brainstorming mode, typically into an open discussion in which criticism is not first allowed. It is only later that discussion points out problems in interpretations and possible design ideas emerge from these discussions. The preference for working together has its origins in design practice, where experience has shown that many eyes see more.[23]

Here, a firsthand sense of design things is particularly important. The work is experimental and playful, and firsthand bodily and social feelings are crucial. Partly for these reasons, most designers are wary of relying on technology only. Thus, even though the Web has extended the possibilities for design research with techniques like "crowdsourcing" and online testing of concepts, it has not caught on in design. Most likely the reason goes back to the disembodied nature of the Web.[24] Design research practice builds heavily on bodily and social interaction, which is difficult to do in the virtual domain.

8.3 Concept Design with Moodboards, Mock-ups, and Sketches

After studio work, constructive design researchers go on to design development, which begins with sketchy ideas and ends with prototypes. Previous phases of research have led to insights and design hypotheses, but many things such as forms, materials, look and feel, mechanic design, and interaction design are

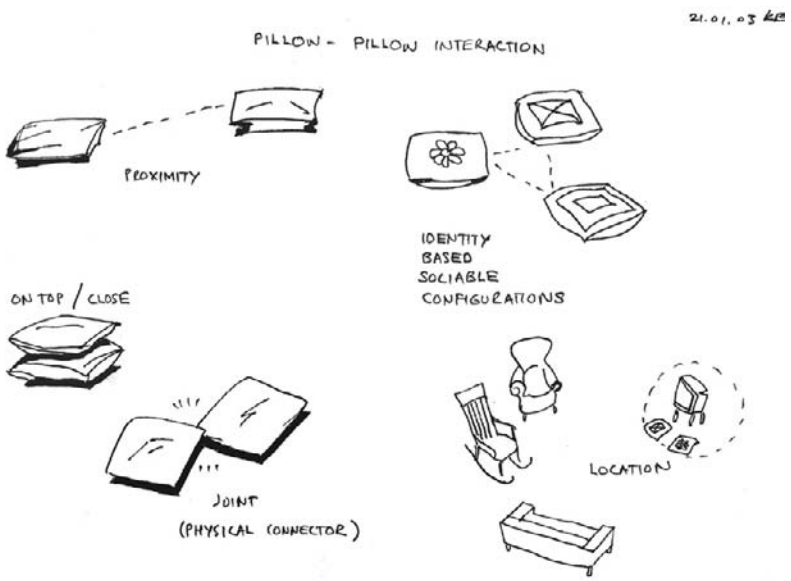

Figure 8.9 Sketches for interactive cushions by Katja Battarbee, January 21, 2003. (Redrawn by I. Koskinen, March 2011.)

still open. These issues are handled with methods borrowed from design practice, including moodboards from fashion design, storyboards from film making, and scenarios that have their origins in the military. With these methods, researchers are able to bring their design skills and intuition into the research process.[25] Up-to-date practice in scenarios starts with scriptwriting and ends with 3D animations, concept films, and virtual reality.[26]

For example, researchers explore how the design looks and feels; its color, light, and shade; surfaces; contrasts; and materials with sketches. They also explore structures and functions with these sketches.[27] Some sketches are 3D studies in clay and other cheap modeling materials like styrofoam. These sketches are done to study scale and feel in the hand and on the body, as well as mass, form, and composition. Later, they may also turn to studies of materials and mechanisms. It is important to choose the appropriate level of coarseness and not get into details before the basic idea is mature (Figure 8.9).

For studies of form and scale, researchers do mock-ups from cardboard, wood, cheap plastics, and other materials at hand. Mock-ups are simple and cheap, and they can be changed easily for feedback. Also, they facilitate communication, enable participation in the design process, and encourage imagination. As they are not limited to current technology, they unleash imagination.[28] Even though the past few years have seen a rapid technological

Figure 8.10 Sketches for an interactive robot from Carnegie Mellon's Snackbot study, which developed a mobile and autonomous robot for delivering snacks to people at Carnegie Mellon University.[30] (Picture by Eric Glaser, thanks to Jodi Forlizzi.)

development with 3D printers being used in design and design research, mock-up materials are typically low-tech (Figure 8.10).[29]

Sketches are helpful in nailing down design ideas; they also help to understand things like service flow, scale, form, and how people will interact with the concept. They are not meant, however, to study issues like technology, materials, the look and feel of the idea, details of user interfaces, or details of how the concept functions. For these studies, researchers use scenarios — often verbal, sometimes visual (Figure 8.11).

8.4 Prototyping

At this stage, design concepts are grounded in experience, but they still remain barely more than images. To get an idea of tangible things like mechanics, behavior, and materials and colors, researchers build prototypes. Prototyping is the only way to understand touch, materials, shapes, and the style and feel of interaction. It is also the only way to understand how people experience product concepts and how they would interact with them. As researchers in Eindhoven explained:

> *Design always goes through many explorations. The exploration within design research must be as abundant, but must also be more structured and systematic than in the normal design case. Reflection on a multitude of prototypes might, e.g., be done by trying to categorize them on dimensions of similarity and difference.*

The form theory course in [Wensveen's study] resulted in more than 100 models that could be categorized.… Reflection on this categorization informed the rest of the design process. This insight can only be gained by making all these prototypes, and not by thinking about them.[31]

Research prototyping shares these functions with industrial prototyping, but differs from it in several other respects.[32] For example, researchers are not usually interested in technical testing, robustness, safety, or manufacturability.[33] Also, they do not need to sell their ideas to product development, management, and customers. Prototyping has its share of problems. Since prototypes are future oriented, they often lack connection to the present. Also, there is a danger of "tunnel vision" in which researchers elaborate the prototype rather than question its premise. Finally, there is a danger of paying too little attention to social aspects of use, as technology development takes priority (Figure 8.12).[34]

Somewhere between mock-ups and prototypes are "experience prototypes," which Buchenau and Fulton Suri defined as representations designed "to understand, explore or communicate what it might be like to engage with the product, space or system we are designing."[35] Experience prototypes create a shared experience

Figure 8.11 Scenario studies of proactive information technology in everyday life. Top: lamps are brighter when they sense sound and dim slowly. Bottom: lamps react to the sound of other appliances at home. (From K. Kuusela, 2004.)

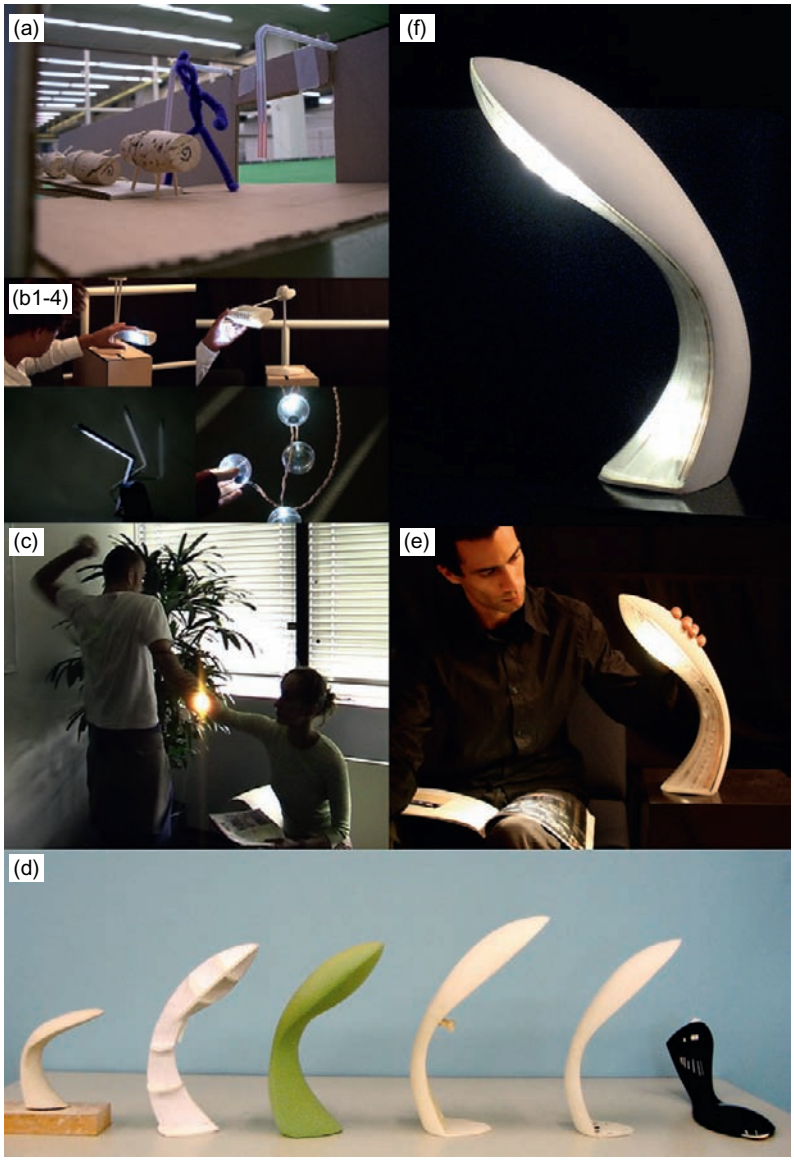

Figure 8.12 Building ethical lamps. (a) Nietzschean slaughter machine from an ethical workshop. (b1-4) Four lamp designs by TU/Eindhoven students (Rutger Menges, Ralph Zoontjes, and Lissa Kooijman). (c) Workshop on the aesthetics of interaction with dancers behaving as lamps. (d) Form studies. (e) Philip Ross using the AEI lamp. (f) Lamp prototype. (g) Philip Ross' industrial prototype. Sometimes research prototypes end up becoming industrial prototypes, but this requires extra work and funding. (Picture courtesy of Philip Ross.)

and provide a foundation for a common point of view in design teams. They are used to understand existing experiences and contexts, to explore and evaluate design ideas, and communicate ideas to audiences. With programmable toys like Lego Mindstorms it is also possible to build simple mechanisms and programs into the mock-ups to see how they function and what kinds of messages their behavior conveys.

8.5 Platforms: Taking Design into the Field

Prototypes may be ingenious and well made, but they remain researchers' guesses about a possible product unless they are somehow studied. Over the past few years, researchers have started to do increasingly ambitious research to see how their prototypes work. Research has recently gone beyond brief site visits, evaluation studies, and tests.[36] When working with new technologies that have little origin in current practices, the best way to follow these technologies and practices is to build them, hand them to people, and then study what happens.[37]

Researchers have increasingly given people freedom to do whatever they will with designs. For example, Ianus Keller gave his Cabinet design to several design studios for a month to see how designers interacted with it.[38] Another ambitious study was Morphome, in which all designs were repeatedly studied with people in everyday life for weeks and months.[39] The reasons are well explained on the Web site of Interaction Research Studio at Goldsmiths College, London:

> *Designing, building and testing prototype products is at the centre of our research…. We build our prototype products to a very high level of finish and technical robustness, which allows them to be tested for long periods in everyday life, and to be shown in lengthy exhibitions with minimal maintenance. Currently we are moving towards batch producing prototypes, so that we can disseminate 50–100 instances of a given design for extensive field trials.*[40]

In addition to field studies, many researchers have recently built platforms for observation. Radiolinja was a study about camera phones in Helsinki between 1999 and 2002. Researchers followed camera phone messaging through the network of Radiolinja, which was Helsinki Telephone Company's mobile carrier. In this system, people sent multimedia messages to the Radiolinja network, which distributed them to recipients' phones as well as a log site, where the message could be browsed through a Web link. Through the log site, researchers were able to follow

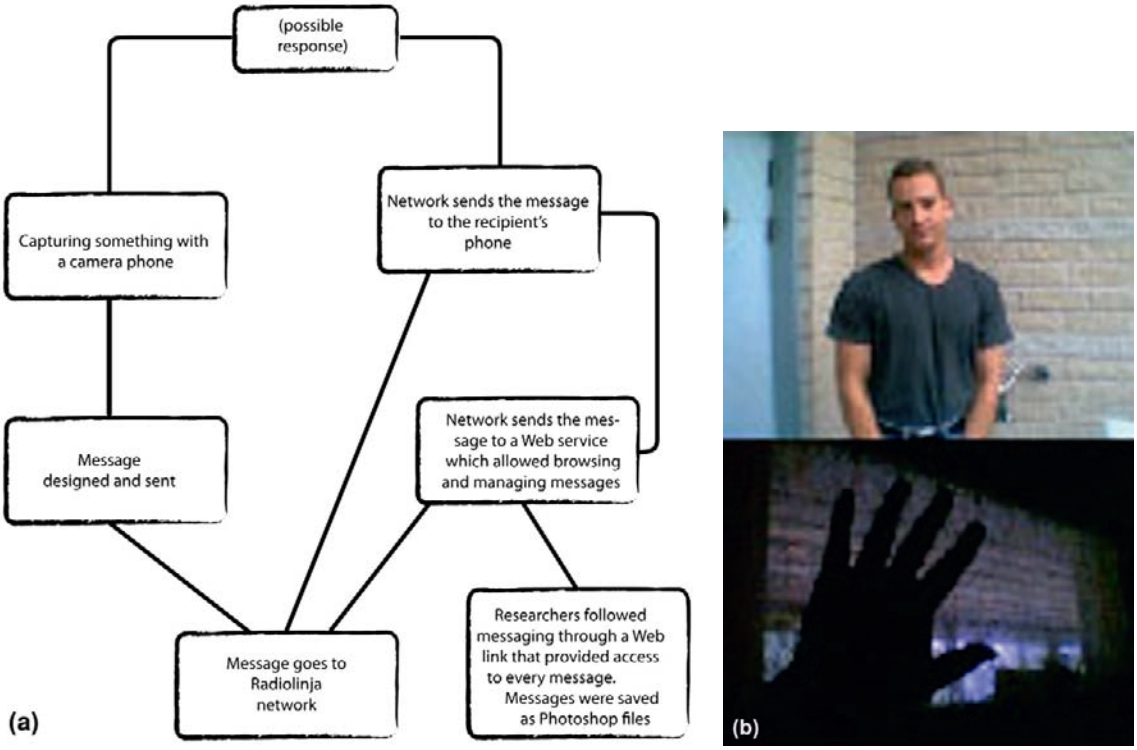

Figure 8.13 (a) System used in Mobile Multimedia in 2002. (b) This platform allowed actual messages to be followed. The first picture was sent to Anna with text saying "Greetings." Anna's response was a picture of a hand waving with the text "Greetings, also from Mama."

messaging. They followed it daily to see how people used this new technology (Figure 8.13).[41]

There is little new in these platforms. They have existed for a long time under various names, ranging from panel studies in the social sciences to field stations in agriculture, and field hospitals in medicine. In industry, the most comprehensive platform so far comes from Philips Research, which has developed an Experience Research Cycle for studying how ambient intelligence could be embedded into everyday life on a large scale. The cycle begins with a context study that maps context without technology, usually with observations. It continues to laboratory studies that test usability and user acceptance in controlled environments that enable detailed and accurate qualitative and quantitative studies. It ends with field studies that validate the results of laboratory studies and focus on the long-term effects of technology.[42]

Platforms like these enable many kinds of studies. For example, in Radiolinja the main focus was on how people design their messages and respond to them, but researchers also calculated

statistics of traffic, message types and networks, and time series analyses.[43] Even more complex platforms for studying camera phones were built in Berkeley, leading ultimately to the redevelopment of services like Flickr.[44] With platforms, researchers can follow things over time and do comparisons between technologies and their variations. Another benefit of platforms is that they pave the way to more complex research designs, including doing quasi-experiments to compare different technologies and designs.[45]

8.6 Design Things in Research

Design things like moodboards and prototypes populate the spaces in which designers work. Likewise, they populate constructive design researchers' studios and the pages they write. The reasons for using them in research are the same as in design. They are an effective way to bring people to the same table to imagine better futures together. Most important, they make it possible to probe and discuss those sensuous, embodied and social things that are central to design — like colors, how materials feel on skin and the shapes of objects. Few people have a reliable vocabulary to talk about them. Inventive methods have a place in design for this reason alone. We do not know why these things work, only that they do work.[46]

This chapter looked at how design things are used over the design process. In early-stage user studies, these things are used to bring imagination and playfulness into these studies and to make imagination shareable. Later, when design enters a concept design phase, design things are used to develop concepts for products and systems. When research enters the design phase, researchers create models, mock-ups, and prototypes. Even later, with concepts and prototypes at hand, constructive design researchers usually study them with people to see how their ideas work. It goes without saying that for different types of research tasks, different methods are used. Also, there are few studies in which all of these steps are used; this is not a mechanical sequence, it is a creative process.[47]

Design things are colorful, playful, and usually projective: they illustrate future possibilities. They also fail occasionally. When the Presence Project asked people to imagine Biljmer in Amsterdam as a body, most participants were perplexed and did not know what to do.[48] This playful, exploratory, and projective stance made it difficult to think about these things logically. Design things are not traditional research instruments.

It is this richness, however, that creates touching points in life. Philip Ross did not need to be able to explain everything that happens in his clay models because people connected to them

in many ways, not just intellectually; people can study and discuss these models. This is more important than whether or not design things can be explained in detail. In still broader terms, design things enable designers to capture Maurice Merleau-Ponty's "flesh" — that poorly understood netherworld in which humans meet things from which designers get much of their inspiration.[49] The specific skill of a designer is to be able to put a concept into a workable form. Ideas may fly in any conversation, but methods are needed to turn these ideas into prototypes, products, or systems.

End Notes

1. Ehn (2008, 2009).
2. Ehn (1988a,b), Star and Griesemer (1989).
3. There are a few precursors to this argument, most notably Henderson (1999; see also Kurvinen, 2005). Ehn's argument about design things is social institutional and, as such, an alternative to those explanations in which design is seen as primarily a cognitive activity (Lawson, 1980, 2004; Cross, 2007; Visser, 2006).
4. The link between using design things and making the design process more democratic is obvious and has been made by many writers, although usually in less colorful language than Ehn (see Muller, 2009; Säde, 2001; Shaw, 2007; Moon, 2005; Pallasmaa, 2009).

   Ehn's argument is similar to that of Bruno Latour and is also indebted to Martin Heidegger's philosophy. A member of the group led by Ehn, Giorgio De Michelis (2009, p. 153, italics added), wrote:

   > *In a short essay published in* Poetry, Language, Thought *Martin Heidegger recalls that the German word "ding" (sharing its root with the English word "thing") was used to name the governing assembly in ancient Germanic societies, made up of the free men of the community and presided by lawspeakers. It should be noticed that also the Latin word for thing, "res," occurs in "res publica" ("republic" in English).* So things are the issues governing assemblies take into consideration, the issues raising public concern. *The word "thing," therefore, does not indicate genericity, absence of specification, but impossibility of specification. Things are not without interest: on the contrary, they are what merit our attention. Things are matters of concern because they can't be reduced to any specification: Things exceed the way we classify them and are open to discovery and surprise.*

   From this perspective, as De Michelis noted, design appears as one of those elementary practices in which human beings experience not yet existing things.

   Similar semantics also works in Finnish, although etymology of the word "asia" is of course different.
5. Seago and Dunne (1999, p. 16).
6. For the politics of prototyping, see Henderson (1999). Juhani Pallasmaa (2009, pp. 58–60) wrote about models in architecture, but his description no doubt works in design too:

   > *Drawings and models have the double purpose of facilitating the design process itself and mediating ideas to others…. Even in the age*

of computer-aided design and virtual modeling, physical models are incomparable aids in the design process of the architect and the designer. The three-dimensional material model speaks to the hand and the body as powerfully as to the eye, and the very process of constructing a model simulates the process of construction. Models are used for a variety of purposes: they are a way of quickly sketching the essence of an idea; a medium of thinking and working, of concretizing or clarifying one's own ideas; a means of presenting a project to the client or authorities; and a way of analyzing and presenting the conceptual essence of the project…. The architect moves about freely in the imagined structure, however large and complex it may be, as if walking in a building and touching all its surfaces and sensing their materiality and texture. This is an intimacy that is surely difficult, if not impossible, to simulate through computer-aided means of modeling and simulation.

7. Latour (1987).

8. Models have received a lot of attention in architecture recently. Karen Moon (2005) wrote extensively about models in architecture, largely focusing on historical examples, but also on the likes of Eero Saarinen, Cesar Pelli, Norman Foster, Toyo Ito, Skidmore, Owings, & Merrill, and, of course, Frank Gehry.

Despite swings in popularity and purpose, architects still construct models mainly to develop their ideas and communicate them to clients and financiers. Models communicate a purpose, and often have a utopian character, and although for many architects, models are but stages in a process in which only the final product — usually a building or a plan — matters, they have recently achieved a celebrity status of sorts, having a market in which models are bought from studios sometimes at the cost of hundreds of thousands of dollars. Buyers are usually museums that have room for often precarious models.

Moon focused on architecture, where issues like scale, lighting, and photography are important, but some of her observations may also apply to design. In particular, the functions of models are largely the same. Designers face questions about the artistic and sculptural quality of their work just as architects do. Their models can also be expensive to build. In the main, however, design models are cheap, in-the-moment creations meant for critiques in the design process, and although there is already a market for design sketches and prototypes, the market for design models is less developed.

No doubt, this will change when design museums become more common and gain importance. After all, the key factor in developing a market for architecture models has been the rise of architecture museums. Design prototypes are also small, which helps in creating this market.

Another recent book on models in architecture is Morris (2006).

9. Säde (2001) is still a good introduction.

10. For recent discussion, see Zimmerman et al. (2007).

11. Sleeswijk Visser (2009).

12. Wasson (2000) and for E-Lab, Wasson (2002), Ylirisku and Buur (2007).

13. See Brandes et al. (2009), Fulton Suri and IDEO (2005).

14. For probes, see Gaver et al. (1999); for Make Tools, see Stappers and Sanders (2003).

15. Nugent et al. (2007).

16. Sanders (2000), Stappers and Sanders (2003).

17. Iacucci et al. (2000).

18. Fulton Suri et al. (2005).

19. See IP08 (2009).

20. See Poggenpohl (2009a, p. 7) and the reference to Maurice Merleau-Ponty in note 19 in Chapter 1.

21. Nugent et al. (2007).
22. Buchenau and Fulton Suri (2000).
23. Wasson (2000), Szymanski and Whalen (2011).
24. Dreyfus (2001).
25. For moodboards, see Lucero (2009); for scenarios, see Carroll (2000).
26. Raijmakers (2007).
27. Buxton (2007).
28. Ehn (1988a, pp. 335–336).
29. See Caption (2004). For lo-tech approach, see Ehn and Kyng (1991).
30. See snackbot.org and Lee et al. (2009).
31. Overbeeke et al. (2006, p. 12).
32. Säde (2001, p. 55). For differences between research prototypes and industrial prototypes, see Chapter 4, which quotes Frens (2006a, p. 64).
33. Ross (2008), Hummels and Frens (2008), and Frens (2006a). Some research groups, however, have gone into that direction, most notably researchers in Interaction Research Studio of Goldsmiths College, London. See gold.ac.uk/interaction/portfolio/, retrieved March 10, 2010.
34. See Mogensen (1992, pp. 5–6.
35. Buchenau and Fulton Suri (2000).
36. See Kankainen (2002).
37. Crabtree (2004).
38. Keller (2005, p. 119ff).
39. Mäyrä et al. (2006), Koskinen et al. (2006).
40. gold.ac.uk/interaction/portfolio/, retrieved March 26, 2011.
41. Koskinen et al. (2002), Battarbee (2004), Kurvinen (2007), Koskinen (2007).
42. De Ruyter and Aarts (2010).

Some global companies have organizational models for achieving similar results. They have for so long placed their creative studios in fashionable places where designers can observe the world without effort.

We have already mentioned Olivetti as a historical example in Chapter 2, but the practice still exists today; for example, one of Toyota's Creative Studios is in Chicago's fashionable Bucktown. Similarly, the car industry has long had its main design studios in the world's leading car culture, Los Angeles. Harvey Molotch (1996, pp. 257–258) wrote an elegy to Southern California:

> *Those in California auto design disagree among themselves on what, if anything, may be the basis for the region's special design role. For Hiroaki Ohba, executive vice president of Toyota's Calty Design, the company's Orange County location is particularly stimulating, among other reasons because "Newport Beach is a museum for automobiles and an ideal place for the automobile designer…. We see many antique cars in Newport Beach." There are also "more exotic cars on the streets of a place like Newport Beach (Porsches, Ferraris), more, according to Ohba, than one would find in Germany or Japan. The youth of California have for generations been great style experimenters. One auto designer told me that the fashions on Melrose Avenue, a 1990s hot strip of boutiques and high-end junk shoppes for the affluent young, influence car design. The shapes and colors of jewelry, the textures and combinations of outfits, all may end up in design details…. Even if not consciously inventorying "the trends," designers are alert to such messages from the streets and shop windows. The GM California studio chef says he likes to take "a few of our guys and drive along the beach … to see what people do on weekends with their vehicles." The Chrysler vice president for design explains his company's presence in Southern California as taking "advantage of the local culture there."*

There is also the notion of the "living lab," which we find confusing. Again, the idea here is to build environments in which people are free to do things, but which can be followed with permanent research instruments. This term gained some popularity in Europe from 2005 to 2008.

43. See Kurvinen (2007), Koskinen (2007). For other large-scale field studies in context, see Jacucci et al. (2007), who studied multimedia systems for rock and jazz festivals and even a massive, 400,000 participant World Rally Championship event in Finland.

44. van House et al. (2004, 2005).

45. For the "breaching experiment," see Crabtree (2004). For another approach, see Binder (2007) and Binder et al. (2011), who talks about design:labs.

46. However, see Kurvinen (2007) for a study of how people interact with design things in meetings.

47. But see Wensveen (2004) and Ross (2008).

48. Gaver (2002).

49. For this weight, see Chapter 1, and our inspiration, Maurice Merleau-Ponty (1968, 1970). See also Chapter 5 and the quote from Fulton Suri in that same chapter (Fulton Suri, 2011).

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9

CONSTRUCTIVE DESIGN RESEARCH IN SOCIETY

Chapter 8 outlined the ways in which constructive design researchers use design things in their research process. Design things, we saw, gather people around actual design work.[1] Just as any research, however, constructive design research cannot stop there. Any research program worthy of its salt needs to function in society, not just during the project. Successful programs keep designers dialoging with society; unsuccessful ones are unable to keep this dialog going long enough.

This chapter reviews constructive design research in society. As soon as researchers leave the university, they face rationalities different from their own. Many of these rationalities are beyond their control; more often than not, researchers find themselves in a subordinate position in activities initiated and controlled by people who think differently.[2] In practice, constructive design researchers work in a network of contracts and overlapping commitments. As various partners come and go into the projects with varying agendas, it is difficult to predict what comes out. Projects like these are "garbage-cans," as Michael Cohen, James March, and Johan Olsen once famously called organizational decision-making processes.[3]

To keep research going, researchers have to understand the demands society imposes on them. To function, researchers need to understand some of the rationalities they face outside of the studio. This chapter explores some of these rationalities through the example of Luotain, a key project in Helsinki's empathic design program. Taking these demands into account improves the chances of success in research.

9.1 Luotain

Luotain ("probe" in English) was a design research project in Helsinki from 2002 to 2005. It was built around cultural probes

Design Research through Practice.

that had been used in research in Helsinki since 1998. While the original British work on cultural probes sought to expand the mindset of human–computer interaction (HCI) researchers, Luotain took a step back and studied whether cultural probes work in company settings.[4] The practical goal was to improve product development in companies by introducing new, design-specific research methods. In practical terms, Luotain created concepts for companies. Product development, however, was left to the design firms.

The project had thirteen participants. The coordinators were industrial designers at the University of Art and Design Helsinki.[5] Originally, participants consisted of five pairs of companies. Each pair had a company and its design partner and brought a case for the project, which was run as a series of cases with seminars and workshops in between. Later, this setup expanded to include an extra design consultant and new companies. Funding came partly from companies, but the main funding came from the National Technology Research Agency.

The conceptual roots of Luotain were in an interpretive critique of emotions. By the end of the 1990s, the prevailing view in information technology was that emotions can and ought to be measured. Instead, Luotain turned to empathic, sociological, and interpretive theories of emotions. Emotions were seen as crucial to design and as social processes in need of empathic interpretation rather than directly measurable bodily processes (Figure 9.1).[6]

Figure 9.1 The structure of the Luotain project.

By any measure, Luotain was successful. It lasted about three years, and during this time it was able to attract company interest and funding. It also led to more than twenty scientific papers and Tuuli Mattelmäki's widely admired doctoral thesis "Design Probes."[7] Its later impact can be seen in numerous studies. It has influenced dozens of master's theses: some oriented to user research, some to concept development, and some to construction. For example, during Luotain Katja Soini was a doctoral student who went into organizational development and started to explore how design researchers can even participate in legislature. Another doctoral student, Kirsikka Vaajakallio, begun to explore how methods in Luotain were connected to participatory design; she first explored design games but later rediscovered the empathic roots of Luotain. Mattelmäki realized that through workshops many kinds of participants can be brought into design. Since then, this realization has led her to co-design.[8]

9.2 Researchers as Peers

Luotain found an audience in many research communities. The project plan in 2002 built mostly on literature in HCI, which was still fashionable after the dot.com bubble burst. The key papers in Mattelmäki's Empathy Probes from 2006 were published in human-centered computer science conferences. This work was based on earlier work in smart products — small software-intensive gadgets that had become an important part of the design business in the 1990s.[9]

The audience soon started to change. Luotain started to build on the notion of user experience, a term that had been introduced to design more than ten years earlier and had become popular after the turn of the century. For Luotain, this term opened doors to HCI and design research. By the end of the project in 2005, researchers were publishing in HCI conferences and journals as well as in more design-oriented conferences like the Royal College of Art's Include. Subsequent projects continue to be seen in all of these venues.[10]

For researchers, this is basically a safe world. Researchers may disagree on many things, but they share many goals. In this world, they are able to gain a high degree of control over their activities and ways of thinking, and they know a great deal about its ways of reasoning.

However, there are also differences. Interaction designers, for example, mostly build their research traditions on computer science and psychology. They favor theory building, experimental research, and statistical analysis. For empathic designers, this can be a hostile environment: there are few pockets of

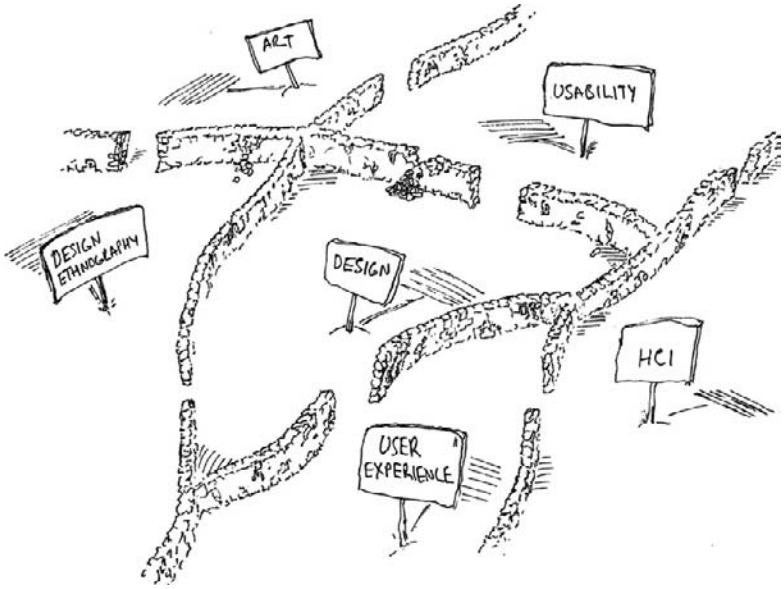

Figure 9.2 Research programs find their paths from several communities.

sympathetic reviewers. In ethnographic communities like the Ethnographic Praxis in Industry conference, empathic designers find people who understand interpretive research. Still, there are many dividing lines here too. For example, one issue is whether research should provide inspiration for design or whether it ought to be based on careful documentation, analysis, and theoretical work.[11] In artistically oriented communities, even interpretive research may be too analytical because it stresses writing at the expense of exhibitions (Figure 9.2).[12]

Constructive design researchers place their work on this palette of communities in several ways. For example, researchers in Eindhoven mostly publish in HCI conferences and journals but also find outlets in design. Critical designers publish in both places but have focused on HCI for most of the decade. They have only recently come back to design much like the participatory designer places in Scandinavian design universities and empathic designers in Helsinki.

As design research has matured and gained a degree of academic autonomy, there has been a marked trend toward design as a disciplinary base. Still, constructive design researchers keep publishing in several communities. Interaction designers have increasingly been interested in the material, cultural, and social sensitivities every good designer works with and are willing to learn from their practices. The scientific leanings of HCI occasionally clash with the creative leanings of designers, but the gap

is far less pronounced than it was a decade earlier. The HCI community has become far more receptive to design, setting up a design subcommittee at its CHI conference in 2009.

Constructive design research has also found a home in many design schools. Often, however, design research in these schools focuses on history, aesthetics, and critical studies. Also, traditional design disciplines like ceramics and textiles define their future through art, not research. Perhaps for these reasons, constructive design research usually takes place in industrial and interaction design programs. Constructive research widens the research basis of art and design schools but may also create a split between the humanities. However, as most constructive design researchers build on interpretive thinking, art, and design, there are also many things that create bridges to the humanities.

9.3 Research Faces Design Traditions

Luotain was created after about ten years of work on smart products in Helsinki,[13] but it put methodology into a new theoretical context. The main research question was inspiration rather than usability: finding new design opportunities rather than optimizing products and product concepts. The leading idea was that designers need to understand people before they can start designing. This idea came to be known as "empathic design," even though "interpretive design" would have been a more accurate term. Innovative research methods, as Carnegie Mellon's Bruce Hanington has called them, quickly became a meeting point for researchers, companies, designers, and other stakeholders.[14]

In terms of design, these were not obvious steps. Language in design had few concepts with which to describe work that was interpretive, relied on post-Cartesian theory, and used methods that were often inspired by twentieth century avant-garde art.

Still, for many reasons, Luotain found support in industrial and interaction design. For some designers, Luotain was putting on paper what any good designer already knew. For others, it was a research community's answer to their interpretive self-image and that good design has to start from understanding people. Also, because Luotain borrowed many methods from design practice and its workshop-based methods of analysis were familiar to every designer, it was easy to integrate it into teaching and practice. Luotain's primary creator, Tuuli Mattelmäki, was named the industrial designer of the year in 2008.

A somewhat harder nut to crack was the workshop culture at the heart of design. Traditional design education is a hands-on education, and the dominant tradition of design education still uses the Bauhaus as its prototype.[15] The Bauhaus gave design education

Figure 9.3 What designers tell researchers.

the idea of combining art, craft, and industry, as well as the idea of bringing the best from other fields of learning into design. However, empirical social science was not a part of its program.[16] In many programs modeled after the Bauhaus, user researchers have hit their heads against this heritage. They have usually been placed into separate research units, away from design.[17] Luotain's solution was to focus on the early-stage interpretive foundations of design work, concept search, and concept design, rather than plywood and screws. For practitioners, this is perfectly acceptable. Conceptual work belongs to good design, and many designers live by conceptual design rather than construction (Figure 9.3).

In broader terms, constructive design research has gained many sympathetic listeners in design. Since the 1960s, many things have been pushing design away from its practical roots.[18] Industrial design has made design a more abstract discipline, process-based rather than material- or form-based. CAD technologies have made the skills of the hand less important and pushed descriptive geometry to the sidelines. Design management has focused designers on brands, markets, images, and organizational processes. Interaction design had valued an ability to talk about behavior and meanings in the abstract and to think in terms of flows and logic rather than traditional design forms and materials. The media image of design has been conceptual and is on the verge of becoming artistic. Most recently, services and sustainability have pushed designers still farther into abstraction.

In this context, most practitioners have welcomed constructive design research. For them, its stress on doing has an air of familiarity. When they see researchers in studios and workshops, they find it easy to communicate with them on equal ground. Most ideologists of constructive design research are programmatically pushing into the heart of research. Some are even arguing for using research as a template for wider restoration of universities that have become dangerously scientific at the expense of practice.[19]

9.4 New Bauhauses: Digital and Electronic

Constructive design researchers face another type of environment in design programs at technical universities. Technical universities traditionally build design on science and engineering, not on art and craft. When designers in these environments turn to ubiquitous and tangible computing models, they often turn to industrial design as a model. At one extreme, the dream is to create a version of digital and electronic Bauhaus by merging technology and art.[20]

A recent example of this type of program is K3 at Malmö University in Sweden. This program combines art, cultural studies, and communication.[21] Its research side builds on media studies as well as on participatory design and computer science. Its founders' goal was to turn it into a digital version of the Bauhaus. For the program's founders, post-Cartesian philosophy and contemporary art provided useful arguments that justified building workshops to enable experimental work.[22] Here, they continued their earlier work from Sweden, where several researchers had defined electronics and software as design material.[23]

The reasons for bringing studios to technological research are well explained by Pieter Jan Stappers of Delft University of Technology:

Classically, design studios are known for their visual culture. Designers surround themselves with inspiring materials, sketches

Interactive Rear-View Mirror

IP08 was a nine-week design class given at the University of Art and Design Helsinki in spring 2008. In this class, master's level industrial design students went through user-centered design processes. Students had to create a design concept, learn the basics of microcontroller, learn some programming in C, and refresh the basics of electric circuits.

In 2008, the theme of the class was co-experience (Battarbee, 2004) in the car and safety while driving. Interaction between the front and the back seat at that time was a major road safety issue, taking people's focus away from what was happening on the road, causing potential hazards, and introducing risks into the driving experience. The class wanted to give students a firsthand bodily understanding of embedded technology, in our case how sensors and actuators work, and this was stressed throughout the class from the first user studies to the final testing of the prototypes.[24]

Kaj Eckoldt and Benjamin Schultz built an interactive rear-view mirror. Their work process is described in Figure 9.4.

In terms of process and the way in which the class oscillated between studios and workshops, IP08 is much like any typical design process. The difference is that the design came from theoretical reading, lectures, and the elaborate philosophy behind the class.

Figure 9.4 Constructive research in the classroom. (a) User studies in Lahti, Finland. (b) Concept creation. (c) Studio work. (d) An experience prototype of how screens could be used to mediate communication between parents and children. Eckoldt and Schultz rejected this concept and worked with real mirrors. (e) Eckoldt and Schultz are trying out early concepts with a Lego Mindstorms model in the workshop. (f) From the workshop. (g) They test another concept with Lego Mindstorms. (h) Mock-up of a child sitting in a baby chair.[25]

and prototypes; other designers in the studio absorb these visual sparks as well, and such visual outlets are known to set off unplanned and informal communications, and present people with unexpected inputs, which can serve as part of solutions and lead to serendipitous innovation.

> *In 2001, four research groups from our department started ID-StudioLab, in which staff, PhD students and MSc students on research projects worked in a studio situation to promote contact between different expertises and different projects…. It promoted the informal contact and sharing of ideas and skills, an undercurrent that can be as important for the dissemination of research findings as the official publication channels. Moreover, it formed a playground in which design researchers could "live with their prototypes," an important ingredient of "research through design"….*
>
> *The "living prototypes" were part of the "texture" of StudioLab, influencing and being influenced by dozens of researchers, students and visitors who all brought and took away snippets and insights according to their specific background. This is why design studios are so important for growing knowledge.*[26]

This setting keeps the distance between the source of inspiration and reasoning small. ID-StudioLab is also located close to Delft's workshops, and there is a small electronics lab next to the StudioLab. Proximity encourages researchers to explore their ideas not just through discussion, but also physically. However, StudioLab's researchers also have expertise in user studies and in field-based evaluation of their prototypes. It is not a laboratory in which researchers explore things sheltered from reality; its boundary is permeable.[27]

9.5 Meet the Business

Luotain was a novel experience to many company participants, just as it was for many designers. For instance, in Datex-Ohmeda, which General Electric bought during Luotain, the project was owned first by the company's usability group. Many suspicions were voiced because the project did not follow the group's standard practices and put many of them in doubt. When the upper management saw the value of the project, however, it began to be accepted. On the other hand, when Luotain worked with Nokia, it was not seen as a novelty. Nokia had been involved in European research projects that had used cultural probes, and many researchers working in the project had trained many Nokia designers.

With the exception of Nokia, Luotain prompted rethinking of products, product road maps, and in some cases product development as a whole as early as 2002. At the end of the project in 2005, companies were on the map. Former usability testing groups had by then evolved into user-centered design groups.

When Mattelmäki was writing her doctoral thesis, she interviewed companies that had been involved in Luotain. She

learned that the main benefits of her "empathy probes" were that they provided inspiration and information on users' needs and contexts for company designers, they allowed users to express their idea to product developers, and they created a dialog between users and designers.[28]

There are other studies that show how constructive design research is attractive to industry and has been appropriated in businesses. When working with constructive design researchers, companies find research that helps them to identify opportunities. In addition, they provide concepts, prototypes, and well-crafted arguments that explain these. Constructive design research also prepares people who can go back and forth between theoretical ideas, studio work, and workshops, and who have the ability to plan and to work with materials and technologies. These are valuable skills.

There are some patterns in how research finds a place in business. With the exception of the smallest one-man firms, with few resources to buy research, several design firms have embraced design research, turning it into a strategic tool. On the one hand, research has helped design firms to diversify their offerings and to make long-term contracts with clients and land lucrative research contracts.[29] On the other hand, research adds value to the customer who does not want to buy research and prototypes from two different places. This business concept has been around since the early days of E-Lab and Cheskin and continues to thrive today.[30]

On the client side, there are also patterns. At one end are small companies with few resources to invest in design. At the other end of the business hierarchy are global companies like Intel, Philips, Microsoft, and Nokia that have resources for extensive research. Widely known research programs from these companies include Intel's former People and Practices Research group, Alessi's research programs, and Philips Design's vision projects.[31] Again, there are powerful economic reasons to invest in constructive design research. Failing in research is cheap compared to failing with a product (Figure 9.5).

The first markets for constructive design research were born in cities with sophisticated design markets, such as Silicon Valley, the Scandinavian capitals, Munich, Amsterdam, and London. These places have had markets for highly specialized design services for decades, and they continue to create demand for new openings. A city like London can support companies that specialize in using documentary film in user research.[32]

The Internet is currently creating a new interface between constructive design research and business. The cost of a start-up on the Web may be little more than having time for research, a laptop, and an Internet connection. Testing concepts is also

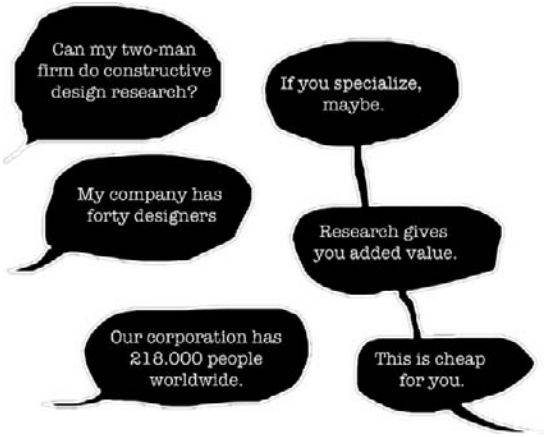

Figure 9.5 Discussions about research in companies.

cheaper than testing physical products. Publishing on the Web is easy, and Web-based marketing is cheaper than traditional marketing. The differences in producing hardware are significant: a solid concept for a new umbrella has to be sold to business angels, risk investors, banks, manufacturers, wholesalers, and department stores. We believe that constructive work may provide IT start-ups with useful ideas and a relatively cheap way to test their ideas and strategies. In the world of bits, research gets a far more important role as the driver of innovation than in the world of atoms.

9.6 Embracing the Public Good

Design takes place in the market, but this is only one side of the story. The other side is the public sector. When funding comes from public sources, research is expected to produce something the market fails to do. Examples include plans and concepts for public spaces, new infrastructures, and for "special" groups too small to attract product development money from the private sector.

Again, Luotain is a good example. Although the public sector was not involved in the project, it made the project possible in several ways. It was mostly funded by public sources, and for this reason, it had to have several participants, and it needed to publish its findings to benefit society, not just participating companies. Besides, political considerations made the project possible in the first place. Funding for the project came from a government program, Muoto 2005!, which aimed at rebuilding Finnish industry through design.

Policy work that led to the Muoto 2005! program had been done in part by professors at Luotain's home department.

Local and national governments have funded many key constructive design research projects in Europe, and the European Union is another major source of funds.[33] Some of these projects have become important milestones on the road toward constructive research, like the Presence Project and Maypole.[34] Both were funded mostly by a consortium where part of the money came from industry seeking applications, but long-term continuity was built on funds from public sources.

Many European and Asian countries, such as the United Kingdom and the Scandinavian countries, and South Korea, New Zealand, South Africa, and India have similar design policies. The European Union was also preparing its design policy from 2008, building it mostly on experience and thinking from Denmark, Finland, and the United Kingdom. Small European countries, in particular, have integrated design and design research into their industrial and innovation policies.

Constructive Design Research in Innovation Policy

Constructive design research is a winner in many political discussions about what kind of research should be funded.[35] Its value proposal is flexible and robust. For companies with enough intellectual, technological, and fiscal resources, it leads to prototypes that companies may use in various ways, which is another promise field research can make. Like any research, it promises knowledge that is in the public interest. Profits from relatively small investments in research can be significant.

In particular, fieldwork is directly relevant for industrial interests. This is hardly surprising, given the roots of field research in industry and global companies' investment in it. The key word has been user-centered design. However, field research fits best under this concept. The word "design," for its part, creates the connection to industrial policy, which currently usually comes under the label of "innovation policy." Conveniently enough, "design" also has an air of creativity. This sounds like a marriage made in heaven.

The link between user-centered design and innovations has become the cornerstone in policies in Denmark, India, and more recently, the European Union. For example, the European Union has titled its design policy document as "Design as a Driver of User-Centered Innovation."[36] In this document, design is distanced from aesthetics and styling, and firmly situated in the realm of user-centered design. In these policies, design typically complements more traditional innovation activities such as research. Design and other non-technological innovation drivers like organizational development are less capital intensive and have shorter pay-back periods than, for example, technological research but still have the potential to drive competitiveness.

For example, the Muoto 2005! program in Finland aimed to increase the number of design graduates and to better connect design with industry.[37] It was surprisingly successful in both respects, but more relevant to our concerns is its conceptual structure. It consisted of concentric circles, with technology in the middle, business around this core, and social and cultural "factors" at the outer circles: design connected these circles. This delightfully simplistic model

became the structure for both technological and social science and humanistic research. With the exception of a few theoretical studies, and some technology studies in industry, most research funded in this initiative was user-centered (Figure 9.6).

Designers have been more than passive partners in preparing these policies. A good deal of expertise for policy preparation came from the top of the design world, which had a plenty of resources needed to participate in the time-consuming and often tricky world of policy making.

In Muoto 2005!, most of the background preparation work was done in the country's largest design school and its design department. When the policy was running, management was delegated to business consultants. The university had expertise, money, and enough resources to participate in this work, which does not lead to billable hours. It was also sufficiently removed from industrial interests to be capable of articulating the larger interests of the design community.

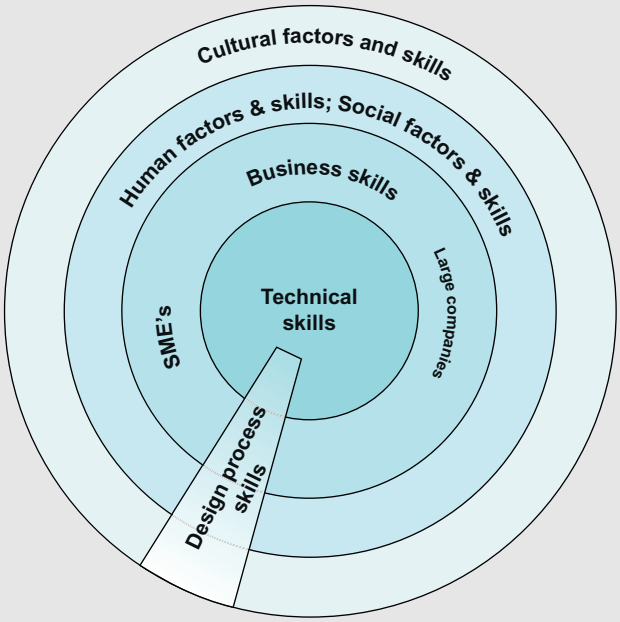

Figure 9.6 This was drawn in the preparation phase of Finland's design policy in 2000. Notice how it centers on technology. Despite its populist tone, this image lived for years, and it was used to explain design to engineers and technology policy makers. (Drawing by Juha Järvinen, original design by Juhani Salovaara and Ilpo Koskinen.)

The main exception is the United States. Although it has gone through several attempts to construct a design policy, little has been produced, and most funding is based on private funds.[38] America channels public funds to design, but usually through

funding national security, which is impossible to track.[39] Other major stable sources of funding outside of the market are major foundations, but as far as we know, no systematic studies of how design has fared in their boards exist.[40] There is no way around the public good argument in America, although it does not work in the same way as in Europe.

Public funding introduces designers to partners they would not ordinarily work with. These include a host of engineering specialties but also several sciences, research institutions, service companies, public sector organizations, and non-governmental organizations. In this world, design researchers have learned to explicate their aims and methods with new types of arguments. The best recent example is probably Material Beliefs, a London-based project exploring potential implications of biomedical and cybernetic technologies. The project cooperated with engineers, scientists, and social scientists but aimed at producing prototypes, exhibitions, and debates rather than just scientific papers. It was funded by Britain's Engineering and Physical Sciences Research Council, which had a program about public involvement in science.[41]

9.7 Constructive Design Research in Society

This chapter reviewed constructive design research in society by illustrating it with Luotain, a study done in Helsinki from 2002 to 2005, with many spillovers that still continue. Luotain first oriented to HCI but later turned to design. Its home base was industrial design, but compared to design-as-usual, its aims were considerably abstract. Still, its methods were largely borrowed from design. Its business context was lively: eleven companies participated in the project. Luotain avoided product orientation but was business friendly. Finally, it had a public dimension through funding from the National Technology Research Agency. It was to produce knowledge for the public domain, which it did.

As Luotain illustrated, constructive design researchers face many types of rationalities. Some of these rationalities are close to home, such as in the research, design, and business worlds. Some others are distant such as the idea that public good seldom figures in designers' minds. It can be difficult to keep all of these rationalities in line, but Luotain managed to do that with design things and workshops. The project elaborated on the empathic design program a great deal, first by taking it into a more workshop-based methodology and, later, through co-design and service

design. Projects that build on Luotain today seek inspiration from scenography and environmental art.[42]

How researchers face these rationalities depends on their positions in research and the social organizations that surround it. Researchers in Luotain concentrated on project work, published in conferences, and worked with businesses and occasionally in seminars organized by the National Technology Research Agency, where they saw a glimpse of technology policy. However, abstract arguments about public good were far from their minds; instead, they worried about design and conceptual frameworks, and tending to the public good was reserved for senior professors and university presidents. Indeed, many who inhabited these lofty heights were not from the design side; they were managers, industrialists, politicians, university presidents, and senior public servants.

Other programs relate to society in different ways. For example, research in Eindhoven has technical roots and builds on HCI, which is an accepted part of research in engineering and shares its mathematical beliefs. This is in stark contrast to research in art and design universities like the Royal College of Art, in which constructive design researchers share vocabulary, techniques, conventions, and methods for breaking social conventions with contemporary artists. Scandinavian research, on the other hand, falls in between. To make a constructive design research program socially robust, it has to respond to the demands of its local environment.[43]

End Notes

1. While Ehn primarily follows Bruno Latour's philosophy (especially Latour, 1987), this chapter takes most design readers to a more familiar terrain, pragmatism. In particular, Donald Schön (1983) did more than anyone in teaching researchers that design is a reflective dialog between designers and their materials. His perspective, building on pragmatism, was historically important in turning design research to post-Cartesian thinking, but it has its problems as well. In particular, it is too easy to misread Schön and exaggerate dialog at the expense of "design things." Here, Ehn's Latourian interpretation of design things comes in handy: it gives a far more important a place to those things that populate design practice. Precedents to this rehabilitation of material things are numerous; among writers we have referred to in this book, they most notably include phenomenologists and also Michael Lynch's reinterpretation of ethnomethodology (Lynch, 1993). One of the founders of pragmatism, John Dewey, has been another constant reference in Ehn's most recent interpretation of what makes design tools work (see Ehn, 2008, especially p. 99).
2. See Abbott (1988).
3. Cohen et al. (1972).

4. For original formulation of cultural probes, see Gaver et al. (1999); for defense of building ambiguity into design research, see Gaver et al. (2004).
5. The leader of the project was professor Turkka Keinonen and the main researcher was Tuuli Mattelmäki, who received her doctoral degree in 2006.
6. One issue in the study of emotions is how much interpretation there is in emotion. Roughly, the dividing line goes between the positivists, who see emotions as biological processes, and constructionists, who stress interpretation (Kemper, 1981). For positivists, stimuli leads to certain states in the body, and people understand these states as emotions (Kemper, 1981). For constructivists, stimuli leads to changes in the body, but these changes need interpretation before they become emotions (Shott, 1979). Some mediate between these views, usually on Darwinistic grounds: in some situations automatic emotional responses are the last resort to survival, and emotions like fear are for that reason beyond interpretation, while other emotions have an interpretive component (Kemper, 1981). Few claim that more complex emotions like enjoying good design belong to the automatic category.

   The details of this debate are beyond this book. It is important to note, though, that emotions are also used to make sense of ourselves, and they often function as tactical and even commercial devices (Rosenberg, 1990; Hochschild, 2003). These social uses of emotions are the ones researchers in Helsinki were after, not (possibly) measurable emotions like a fear of snakes; hence, interpretive (or constructive) theories of emotions.
7. Mattelmäki (2006).
8. This paragraph refers to several ongoing doctoral theses, built on Luotain, that are due to be published in 2011–2012. Workshops in the context of legislation have been explored by Katja Soini. Design games and their empathic roots are explored by Kirsikka Vaajakallio.
9. In Helsinki, Keinonen (1998) and Säde (2001).
10. Design conferences include the International Association of Societies for Design Research (IASDR), Nordic Design Research Conference (Nordes), Designing Pleasurable Products and Interfaces (DPPI), Design and Emotion (D + E), and Design Research Society in England (DRS). Popular journals are *Design Issues* and *Co-Design Journal*, among others. Popular human–computer interaction conferences like Computer-Human Interaction, and a host of smaller conferences like Designing Information Systems, Computer-Supported Collaborative Work, Participatory Design, and Mobile HCI.
11. See Chapter 5.
12. See the conference the Art of Research, the Design Research Society's Experiential Knowledge Special Group, and also the new *Craft Research* journal.
13. Around 1995 to 1999, smart products were much like computers had been 15 years earlier. Before 1995, few people carried complex electronic devices like mobile phones in their pockets and bags. With portable stereos and mobile phones, designers faced usability questions that were much like those met in Silicon Valley in the 1980s. Designers could not assume that the users were professionals or could even be trained to use products. Products had to be built for people, not the other way around.

    In research in Helsinki, usability became a research focus. While some work focused on consumer preferences, other pieces of work focused on developing methods for studying usability. Methods like paper prototyping were borrowed from computer designers, used in collaborative projects with industry, and then reported to HCI research communities.
14. Hanington (2003).

15. Why the Bauhaus has become a reference to design education is beyond the subjects covered in this book. It was only a small part of a much larger reform of design education in German-speaking Europe at the time (Siebenbrodt and Schöbe, 2009, p. 8ff). Also, its influence was, as Otl Aicher noted, felt more in museums than in actual life (Aicher, 2009).

We believe the main reason it has become so prominent in historical writing goes back to the extraordinary talent from Weimar, Dessau, Berlin, and later, Chicago. With alumni like Paul Klee, Wassily Kandinsky, Marcel Breuer, Walter Gropius, and Mies van der Rohe, it obviously receives more attention than its competitors in early twentieth century Germany, Switzerland, and Austria.

16. The reasons are solid: empirical social science was in its infancy in the heyday of the Bauhaus and mostly built on history. Most of the tools of post-war social science were simply not available for people like Moholy-Nagy.

17. After all, it is easy to be romantic about handicrafts. However, it is also good to remember some of the problems in craft and workshops; they tend to be male-dominated, tradition-bound, and means-oriented. Also, history certainly tells a tale that questions any romantic call back to craft. It is industrialization that has lifted us from poverty and improved our life standards, not craft. Some of these critiques are discussed in Ehn (1988a).

18. This is the situation in architecture, too, as Pallasmaa (2009) noted.

19. Overbeeke (2007), Keitsch et al. (2010). For 50 years, industrial design turned to research to gain legitimacy at the face of the Bauhaus tradition, creating opportunities for researchers. See Valtonen (2007, p. 118 ff).

It needs to be noted that departures from the Bauhaus tradition have happened in places in which design is business- and technology-oriented rather than artistic. There are exceptions, however. For example, critical design and the Presence Project both came out from Computer-Related Design, which was set up in the 1990s as a response to digital technology that had transformed design thoroughly in the previous decade. Computer-Related Design, headed by the graphic designer Gillian Crampton-Smith, was a multidisciplinary program from the very beginning but with roots in industrial design. It became the site for research after a research grant from Interval Research Corporation in 1994. Later, this program evolved into Design Interactions under Tony Dunne. For a brief history of Computer-Related Design, see Crampton-Smith (1997).

20. Ehn and Crampton-Smith (1998).

21. K3 stands for *konst, kultur*, and *kommunikation*, or in English, art, culture, and communication. For the original version in Swedish, see mah.se/fakulteter-och-omraden/Kultur-och-samhalle/Institutioner-och-centrum/Konst-kultur-och-kommunikation-K3/Om-Konst-kultur-och-kommunikation-K3/Design-pa-K3/, retrieved May 26, 2010.

In his original manifesto for a digital Bauhaus, Pelle Ehn (1998, p. 210) wrote:

> *What is needed is not the modern praise of new technology, but a critical and creative aesthetic-technical production orientation that unites modern information and communication technology with design, art, culture and society, and at the same time places the development of the new mediating technologies in their real everyday context of changes in lifestyle, work and leisure.*

Nostalgic this may be, but this, indeed, is the Bauhaus applied to the digital domain.

22. In design in particular, Brown (2009) and Verganti (2009).

23. See Redström (2005).

24. See IP08 (2008). In 2008, the participants were Kaj Eckoldt, Thorsteinn Helgason, Riikka Hänninen, Jing Jiang, Ella Kaila, Timo Niskanen, and Benjamin Schultz. Funding for the project came from the Nordic Innovation Center's Ludinno project led by Tomas Edman. Instructors were Ilpo Koskinen, Jussi Mikkonen (electronics), and Petra Ahde (design).

25. Photos from the user study and experience prototyping are by Eckoldt and Schultz; others are by Ilpo Koskinen.

26. Stappers (2007, pp. 88–89).

27. IO StudioLab has been home to many of the best doctoral theses in the Netherlands, including Djajadiningrat (1998), Wensveen (2004), Keller (2005), and Sleeswijk Visser (2009).

28. Mattelmäki (2006, pp. 197–205).

29. This is especially true if they are able to link this new expertise to management consulting, as RED associates in Copenhagen. IDEO and previously E-Lab have provided important models for other companies.

At the small-business and craft-oriented end of the spectrum, researchers face some of the same tensions as artists. As Howard S. Becker (1982) noted in *Art Worlds*, craftspeople routinely complain about "bad craft" in seeing artists' craft objects. The complaint has institutional foundations. Art occupies a much higher position in society than art. When artists attempt pottery, for example, they are able to connect to media and wealthy clients in ways beyond reach by craftsmen, whose work, naturally, is technically much better. The strain is inevitable. No doubt, this is also the case with research. After all, research prototypes are barely ever meant to achieve a high level of craft, while research budgets can typically be only dreamt of by craftspeople.

30. For E-Lab, see Wasson (2000, 2002).

31. For Intel, see Intel's *Reassessing ICTs and Development: The Social Forces of Consumption* (Intel, 2010a), which presented a series of case studies of ICT use through a multi-site ethnography and contextualized these studies to social science literature on development. For Alessi, Verganti (2009) and Alessi and Zilocchi (2010); for Philips, for example, Aarts and Marzano (2003) and *Vision of the Future* (Philips Design 2005).

32. Like in Stbd, a design company based in Amsterdam and London that specializes in using documentary film for design. Its use of documentary partly builds on the doctoral thesis of one of its partners, Bas Raijmakers (2007). Companies like DesignIT in Copenhagen and Aarhus, Denmark, typically sell both research and design services. See designit.com/.

33. Many examples we have shown in this book, such as DAIM (Halse et al., 2010), Luotain (see Mattelmäki, 2006), and Switch!, received funding from national sources in their home countries. On the other hand, the EU funded the Presence Project and Maypole.

34. *Presence Project* (2000), Mäkelä et al. (2000).

35. Other winners are obvious: research in technology and business.

36. European Union (2009, p. 2).

37. For Muoto 2005!, see Saarela (1999).

38. For the latest effort, see designpolicy.org/from 2009. This effort came from the design world. In Europe, the main drivers have been people with power, usually either administration and politicians, or major corporations.

39. Historically, the military was an important source of revenue for design firms run by Henry Dreyfuss, Walter Teague, and even Raymond Loewy. Although the details still remain under the veil of secrecy, ergonomics is in debt to military spending that started during World War II. See Flinchum (1997, pp. 78–87).

40. To see how Herbert Simon connected with the Ford, Carnegie, and Rockefeller foundations to pool resources for psychology, management, and computer science at Carnegie Tech (now Carnegie Mellon University), see Crowther-Heyck (2005, pp. 149ff). Crowther-Heyck does not mention how design was progressing on Simon's agenda for the university. A more recent example is the now defunct Interval Research from Paul Allen, which funded what came to be one of the key projects in shaping constructive work, Presence.

41. See Beaver et al. (2009).

42. For workshops, see Soini and Pirinen (2005); for more artistic work, see Mattelmäki et al. (2010) and the Spice Project at designresearch.fi/spice.

43. "Socially robust" is from Nowotny et al. (2008).

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10

BUILDING RESEARCH PROGRAMS

It is impossible to describe everything in constructive design research today, and we need more specific language to understand what is happening in this discipline. For us, this language has been methodology, which gives a simple enough yet informative storyline. As always in methodology, there is a fine line between aim, description, and prescription, which we wanted to avoid. We hope this book is not read as a manual. Having said this, this chapter gives a few tips for establishing and maintaining constructive design research programs.

We have located the origins of research from what Andrea Branzi called "second modernity."[1] In first modernity, design had few industries in which to work, consumer tastes were fairly homogeneous, and taste elites promoted sleek modernism in design. In second modernity, these certainties are not self-evident. Revolutions of taste have moved design from its modernist roots, and design has become a mass profession.[2] Also, the social base of design is far more diverse than before, and this gives design a better ability to respond to demands coming from all walks of life, however surprising these might be.

We have also seen how constructive design researchers have moved from product design to systems, services, organizations, technologies, and even the relationship of the city to the countryside.[3] Constructive design researchers may have changed the world only a little, but they have certainly seen what is happening around them and taken a stance. Society has changed, and so has design research. It does not have a simple objective anymore.

Almost a century ago, László Moholy-Nagy wrote about the need to bring many types of knowledge into design. In the same spirit, constructive design research has opened design for many new developments.

> *Human history is much too short to compete with nature's richness in creating functional forms. Nevertheless, the ingenuity of man has brought forth excellent results in every period of his*

Design Research through Practice.

> *history when he understood the scientific, technological, esthetic, and other requirements. This means that the statement, "form follows function," has to be supplemented; that is, form also follows — or at least it should follow — existing scientific, technical and artistic developments, including sociology and economy.*[4]

Several people in this book are not designers by training. They have brought new skills, practices, and ideas into design and design research. It is hard to imagine the constant stream of innovative work coming from Eindhoven without Kees Overbeeke, a mathematical psychologist by training. Similarly, the psychologist Bill Gaver's contribution to interaction design and its research is undeniable. Many other characters in our story, however, are designers like Tom Djajadiningrat and Ianus Keller in the Netherlands, Simo Säde in Finland, and Anthony Dunne and Fiona Raby in England. Yet in other cases, we have been writing about designers whose roots are outside design, like Tobie Kerridge, whose first academic home was in English language, and Johan Redström, whose academic home was in music and philosophy. Research programs are rich creatures in which many kinds of expertise may be relevant.

10.1 Beyond Rationalism

If there ever was a paradigm in design research, it was during the 1960s. At that time, rationalism reigned in various forms. Herbert Simon tried to turn design into a science through systems theory.[5] For writers in the design methods movement, the aim was to turn design into a systematic discipline by making the design process methodic.[6] This was the dominant understanding of design methods in industrial design for a few years. Even though these writers aimed at rationalizing design and not research, many design researchers still built on their work.

This rationalistic ethos was paradigmatic. Its premise was accepted without asking if it was right or wrong. There was no need to question any premise in the post-war university, because it was dominated by one generation of white males with a background in engineering and the military, and with a small number of teachers coming from another generation. Practically everyone had similar values, and it was the *Zeitgeist*. Systems theory was growing in stature in the natural and social sciences, giving an air of legitimacy to the effort.[7]

However, this paradigmatic phase was short-lived. As we have seen, its main proponents quickly turned away from it[8] as well as practicing designers who found this effort impractical and unnecessary. Also, this paradigm failed in Ulm, as its long-term headmaster Tomás Maldonado noted (Figure 10.1).[9]

Figure 10.1 Contemporary design research has many rationalities.

During this time the intellectual climate changed. The rationalistic worldview was discarded in the humanities and the social sciences, at first for political reasons.[10] Some of the criticisms focused on its destructive force; it had created prosperity on an unprecedented scale, but also massive destruction, and others found problems with its conceptual and theoretical underpinnings.[11] When women, lower-middle class students, and new ethnic groups entered universities, the social basis of the rational paradigm was contested. For these critiques, rationalism was little more than a hollow claim to universalism by one demographic group.

As soon as we look at constructive design research programs, we find ourselves in a room familiar to any well-read philosopher, humanist, artist, or social scientist. From this room, we find J.J. Gibson's ecological psychology, which in turn builds on Gestalt psychology and is tied to phenomenology from many different directions. Similarly, there are references to symbolic interactionism and surrealism, and through them, to the very foundations of twentieth century thinking. These foundations include psychoanalysis, structuralism, phenomenology, and pragmatism.

Philosophers call these intellectual and artistic movements post-Cartesian. This word covers many things, such as the major differences between, say, phenomenology, structuralism, Dada, or Gestalt psychology.[12] Post-Cartesian philosophies importantly tell designers to approach the world with sensitivity by trying to understand it rather than by imposing theoretical order on it. They tell designers to become interpreters rather than legislators, and to use the metaphor of Zygmunt Bauman, a leading Polish-British social critic.[13] This quality is particularly important in design — a creative exercise by definition.

10.2 Contribution and Knowledge

Constructive design research creates many kinds of knowledge, and designs capture knowledge from previous research.

When researchers study these designs, they generate knowledge about design techniques and processes, as well as about how people understood and appropriated these designs.

Typically, however, the most important form of knowledge are the frameworks researchers build to explicate their designs. These frameworks vary from Stephan Wensveen's interaction frogger and Katja Battarbee's co-experience to Jodi Forlizzi's product ecology.[14] Even the frameworks may sometimes be unimportant: a good deal of critical design does not try to develop frameworks. Its contribution lies in debates raised by its designs. Constructive design research produces ways to understand how people interact with the material world. It also shows how to use that knowledge in design.

Constructive design researchers routinely build on theoretical and philosophical sources from older, more established fields of research, but few claim to contribute to psychology, sociology, philosophy, or the natural sciences. Knowing the theoretical background of a program helps to keep a program consistent and may help to take it forward at important junctions, but it does not help to make a better television, communication concept, or mouse.[15] Typically, only very experienced researchers go to philosophical heights. Even they take this step cautiously when settling controversies or breaking free from clichés of thought and not with the intention of contributing to philosophical discourse.

The word "knowledge" easily leads to unnecessary discussions that hinder research.[16] Chemists, after all, do not think they need to know how chemists think in order to do research or what kind of knowledge they produce. We believe that here, design needs to learn from the natural and the social sciences. It is better to go full steam ahead rather than stop thinking about knowledge in the abstract. When the volume of research grows, there will be milestones every researcher knows, refers to, and criticizes. Sociology may not have found any hard facts about society, but there is a tremendous amount of wisdom about society in that discipline.

Constructive design research probes an imagined world, not the real world of a social scientist. Although things that are often playful and sometimes disturbing populate it, it is a very useful world. It makes it possible to study things outside normal experience. For example, we learn how rich interaction might work by reading Joep Frens' work and how social media based on "self" might work by reading John Zimmerman's studies. Their research tells a tremendous amount about specifics like materials, forms, functions, user experience, software, and the social environment of design.[17] This knowledge is useful for the project at hand, and it may also end up being used in industry (Figure 10.2).

One implication is important. The "contribution" in constructive design research is not like in the natural sciences, where it is

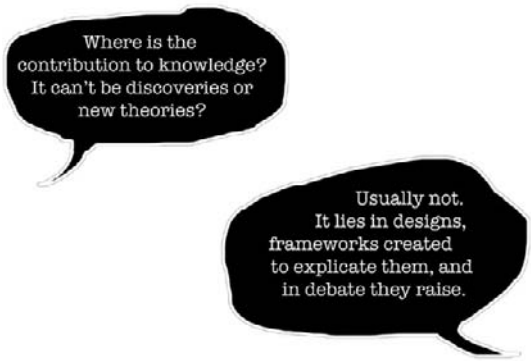

Figure 10.2 Ways to contribute to knowledge include designs, frameworks, and debate.

possible talk about "facts" as long as one remembers that most facts are contestable.[18]

With the possible exception of some researchers in Lab, most constructive design researchers work like the humanists and interpretive social scientists. They usually want to improve thinking and understanding, not to make discoveries, much like the humanities and the social sciences, where a new perspective or distinction can be an important contribution. Practically all contributions to knowledge of Shakespeare or Goethe come from improvements in discourse. This, however, is not a dramatic distinction. In the sciences, better explanations are welcomed even when little new data exist. Also, the main contribution of many scientific projects is an approach, method, or instrument. There is no one right way to do "science"; for example, to study bird migrations, researchers need different methods from astrophysics.

10.3 How to Build Research Programs

To anyone interested in entering constructive design research, the main advice from this book is to think in terms of programs. If we look at places in which constructive design research has taken shape, we see variety, but also many connecting dots. The key element is a community that is able to work with things we have talked about, including theory, many types of research methods, and imaginative design skills. Programs also need some infrastructure to make construction possible. What kinds of machinery and workshops are needed remains unanswered in this book, but for us it is clear that any design school, medium-sized design firm, and global corporation have everything necessary.

Figure 10.3 Things to keep in mind when building programs.

In design schools, the main difficulty is understanding how research works. Programs evolve and mature over time. What is important is typically seen only in retrospect and often years after the fact.[19] Few designers have enough patience to wait that long for results. It is easy to kill programs before they lead to success. In technical environments, the most difficult question is how to give enough space to design. As Kees Overbeeke noted in his inaugural lecture in 2007 at Technische Universiteit Eindhoven, universities tend to put too much value on cognitive skills at the expense of other human skills.[20] If the notions of science are narrow-minded, design may not get a fair chance to show its value (Figure 10.3).

Writing a successful program in a committee would require oracle-like abilities. Even though writing successful programs may be difficult, it is not difficult to create preconditions and make a good attempt. The risk is small if we look at the research described in this book. Major contributions often come from small groups, and these groups need to have theoretically knowledgeable senior researchers, young researchers, and designers, but they do not need dozens of people.[21]

Compared to these questions of ethos and managerial culture, some things are plain in comparison. In supervising research, it is important to build research on what others have done in the program. This is obvious for people in science universities, but clashes with the ethos of creativity that reigns in design schools, where originality and raising personalities are stressed. Also, research programs are not run by organizations. Every successful program has been open to change and has given things to other programs. For example, field researchers in Helsinki borrowed

from cultural probes and from the Interactive Institute's artistic work. Larger organizations may run several programs, as in Sheffield-Hallam University in England.

Yet another observation is that it makes sense to build on one's strengths, whether design, science, social science, or contemporary art.[22] In places like Helsinki, one can work with complex technology, design, consumer goods, Web systems, and services simultaneously. All resources required are within a reasonable travel distance. With Philips Design nearby, it is natural for researchers in Eindhoven to focus on sophisticated interactive technology with a serious focus on process. London's art market accepts complex artistic argumentation that would raise eyebrows in Pittsburgh with its pragmatic culture valuing solid engineering.

However, this argument should not be stretched too far. It would be plainly wrong to say that the environment somehow dictates what researchers can do. Such a claim runs contrary to what we have just said about the relatively modest resources needed for a solid research program. Also, sometimes limits turn into opportunities; revolutions in thinking often come from surprising places. Why not art in Pittsburgh, which has some of the best art collections imaginable, but not the elite tastes of a New York or a Paris dictating what is interesting?

10.4 Inspirations and Programs

Our list of things that inspire constructive design researchers includes issues, ordinary things in society, research-related sources, and tinkering with materials.

Issues are funded by major corporations and the governments. The biggest issue lately has no doubt been climate and sustainability, but many other things on the design research agenda are also issues. Some issues come from technology policy and technology companies, as the steady stream of new technologies since the 1980s reveals. For example, one of the buzzwords of 2009–2010 was "service design," which initially had its origins in IBM's global strategy. It was later pushed into research and higher education as a novelty with little regard for the fact that most advanced economies have been service economics since the 1960s. Issues come and go. New issues emerge when governments and administrations change.

Behind these issues are the humbler sources in everyday life. These consist of ordinary activities, technologies, things happening on the markets, and all kinds of sources in culture, such as folklore, books, ads, and films.[23] Herein lies the charm of second modernity: it is manifold, consisting of many overlapping realities

that inspire endlessly. Things closer to design research are scientific theories, frameworks, data collected in other studies, and the very history of design. Even closer to design is tinkering — work on structures and materials in workshops and laboratories. Interaction designers tinker with software rather than with materials and physical objects.[24]

As this offhand list shows, inspiration can come from anywhere. It is more important to look at how researchers turn these ideas into research questions and studies.

Here again, we meet research programs. Researchers turn what they see into research problems through conceptual analysis and theoretical work. In this work, they turn to their own program, look at what other researchers have done, and then decide what to do. The exact order in which these things are done varies and is less important than situating research into a program. Research programs have many ways to build on inspiration. Some stress artistic sources, while others turn to design history. Some turn to theory in psychology and sociology, while others start with user studies.[25]

Although sources of inspiration may change, programs have their histories, key members, methodological preferences, and tradition. These things give them identity but also an air of calmness. What may seem like rigidity is really a source of flexibility. Programs may change slowly, but they are repositories of expertise. Over time, successful programs provide referents and precedents.[26] For this reason, they are able to work on a wealth of inspirations. Thus, critical designers had no difficulties in going into the sciences, researchers in Helsinki switched from smart products to services and urban design effortlessly, and Danish researchers went from participatory design to co-design without missing a beat.

10.5 Research Programs and Methodologies

The first exemplary constructive pieces were done between 1998 and 2005. As often, the best formulations of central ideas are the first articulations. Some kinds of progress, however, are built into the notion of the research program. Where is research heading next? (See Figure 10.4.)

One thing to note is the difference between research programs and methodologies. Without a doubt, as constructive design research matures, several new research programs will emerge. They will find homes at art and design universities, technical universities, and in design practice.

Another thing of note is the difference between methods and methodologies. We will see new methods in the future.

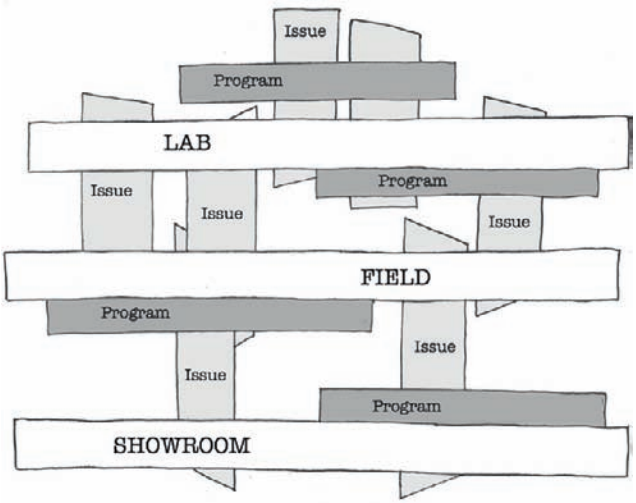

Figure 10.4 Issues come and go, programs are tenacious, and methodologies change slowly. Some issues come and go, some reform, reappear, and outlive the programs.

In inventing new methods, there is basically no limit, especially if we look at what Carnegie Mellon's Bruce Hanington once called "innovative methods."[27] We believe that the more methods there are, the better. Novelty in constructive design research has often been based on new methods rather than technologies, issues, or theories. There is far less room for methodological innovation. Here, constructive design research is in good company. The range of methodologies in the sciences is far smaller than the range of methods.

There are some directions to watch to foresee the future of constructive design research. There is a small step from some contemporary art and craft practices to research, and there are already good examples of turning craft into research.[28] Another likely breeding ground is engineering. This is well illustrated by places like the MIT Media Lab.

Also, social issues like climate change may be around long enough to feed research programs that bring more science into design research. In several universities, there are scientists who have become designers but who build their research programs on their scientific training. For example, there is only a short step from Carlo Vezzoli's work on sustainable design in Milan to constructive design research. In the near future, we will most certainly see constructive work based on his work.[29] Indeed, it is easy to imagine a chemist using her skills in design rather than doing technical or industrial applications.

There are also seeds of the future growing within existing research programs. With the exception of Lab, there has been little use of statistics in constructive design research, but there are several interesting openings. For example, Oscar Tomico combined statistics with George Kelly's personal construct theory to create a tool for capturing the sensory qualities of objects for design.[30] Similarly, Kansei engineers analyzed emotions and senses with multivariate statistics. Although the community has mostly influenced Japanese industry and technical universities, it has gained some following in Europe.[31] Furthermore, some recent work in Eindhoven has built on philosopher Charles Lenay's phenomenological work on sensory perception, combining sophisticated experimental work and statistical decision making to this ultimately descriptive philosophy.[32] Although phenomenology and symbolic interactionism are usually seen as qualitative traditions, this is a miscomprehension. There will no doubt be successful attempts to bring statistical analysis into design, and mixed methods approaches are certainly in the near future.[33]

One interesting trend is happening in Field. In Italy and Scandinavia, user-centered design has evolved into co-design and action research.[34] A step to organizational development and community design is not far, but this will further distance design from its base in products.[35] Another possible step is to study the business models in practice, which is happening in the SPIRE group in Sønderborg, Denmark, under Jacob Buur's stewardship. Here design research is intertwined in the policy sciences of the 1960s, but hopefully it avoids becoming overtly political and entangled in value discussions.

Finally, researchers need eclectic approaches to tackle "truly wicked problems" that require years of concentrated work with many stakeholders who often have contradictory agendas. Solutions to problems like climate change have to be particularly imaginative. Any solution has to survive the debate on a large and competitive "agora," where the audience consists of scientists, politicians, companies, and the general public.[36] There are several ways in which constructive design researchers are tackling these truly wicked problems, but are they satisfactory?[37]

10.6 The Quest for a Big Context

When Andrea Branzi was talking about second modernity, he put his finger on something every design researcher knows even though design researchers may not have the vocabulary to talk about it. Second modernity opens many kinds of opportunities for those designers who are willing to seize them.[38] They may be

weak and diffuse rather than based on the sturdy realities of the past. For that reason, second modernity is difficult to grasp with concepts coming from first modernity. This applies to design research as well as to design.

Second modernity requires not only intellectual openness and curiosity but also modesty. We have seen how constructive design researchers have deliberately built on frameworks that encourage exploration. This echoes the opinions of some of the leading design practitioners. In an interview with C. Thomas Mitchell, Daniel Weil reflected on his experiences when studying at the Royal College of Art (RCA) in London in the early 1980s. He talked about how he was disappointed in designers' discourse and was attracted to contemporary art.

When Weil was talking to Mitchell, he had already left his professorship at RCA and was working at Pentagram. He wanted to gain a better grasp of "the big context": not just a product but also things around the product. He was worried about how industrial design in his day focused on products without context.

> *But there's nothing in three dimensions like that, no understanding of the big context, which is what architecture traditionally did. I believe that is the role of industrial design. The people who work in three dimensions need to move away from just being a service and understand the bigger picture. So it's all about understanding the context instead of just purely designing a solution according to what has been designed before in a similar area.... What has happened is that designers are accustomed to the one-to-one scale, but when it starts to go large, they're a bit lost. So it's quite important to work more conceptually on bigger pictures. Then they will find it a lot easier to discover more complexity in what they're doing. It's important that we put more complexity and a bit more intellect into the activity of designing, and the activity of encouraging other designers by doing so.*[39]

We see a revolution brewing here. Weil was among those young designers who grew up with Branzi's Studio Alchymia and was soon invited to participate in Memphis by Ettore Sottsass, Jr. The period he describes prepared him for new kinds of questions. Indeed, why does the radio have to be a box?

This quest for a bigger context later became the breeding ground for Showroom. It, however, can be observed elsewhere in constructive design research. For example, ergonomics taught how humans interact with their physical environment, interaction designers brought systems thinking to design from computer science, and design management introduced them to formal organizations and management, to take only three of the many examples available (Figure 10.5).[40]

Figure 10.5 Two attitudes to research.

Weil's generation, however, was looking for new vocabularies from design. His vocabulary of choice was design management, which gave him an opportunity to design in a strategic context. When constructive design research was created, it picked up many of the leads left by these designers but turned to research. In about ten years, constructive design researchers have given design ways to talk about issues, such as direct perception, social and cultural context, and the implications of top-notch science.[41] Design needs new vocabularies to work with the big context. The unique contribution of constructive design research is that it creates these vocabularies in a design-specific, yet theoretically sophisticated manner.

End Notes

1. Branzi (1988, 2006).
2. Branzi (2010).
3. For services, see Yoo et al. (2010), Mattelmäki et al. (2010), and Meroni and Sangiorgi (2011). For the garbage collecting case, see Halse et al. (2010); for community health see A. Júdice (2011) and M. Júdice (2011) and the relationship of the city to its surroundings in Meroni and Sangiorgi (2011).
4. Moholy-Nagy (1947) in *Vision in Motion*. We have avoided talking about "form" in this book for a reason, but since Moholy-Nagy's quote has a reference to Louis Sullivan's famous adage "form follows function," we need to add a note here.

   For us, it is not obvious that form is the main concern of design, and is far less a concern to design research: there are other concerns that are equally

and more important. In Sullivan's cliché, "form" is also too easy to understand as information instead of chaos, whether the form is a thing, pattern, model, or service. Finally, it is already a cliché, and there is an industry of variations including titles such as *Less Is More, Less + More, Yes Is More*, and so forth.

Another word we have tried to avoid has been "complexity." It simplifies history into a process of increasing complexity and tends to lead to an idea that design needs to respond to increasing complexity by becoming more complex. Quite simply, this is not the way in which most designers prefer to work. Just as often, they describe their work using open-ended artistic terms like "intuition" and "inspiration." Given the well-known shortcomings of the design methods movement, this is understandable.

5. Simon (1996).
6. Jones (1992, 1984), Alexander (1968).
7. See Forlizzi (forthcoming). References to "paradigms" in this chapter are from Thomas Kuhn's (1962) *The Structure of Scientific Revolutions*.
8. For example, Alexander (1971) and Jones (1991).
9. See Chapter 2.
10. Marxism was important in European design schools, but as few schools did research in the 1970s, its impact on research was minor. In information systems design, the early 1980s saw several Marxist developments, in particular, in Scandinavia (see Lyytinen, 1982, 1983; Ehn, 1988a). The detailed history of Marxism in Western design is still unwritten.
11. These critiques were already voiced in Ulm in the 1960s (see the next note), and in the 1970s and 1980s software designers joined the chorus (see Dreyfus 1972, 1993; Winograd and Flores, 1987; Ehn, 1988a, b).
12. For example, see Aicher (2009) and Hoffman-Axthelm (2009, pp. 219–220) for accounts of the theoretical basis of design at the Ulm school.
13. Bauman and May (2000).
14. Wensveen (2004), Battarbee (2004), Forlizzi (2007).
15. See Carroll and Kellogg (1989).
16. Lawson (1980, 2004), Cross (2007), and Visser (2006). For an extensive discussion of knowledge in design, see Downton (2005).
17. In some cases, there are several environments, as our discussion of Nowotny et al. (2008) implies.
18. See Latour (1987). There was a long and once heated discussion in sociology about knowledge and whether even mathematical facts are social or not. In some sense, they are, because there would be no mathematics without people who agree to work with some conventions. Still, some conventions stay long enough to be treated as practically eternal facts. This happens in mathematics and logic, but also in some of the exact natural sciences.
19. Here we obviously follow Lakatos. See Chapter 3.
20. Overbeeke (2007). We must add that he specifically blamed the Greeks (the ancients, to clarify) for this cognitive bias and overvaluation of the written word over the bodily skills.
21. For good reasons. Large organizations get bureaucratic. They also increase the stakes so much that too many stakeholders get interested in protecting their investments and taking the credit for results.
22. See Molotch (1996).
23. Think about the film noir metaphor behind Dunne and Raby's Design Noir.
24. Wroblewski (1991).
25. *Presence Project* (2001); Intel (2010b).
26. See Goldschmidt (1998) and Lawson (2004). As Pallasmaa (2009, p. 146) noted, good architects collaborate not only with builders and engineers, but with the whole tradition of architecture: "Meaningful buildings arise from tradition and they constitute and continue a tradition.... The great gift of

tradition is that we can choose our collaborators; we can collaborate with Brunelleschi and Michelangelo if we are wise enough to do so." No doubt, this statement has more than a hint of exaggeration, but the basic point is right and is also important for designers.

27. Hanington (2003), Stappers and Sanders (2003). For an empathic interpretation of some of these methods, see Koskinen et al. (2003).

28. For art, see Scrivener (2000). For craft, see Mäkelä (2003) and Niedderer (2004). *Craft Research Journal* started in 2010. Also, the first Craft Reader appeared in 2010 (Adamson, 2010).

29. See Manzini and Vezzoli (2002) and Vezzoli (2003).

30. Tomico (2007).

31. See, for example, Lévy and Toshimasa (2009).

32. Lenay et al. (2007).

33. Social scientists talk about "triangulation" when a study uses several methods simultaneously. The idea is that one can trust the results better when several methods point to the same results or interpretation. The origins of the word are in cartography and land surveying.

34. For example, Rizzo (2009), Meroni (2007), Halse et al. (2010), and Mattelmäki et al. (2010).

35. Meroni and Sangiorgi (2011).

36. Nowotny et al. (2008).

37. For example, see Beaver et al. (2009), Switch!, and the work of the Júdices in Vila Rosário, mentioned in Chapter 5.

38. Branzi (1988, 2006).

39. Weil (1996, p. 25).

40. The question of whether designers should be professional problem-solvers or do design in a broader context is one of the standing debates in design. Maldonado contrasted Ulm with Chicago's New Bauhaus:

> *The HfG that we are setting up at Ulm proposes a redefinition of the terms of the new culture. It will not be content to simply turn out men that know how to create and express themselves — as was the case with Moholy-Nagy in Chicago. The Ulm school intends to indicate the path to be followed to reach the highest level of creativity. But, equally and at the same time, it intends to indicate what should be the social aim of this creativity; in other words, which forms deserve to be created and which not. (Maldonado, quoted by Bistolfi, 1984, second page)*

For Maldonado, this was a call to reform Ulm's education to train designers who think about social content rather than think opportunistically about the market. His designers were to enrich cultural experience in addition to satisfy concrete needs in everyday life.

41. The references here are to Chapters 4–6.

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