# Design Fiction: A Method Toolbox for Design Research in a Complex World

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## Abstract

Current debates on design research, and its relation to other research fields and scientific disciplines, refer back to a fundamental distinction introduced by Herb Simon (Simon, 1996 (1981)): Design and design research do not primarily focus on explaining the world as it is; they share with engineering a fundamental interest in focusing on the world as it could be. In parallel, we observe a growing interest in the science studies to interpret scientific research as a constructive and creative practice (Knorr Cetina, 1999; 2002), organized as experimental systems (Rheinberger, 2001). Design fiction is a new approach, which integrates these two perspectives, in order to develop a method toolbox for design research for a complex world (Bleecker, 2009; Wiedmer & Caviezel, 2009; Grand 2010).

## Keywords

epistemology; science studies; design fiction; experiment

## Introduction

### Research Context & Basic Hypothesis

Design research looks back to several decades of debates concerning the practice, theory, methodology and epistemology of design research (Cross, 2007; Bayazit, 2004). Thereby, we can identify different approaches to defining and structuring the field: some scholars focus on mapping and structuring the multiple existing, *self-declared research projects, identifying dominant clusters* and research fields (Sanders, 2006; Laurel, 2003; Gray 2004), assuming that what identifies as design research actually qualifies as design research; some

scholars argue for *particular epistemologies and theories* as a promising starting point to define possible approaches in design research (Cross, 2007; Fallman, 2003; Findeli & Bousbaci, 2005), suggesting that design implies particular ways of knowing and thus also particular epistemologies; some scholars characterize design research in relation to other scientific disciplines or a general pre-understanding of science, arguing for *particular qualities of design as a scientific research discipline* (Cross, 2006) or *emphasizing the oxymoron* inherent in any attempt to link design to scientific research (Frayling, 1993; Krippendorff, 2006).

One interesting observation thereby is, that implicitly or explicitly, these various attempts continue to refer to a fundamental perspective introduced decades ago as a root distinction in design research (Simon, 1996 (1981)): Design and design research do not primarily focus on the world as it is, like most scientific disciplines, trying to develop descriptions, interpretations, and explanations of existing objects, processes, and activities; design and design research share with engineering a fundamental interest in *focusing on the world as it could be, on the imagination and realization of possible futures*, as well as on the disclosure of new worlds. This implies a reflection of the contingencies of our world today, and of the practices for creating, imagining, and materializing new worlds. Another interesting observation is, that the controversies in the science studies concerning scientific research in general increasingly emphasize the *inherently constructivist and imaginative nature of scientific practice* (Galison, 1997; Knorr Cetina, 1999; 2002), the importance of improvisation (Knorr Cetina, 2002) and experimentation (Rheinberger, 2001) for the research process in general, or the primary role of artifacts (Knorr Cetina, 1999), images (Jones & Galison, 1998), or materiality (Galison, 1997) and their design in research practice.

Instead of arguing for design research as a particular approach to scientific research, or for design research as being systematically different from scientific research, it is much more appropriate to understand in more detail the close relation between design as the imagination and creation of possible future realities (Jonas, 2007; Bonsiepe, 2007) on the one hand, and the construction of reality and objectivity in scientific research (Daston & Galison, 2007) on the other hand. In this perspective, we argue for an approach, which understands *research as design* (Grand, 2010), and thus as a systematic extension of the current discussions in design research. Such an approach has two fundamental implications: First, it implies that the conceptualization of design and design research as a practice and research field, which particularly focuses on the world as it could be, should be taken as the actual core for defining and practicing design research: This is what we call *design fiction* (Wiedmer & Caviezel, 2009; Bleecker, 2009). Second, it implies that design is a productive approach to conceptualize scientific research itself as a design practices: This is what we call *research as design* (Grand, 2010; Jonas, 2010).

## Current Relevance & Open Issues

This characterization of design and design research, as well as of scientific research in the perspective of design, is particularly important and relevant today: As we learn from the recent science and technology studies (among others: Nowotny, 2008; Nowotny, Scott & Gibbons, 2001; Rheinberger, 2001; Bijker & Law, 2000; Biagioli, 1999; Latour, 1999; Felt, Nowotny & Taschwer, 1995; Bjiker, Hughes & Pinch, 1989), our societies are involved and engaged in fundamental debates and reflections concerning not only the world as it is, but concerning possible futures, in many areas. Thereby, those debates and reflections are characterized by a high complexity, due to the multiple perspectives, interests, concerns, issues, and approaches, which are represented by the multiple parties involved. From the perspective of the development of our contemporary societies, we can argue that these societies become increasingly knowledge intensive (Stehr, 1994), reflexive (Beck, Giddens & Lash, 1994), and experimental (Latour, 2004), implying that knowledge creation, scientific research and technological innovation are central to our societies. From the perspective of scientific research, we can argue that the sciences are social (Nowotny, Scott & Gibbons, 2001), technological (Bijker & Law, 2000), and commercial (Stehr, 1994).

Our world is increasingly involved and engaged in complex, collective political and economic debates and experiments (the current financial crisis is just one of the most recent examples), in which different actors including governments, companies, NGOs, social movements, virtual communities, … are engaged, and in which the differentiation between scientific research, institutions and laboratories on the one hand, and societal and political processes on the other hand, are blurring (Novotny, 2008). As the same time, this opens new opportunities for research as design, if design is understood as the creation, realization and materialization of possible future realities. In most cases today, the reactions and actions in those collective debates and experiments are not particularly imaginative and creative. We thus suggest that design and design research are pre-disposed to play a very active and important role in those controversies and collective experiments, and that design and design research should make its particular practices, tools and methods relevant to those debates, while at the same time developing new tools and methods, which are important for collectively dealing with possible futures in a complex world.

## Research Question & Argumentative Structure

In our paper, we develop a strategy for design and design research to contribute to those controversies and activities, which we call "Design Fiction", asking the research question:

How can design research contribute to the collective controversies and experiments, in which our societies deal with fundamental current and future challenges and transformations of our complex world?

In order to answer this research question, we proceed in three steps: in Part 1, we discuss recent contributions on the epistemology of design research, which indicate productive building blocks and relevant insights into a re-conceptualization of design and design research as design fiction (Bleecker, 2009; Brown, 2008; Bonsiepe, 2007; Krippendorff,, 2007); in Part 2, we discuss some recent contributions in the science studies, which explore, describe and analyze the inherently constructive, creative, controversial, critical, material and imaginative nature of scientific research in general, thus allowing to re-conceptualize the research process as a design process (Latour, 1986; 2005; Galison, 1997; Knorr Cetina, 1999; 2002; Rheinberger, 2001; Nowotny, 2008); in Part 3, we identify current approaches in design and design research (as well as scientific research), which provide particular methods and tools to conduct research in this design perspective (Dunne, 2005; Dunne & Raby, 2001).

## Part 1: From Design Research to Design Fiction

The ongoing discussion regarding methodology in design research is characterized by a strong dualism between the assertion of what scientific research means and of what designers do (Chow & Jonas, 2009). In order to explore the current state of the art in this debate, as well as to introduce "design fiction" as a new possible perspective, we discuss some promising epistemological approaches in design research today.

In general, the debate is strongly connected to stereotypes of what artists, designers and scientists do. According to Frayling (1993), the stereotypes of an artist or a designer are typically anti-rational and inward looking; the designer practices hands-on experimentation, not based on systematic hypotheses or orderly procedures. The scientist, to the contrary, has "… conjectures on hypotheses and sets about proving or disproving them according to a set of orderly procedures. His subject exists outside himself […]" (Frayling, 1993, p. 3). Frayling dissolves these stereotypes through investigating the blurred zone between art, design and science.

The identification of the intersection between research and design is thereby a significant thread in many relevant perspectives. Frayling stresses the process of discovering as an important intersection between experimental scientific research and artistic creation. He is going even one step further and references the recent research into the philosophy and sociology of science: "Doing science is much more like doing design" (Frayling, 1993, p. 4) .

He is joined by other approaches, which emphasize for example the intersection of analytic and synthetic processes (Owen, 2007), of design-led and research-led practices (Sanders, 2006), of research-oriented design (focusing on the real) and design-oriented research (focusing on the true) (Fallmann, 2007), as essential for both, design practice and research practice.

Implied in this focus on discovery processes is an explicit focus on processes. "Tinkering" is one of the key factors for innovation in design and sciences according to Bonsiepe (2004). Science as a cognitive and design as a non-cognitive process shows a structural similarity and are both intentional (Joas, 1991). As consequence, Bonsiepe argues in favor of a particular school of reflexivity and thinking ("Schule des Denkens") in the area of design and design research, nourished and inspired by the particularities of design experience. As a consequence, design research must involve designers, if we understand designers not as a disciplinary category, but as those people able to create and realize possible futures through their thinking and acting, generating new knowledge for design practice.

„Engineering, medicine, business, architecture and painting are concerned not with the necessary but with the contingent - not with how things are but with how they might be - in short, with design" (Simon, 1969, p. xii). Design research and design can thus be seen as a discipline (amongst others) which deals with practices and processes in order to create preferable, future situations. Designers are aimed at discovering situations which are changeable and designed (Bonsiepe, 2004). They are motivated by challenges, opportunities and possibilities, not seen by others, to change something (Krippendorff, 2007).

When designers envision possible futures, they can rely on multiple ways, methods and strategies how to communicate and materialize possible futures. These „diegetic prototypes" (Bleecker, 2009, p.7) or sketches in the figurative sense, are more than fully functional engineered prototypes or already finished designs. Design artifacts are an entrance point for critical thinking about the self evident, not only as the world could be, but rather to find a new, distant perspective on reality as it is. In critical design, artifacts thus „… should draw attention to how product limit our experiences and expose to criticism and discussion their hidden social and psychological mechanisms …" (Dunne, 2005, p. 24).

In line with these prominent approaches in design practice and design research, "design fiction" can be interpreted as a new strategy for design research, trying to benefit from the qualities of a "designerly way of knowing" (Cross, 2007) and the current discussion of design research frameworks, by systematically questioning and deconstructing the self-evident, transcending it towards new, possible futures; concretely materializing, visualizing and embodying relevant controversies and perspectives in the form of artifacts, interfaces, installations and performances; asking "how the world could be" instead of discussing how

the world is; thus taking the inherent contingency of the world seriously and thereby exploring insights from different disciplines. Thereby,  it is important for any initiative and intervention in design research to find the right focus "in between" the simply utopian, which is too far away from our current concerns and issues to have an impact on the current controversies and approaches, and the too realistic, which is so close to what we already know and experience that no real provocation, relevant challenge, new perspective can emerge.

## Part 2: From Scientific Research to Research as Design

### Controversies concerning Images of Knowledge

In the science studies, we observe a growing interest to interpret scientific research as a constructive and creative practice (Knorr Cetina, 1999; 2002). It is argued that scientific research itself is a particular way of enacting and shaping reality. If we take this seriously, we can identify two major implications: on the one hand, it must be concluded that what we accept as scientific knowledge at a particular point in time is, emerging from ongoing controversies among multiple parties (Latour, 1999); what we discussed as "designerly" ways of knowing are not inherently scientific or non-scientific, but they must be seen as particular perspectives on scientific research, which over time either become part of a collectively shared understanding of scientific research (Foucault, 1971), or they remain dissident (Krippendorff, 2007).

On the other hand, we learn from the science studies that scientific knowledge itself must be differentiated into three dimensions (Elkana, 1986): the corpus of knowledge is identifying the content of scientific knowledge; the images of knowledge are focusing on the types of knowledge which qualify as scientific (this is the dimension, which is most important in our context); and social values, indicating the inherently political and ideological dimension of scientific practice in general. Our attempt to argue in favor of "design fiction" as a way of approaching design research as scientifically relevant is thus an attempt to enter a controversy and establishing this forward-looking, creative way of knowing as relevant to scientific research in general. Thereby, the science studies themselves increasingly emphasize the inherently constructivist and imaginative nature of scientific practice (Galison, 1997; Knorr Cetina, 1999; 2002), the importance of improvisation (Knorr Cetina, 2002) and experimentation (Rheinberger, 2001) for the research process in general, or the primary role of artifacts (Knorr Cetina, 1999), images (Jones & Galison, 1998), or materiality (Galison, 1997) and their design in research practice.

## Scientific Research and Experimental Systems

More specifically, we observe a preoccupation with research on the important role of experimentation in the recent science studies (Knorr Cetina, 1999). It is argued that experimentation has increasingly become the predominant way of scientific research to enact and shape reality in ways, which allow for the exploration of particular research questions and the realization of specific research agendas. Thereby, experimentation is embedded in the creation and construction of specific systems, as specific assemblages of technologies, artifacts, representation tools, methods, research questions, disciplinary perspectives …, which together form an experimental system (Rheinberger, 2001). This implies that contrary to multiple perspectives, which see experimentation in design and design research as a clear indication of the inherently scientific nature of design practice, we argue that it is only through the creation and construction of an experimental system, which allows to explore important open research questions and to investigate a particular research agenda, that design practice and design research have the potential to develop knowledge which potentially qualifies as scientific (Grand, 2010).

Furthermore, we learn from the detailed study of experimental systems, that they are equipped with a series of tools and artifacts, methods and practices, which are closely related to design: first of all, experimental systems are ways of exploring unanswered questions, a feature which we find in various design practices (see below); second, experimental systems require tools and machines, which allow to document and represent the various experiments as they take place, this implying the development and usage of particular representation tools and documentation strategies; third, it is systematically emphasized how important the materialization of an experimental system is, including the selection of particular materials for building experimental assemblages (Galison, 1997), the development of multiple interfaces to conduct those experiments (Knorr Cetina, 2002), the physical, chemical and biological processes, which typically take place in these experiments.


## Blurred Boundaries and Collective Experiments

As we learn from some unconventional perspectives in the science studies, the traditional view on experimental systems as taking place in well-defined laboratories with clear boundaries, it is argued more recently that actually those experimental systems have blurred boundaries and involve multiple parties (Nowotny, 2008; Nowotny, Scott & Gibbons, 2001; Rheinberger, 2001; Latour, 1999; Felt, Nowotny & Taschwer, 1995; Bjiker, Hughes & Pinch, 1989): today, most important societal issues and unanswered questions are somewhat related to what could be called collective experiments (Latour, 1999). Our societies can be characterized by fundamental debates and reflections concerning their possible futures,

implying a high complexity, due to the multiple perspectives, interests, concerns, issues, and approaches, which are represented by the multiple parties involved. As we discussed above, these societies become increasingly knowledge intensive (Stehr, 1994), reflexive (Beck, Giddens & Lash, 1994), and experimental (Latour, 2004), which implies that (scientific) knowledge creation shifts to the center of society itself; the sciences are thus social (Nowotny, Scott & Gibbons, 2001), technological (Bijker & Law, 2000), and commercial (Stehr, 1994).

Our world is thus itself engaged in multiple complex, collective political and economic debates and experiments, our discussion of experimental system thus grows beyond the traditional scientific laboratories and become increasingly relevant for our understanding of the (knowledge) society in general (Stehr, 1994; Latour, 1999). The opportunities of re-thinking the role of design in scientific research, as well as of re-defining scientific research in the perspective of design, are thus not only appropriate within the boundaries of traditional laboratory settings, but might actually become a way of understanding, describing, structuring and creating the experimental systems, which our societies need to deal with their most controversial, essential and complex questions and challenges. This is what we call research as design, arguing that a designerly way of knowing is fundamental for any attempt to build experimental systems, playing a very active role in those controversies and collective experiments. In this perspective, design and design research should make their particular practices, tools and methods of imagination, materialization, visualization, representation and interaction relevant to those debates, while at the same time developing new tools and methods, which are important for collectively dealing with possible futures in a complex world.

## Part 3: Toward a Method Toolbox for Design Research

We argue that our way of conceptualizing design fiction (Part 1) is a particularly promising way of conceptualizing design research and design practice in the perspective of re-interpreting scientific research itself as design (Part 2). In the remaining sections of this paper, we identify some major dimensions for a method toolbox for such design research practices, as well as identify a series of design methods relevant for such a toolbox (Part 3).

### Basic Criteria

Based on our discussion of design research and design fiction, as well as of research as design, we see the following dimensions as particularly important for evaluating the scientific relevance of design practices, design methods and design tools for design research: (1)

design fiction requires methods, practices and tools which allow for the *creation and construction of possible future worlds*, in relation to the actual world; (2) furthermore, these methods, practices and tools must allow for *materializing those possible future worlds*, in terms of images, artifacts and interactions realized in diverse media; (3) in addition, it is important to develop a method toolbox which is characterized by a plurality of different perspectives and approaches, which get beyond ideological premises and allow to map and assemble the *pluralities and the multitude of potentially relevant perspectives*; (4) furthermore, these methods and tools must be able to represent, visualize and document the *experimentation processes*; (5) then, we emphasized the importance of understanding experimentation as being generated through an *experimental system*, which implies a focus on asking a series of questions, allowing for a series of experiments, or the exploration of a series of related hypotheses. Finally, (6) it is important to understand that these multiple methods and tools, visualizations and representations, experiments and questions, will *change the design research practices* themselves over time.

Looking at those six criteria, we see that our approach is somewhat parallel to the four fundamental processes, which characterize translation in Actor-Network Theory (Latour, 1999): The creation and construction of possible future worlds inherently implies what Actor-Network Theory identifies as *problematization*: Any suggestion of a future possibility is at the same time a way of questioning the world as it is, it is emphasizing the contingency of our taken-for-granted reality and identifying alternative possibilities as a general option. Furthermore, our emphasis on materializing through the involvement of multiple artifacts, images, media, and on the engagement of multiple perspectives goes in parallel with *mobilization* in Actor-Network Theory. In addition, we emphasize the importance of collectivizing the experimentation processes, engaging multiple actions, artifacts, actors, activities into the process, thus referring to what Actor-Network Theory identifies as *interessement* and *enrolement*. At the same time, our approach is distinct from Actor-Network Theory in two respects: through its emphasis of creating and constructing new possible futures, which can be identified as the distinct contribution of a design perspective on experimentation; and through its emphasis on the systemic nature of experimentation, which is not at the core of the conceptualization of translation in Actor-Network Theory, but important more general.

## Possible Research Strategies in the Method Toolbox

In order to systematize our design research method toolbox, we allocate individual research strategies to particular dimensions of the method toolbox. At the same time, it is important to

note that each research strategy obviously fulfills multiple criteria and could thus be related to multiple dimensions of the "Design Fiction" method toolbox.

1. Creation and construction of possible future worlds: As discussed, creating possible future worlds at the same time implies to refer to the world as it is: In this perspective, *critical design* (Dunne & Raby, 2001; Dunne, 2005) for example is a promising approach, which is building artifacts, which materialize and visualize the often invisible dimensions of new technologies (including for example electromagnetic fields, …), thereby at the same time criticizing these existing technologies and their ways of hiding important features, while exploring alternatives. Furthermore, multiple design practices are characterized by their focus on exploring research questions: a particularly promising approach in our context is to *ask unanswerable questions*, as it is done by MVRDV in their five minutes city project (as well as in many other research projects), where an unanswerable question triggers the development of unconventional and creative approaches for dealing with urbanistic themes (Maas, 2003). *Reinterpreting the past* is another way of opening new future possibilities, by transforming and translating what is into what could be. Fashion design for example is characterized by the continuous re-interpretation of existing collections for the creation of new collections.

2. Materializing those possible future worlds: Throughout our paper, we have been emphasizing that "design fiction" is an approach, which combines the invention, creation and construction of possible futures, which are explored, tested, evaluated and improved through a constant attempt to materialize their central features. *Sketching* is the central approach in design, which advances at the interfaces between the future and the present, the possible and the actual, the imaginative and the realist (Gänshirt, 2007). Thereby, we learn from an interdisciplinary view on the multiple design practices, that sketching takes multiple forms: *drawing* on paper is the prototypical approach, but *building simple models* in architectural design and industrial design in going in a very similar direction, or *the development of a mood board* in fashion design, or *simulating interactions* in the new media. Furthermore, we can argue that the *ethnographic observation of design in use* is another way of exploring potentially inspiring new ways of materializing, visualizing and embodying the future (Kelley, 2001); in this perspective, the future is actually seen as always already taking place in the everyday activities of people *using and mis-using design* for their purposes and embedded in their mundane practices.

3. Plurality of different perspectives and approaches: This interpretation of design practice and design research as combining the invention of possible futures, combined with sketching and materializing those possible futures, is at the core of design practice in general, as well as of multiple modernist design ideologies. As a consequence, it is essential to complement this perspective with an emphasis on the plurality of possible futures, as well as on the multitude of possible approaches and strategies in inventing, sketching, materializing and

visualizing those possible futures. In this respect, we share the basic intuition of Actor-Network Theory (Latour, 1999), which emphasizes the importance of continuously challenging the taken-for-granted, un-questioned, self-evident "nature" of the world as it is, while at the same time emphasizing and mapping the multitude of possible alternative worldviews. Interestingly, it is in this context that convincing design research strategies are missing, or that the development of tools and methods for mapping those multiple perspectives and related controversies is gaining its relevance (Latour & Weibel, 2005). The recent interest in artistic and design practice and research for mapping technologies is indicating a growing awareness of the importance to advance our competencies and methods in this respect.

4. Representing, visualizing, documenting the experimentation processes: Interestingly, this is at the same time a pre-condition for advancing with respect to another fundamental issues for design research: in order to advance in our understanding, description and explanation of how design practices are inventing and materializing, imagining and visualizing, creating and embodying new possible futures, we need tools and methods, which are able to document and represent, map and visualize those design processes themselves. It is interesting to observe that in many design fields, this emphasis on the design and research process is coming to the forefront of discussion: in urbanistic and architectural contexts, *publicly arguing based on models and computer simulations*; in fashion design, exhibiting the *materiality, processuality, multiplicity of design as a practice*, instead of overemphasizing the resulting outcomes and artifacts (Maison Martin Margiela, 2008); in iconic research, emphasizing the importance of integrating the *sketches, drawings, models, simulations* as important for our understanding of the resulting picture or installation (Boehm, 2007). Furthermore, the growing interest in exploring the potential of *programming design processes*, as an important way of better understating the processuality of design, is interesting to observe (Maeda, 2000).

5. Experimentation as being generated through an experimental system: With this new focus on programming, the inherently systemic nature of creation and experimentation is also more explicitly considered. As discussed above, design research can only benefit from the recent insights in the science studies, if the *processual and systemic nature of experimentation* and the importance of creating and establishing experimental systems is really understood (Knorr Cetina, 2002; Rheinberger, 2001). In parallel, it becomes obvious that those design practices are particularly important for advancing and conceptualizing design research, which already considering experimental systems as their way of organizing practice and research: the current interest in *programming design processes* is obviously one way of advancing this research field (Maeda, 2000); in parallel, *artistic processes exploring seriality* are very important, as they allow to better understand the close interplay between shifting research

questions, and their relation to shifting experimental arrangements (Calle, 2003). Furthermore, we see a growing interest in understanding archives as laboratories, as already realized and materializes series of artistic and designerly practice (Bismark et. al., 2002). Overall, we observe a growing interest in exploring design practice and design research as taking place in *laboratories*, which are characterized by a specific materialization, allowing for processuality and ensuring the systematic representation of what is going on (Obrist & Vanderlinden, 1999).

Changing the design research practices themselves: As discussed above, design research is closely related to design practice (6.), so in the long run it will be interesting to observe how the method toolbox for design research, as it is sketched in this paper, will impact on design as a field of practices.

## Conclusion

In this paper, we argue that the distinct contribution of design as a field of practice and research lies in focusing on the world as it is; design shares with engineering the fundamental interest in focusing on the world as it could be. However, while this perspective is important in many classical approaches to design research, as well as in multiple approaches to design practice, it has not been systematically explored as the actual starting point for conducting design research. We argue that "design fiction" as a way of approaching design research allows to advancing in this direction, by explicitly identifying and discussing a method toolbox for design research in this perspective.

In parallel, we argue that "design fiction" can benefit from the science studies. In this perspective, design research and scientific research in general can be interpreted as a constructive and creative practice (Knorr Cetina, 1999; 2002), organized as experimental systems (Rheinberger, 2001). By emphasizing the processual and systemic nature of experimentation, as well as the importance of developing tools, methods, techniques and media for mapping, representing, visualizing those experimental processes, "design fiction" allows to open a new research field of design research, which at the same time leverages the unique qualities of design as a practice, and incorporates the quality criteria for productive and creative experimentation in scientific research.

# References

Bayazit, N. (2004). Investigating Design: A Review of Forty Years of Design Research. *Design Issues*, 20 (1), 16 -29.

Beck, U., Giddens, A. & Lash, S. (1994). *Reflexive Modernization: Politics, Tradition and Aesthetics in the Modern Social Order.* Cambridge : Polity Press.

Biagioli, M. (1999). *The Science Studies Reader.* New York: Routledge.

Bismark, B. von (Eds) (2002). *Interarchive.* Köln: Verlag der Buchhandlung Walther König.

Bijker, W. E. & Law, J. (2000). *Shaping Technology / Building Society: Studies in Sociotechnical Change*. Cambdridge, MA: MIT Press.

Bjiker, W. E., Hughes, T. P. & Pinch, T. (1989). *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*. Cambdridge, MA: MIT Press.

Bleecker, J. (2009). *Design Fiction. A short essay on design, science, fact and fiction.* Retrieved January 25, 2010, from http://cloud.nearfuturelaboratory.com/writing/DesignFiction_WebEdition.pdf

Boehm, G. (2007). *Wie Bilder Sinn erzeugen. Die Macht des Zeigens*. Berlin: Berlin University Press.

Bonsiepe, G. (2004). Von der Praxisorientierung zur Erkenntnisorientierung oder: Die Dialektik von Entwerfen und Entwurfsforschung. In R. Michel (Ed.). *Erstes Design Forschungssymposium* (pp.14-25). Basel: Swiss Design Network.

Bonsiepe, G. (2007). The uneasy relationship between design and design research. In R. Michel (Ed.), *Design Research Now. Essays and selected projects* (pp. 25-39). Basel/Boston/Berlin: Birkhäuser Verlag AG.

Brown, T. (2008, June). *Design Thinking.* Harvard Business Review.

Calle, S. (2003). *M'as-tu vue.* Paris: Éditions Xavier Barral.

Chow, R. & Jonas, W. (2009). Beyond Dualisms in Methodology: An Integrative Design Research Medium "MAPS" and some Reflections. In *Undisciplined! Design Research Society Conference 2008*, 16-19 July 2008, Sheffield Hallam University, Sheffield, UK.

Cross, N. (2007). Designerly ways of knowing. Basel/Boston/Berlin: Birkhäuser Verlag AG.

Daston, L. & Galison, P. (2007). *Objectivity*. Cambridge, MA: MIT Press.

Dunne, A. & Raby, F. (2001). *Design noir : the secret life of electronic objects*. Basel/Boston/Berlin: Birkhäuser Verlag AG.

Dunne, A. (2005). *Hertzian tales : electronic products, aesthetic experience, and critical design.* Cambridge, MA: MIT Press.

Elkana, Y (1986). *Anthropologie der Erkenntnis*. Frankfurt a.M.: Suhrkamp.

Fallman, D. (2003). Design-oriented Human-Computer Interaction. *CHI Letters*, Vol. 5, Issue No. 1, 225-232.

Fallman, D. (2007). Why Research-oriented Design Isn't Design-oriented Research: On the Tensions between Design and Research in an Implicit Design Discipline. *Journal on Knowledge, Technology and Policy*, Special Issue on Design Research, Vol. 20, No. 3. Retrieved January 25, 2010, from http://www.metapress.com/content/105285/

Felt, U., Nowotny, H. & Taschwer, K. (1995). *Wissenschaftsforschung. Eine Einführung*. Frankfurt a.M.: Campus.

Findeli, A. & Bousbaci, R. (2005). L'Eclipse de L'Objet dans les Théories du Projet en Design (The Eclipse of the Object in Design Project Theories). *The Design Journal*, Volume 8, Number 3, November 2005, 35-49(15).

Foucault, M (1971). *L'ordre du discours.* Paris: Gallimard.

Frayling, C. (1993): Research in Art and Design. Royal College of Art Research Papers 1.

Galison, P (1997). *Image and Logic: A Material Culture of Microphysics*. Chicago: University of Chicago Press.

Gänshirt, C. (2007). *Tools for Ideas: Introduction to Architectural Design.* Basel/Boston/Berlin: Birkhäuser Verlag AG.

Grand, S. (2010). Research as Design: Future Perspectives*.* In Grand, S., Jonas, W., Michel, R. (Eds.), *The Future of Design Research*. Basel/Boston/Berlin: Birkhäuser Verlag AG.

Gray, C. & Mallings, J. (2004) Visualizing Research: A Guide To The Research Process In Art And Design. Aldershot: Ashgate.

Joas, H. (1991). *Kreativität des Handelns.* Frankfurt a.M.: Suhrkamp.

Jonas, W. (2007). Design research and its meaning to the methodological development of the discipline. In R. Michel (Ed.), *Design Research Now. Essays and selected projects* (pp. 187-206). Basel/Boston/Berlin: Birkhäuser Verlag AG.

Jones, C. A. & Galison, P. (1998). *Picturing science, producing art*. New York : Routledge.

Kelley, T. (2001). *The Art of Innovation*. New York: Random House.

Knorr Cetina, K. (1999). *Epistemic cultures : how the sciences make knowledge.* Cambridge, MA : Harvard University Press.

Knorr Cetina, K. (2002). *Die Fabrikation von Erkenntnis. Zur Anthropologie der Naturwissenschaft.* Frankfurt a.M.: Suhrkamp.

Krippendorff, K. (2006). *The semantic turn. A new foundation for design*. Boca Ratan/London/ New York: Taylor & Francis CRC.

Krippendorff, K. (2007). Design Research, an Oxymoron? In R. Michel (Ed.), *Design Research Now. Essays and selected projects* (pp. 67-80). Basel/Boston/Berlin: Birkhäuser Verlag AG.

Latour, B. (1986). *Science in Action: How to Follow Scientists and Engineers Through Society.* Cambridge, MA: Harvard University Press.

Latour, B. (1999). *Pandora's Hope*. Cambridge, MA: Harvard University Press.

Latour, B. (2004). Von "Tatsachen" zu "Sachverhalten". Wie sollen die neuen kollektiven Experimente protokolliert werden. In Schmiedgen, H., Geimer, P. & Dierig, S. (Eds.): *Kultur im Experiment*. Berlin: Kulturverlag Kadmos.

Latour, B. (2005). *Reassembling the Social*. Oxford : Oxford University Press.

Latour, B. & Weibel, P. (2005). *Making Things Public. Atmospères of Democracy.* Cambridge, MA: The MIT Press.

Laurel, B. (2003). *Design Research: Methods and Perspectives.* Cambridge, MA: MIT Press.

Maas, W. (2003). *Five Minutes City. Architecture and (Im)Mobility.*Rotterdam: Episode Publishers.

Maeda, J. (2000). *Maeda & Media.* New York: Universe Publishing.

Maison Martin Margiela (2008). *20, The Exhibition*. Antwerpen: Momu.

Nowotny, H. (2008). *Unersättliche Neugier. Innovation in einer fragile Zukunft*. Berlin: Kulturverlag Kadmos.

Nowotny, H., Scott, P. & Gibbons, M. (2001). Re-thinking science : knowledge and the public in an age of uncertainty. Cambridge : Polity.

Obrist, H. U., Vanderlinden, B. (1999). *Laboratorium*. Antwerpen: Dumont.

Owen, C. (2007, January). Design Thinking: Notes on its Nature and Use. *Design Research Quarterly* vol 2, no 1 (Design Research Society). Retrieved January 25, 2010, from http://www.drsq.org/.

Rheinberger, H.J. (2001). *Experimentalsysteme und epistemische Dinge. Eine Geschichte der Proteinsynthese im Reagenzglas.* Göttingen: Wallstein.

Sanders, E. (2006, September). Design Research in 2006. *Design Research Quarterly* vol 1, no 1 (Design Research Society). Retrieved January 25, 2010, from http://www.drsq.org/.

Simon, H. A. (1969). *The sciences of the artificial*. Cambridge, MA: MIT Press.

Stehr, Nico (1994). *Knowledge Societies*. London: Sage.

Wiedmer, M. & Caviezel, F. (2009). *Design Fiction, Perspectives for Research in Art and Design.* Norderstedt: Books on Demand.

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