SOME NOTES ON PROGRAM/EXPERIMENT DIALECTICS

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ABSTRACT

Searching for ways of conducting practice-based design research, we have explored an approach based on the formulation of design programs as a foundation and framework for carrying out design experiments. Over the years, we have presented a number of such programs along with experiments that explore and express their potential. There are, however, methodological issues in this way of working that need further development. One such set of issues pertains to what we might refer to as a program–experiment dialectics, that is, how the research process unfolds over time as program and experiments influence, challenge and transform each other.

In what follows, aspects of this dialectic will be discussed with focus on issues such as how such a process is initiated, how the unfolding of the research process depends on both stabilisation and drift, and what it means to say that such a process comes to a closure.

Keywords: design programs, experimental design, practice-based research.

INTRODUCTION

Over the past decade, we have developed a practice-based approach to design research centred on the notions of programs and experiments. Introduced in more detail elsewhere (e.g. Binder & Redström 2006, Hallnäs och Redström 2006, Koskinen et al 2008, cf. also Brandt & Binder 2007), this approach centres on the explicit formulation of design programs acting as a foundation and frame for carrying out series of experiments.

Compared to many of the epistemological discussions in practice-based research which often centres on the articulation of knowledge as such (cf. discussions such as Biggs 2006, Rosengren 2007), the discussion that follows will concentrate on how these programmatic practices work, rather than on what (kinds of) knowledge they may (or may not) produce. In many ways, the notion of program referred to here is close to the everyday use of the term, as in e.g. conjunction with architectural programs or educational programs, but there is also a relation to how Lakatos' used the notion of programs in science, and especially how central frames of reference in science evolve over time (Lakatos 1978).

With origins in the Greek word *programma*, a public notice, meanings of the term program include (from the Merriam-Webster Online Dictionary):

– *a brief usually printed outline of the order to be followed, of the features to be presented, and the persons participating (as in a public performance)*

– *a plan or system under which action may be taken toward a goal.*

To give a practical example, consider the design program for Static!, a research effort into how design research could offer a new set of perspectives and possibilities on energy consumption in everyday life in contrast to the prevalent strategies of changes the current state of affairs either by improving the technology or informing the consumer (Redström 2010, p. 17):

– *The aesthetics of energy as material in design: working with energy not only from a technical but also from an aesthetic point of view.*

– Reflective use: systematically reinterpreting designed things not only in terms of utility and ease-of-use but in terms of critical reflection through the things at hand

Within this program we developed examples such as the Energy Curtain, the Flower Lamp (with Front Design) and the Power-Aware Cord (Mazé 2010).

The basic mechanisms for putting this process in motion are typically present in the form of a critical question about the present and a suggestion about an alternative way of doing things. In the example given above, this can be seen in how the program contains a challenge to consider technology not in terms of energy efficiency, but energy aesthetics – and (therefore) that we need to work with it as material in, rather than infrastructure behind, design. And with respect to consumers and consumption, the program emphasis use as practice, what we actually do, and suggests that the very interaction with everyday objects is a site for design intervention.

This way of expressing the starting point for a research process is therefore quite different from, say, setting the frames using questions such as "How can we make people more aware of the energy consumption?" or "How can we make energy consumption visible?" However subtle we may express this in the research literature, there is a basic difference between such questions and statements like "*systematically reinterpreting designed things…".*

Even when we ask open questions on the form of "How can we…?", these are not without context. Who is asking, for what reason and with what expectations? In case we want to do things *differently*, there is a need to bring also such factors influencing where and how answers will be searched for into the picture. This is where the program makes a difference; a difference similar to how "Let us try this instead!" differs from "How can we change this?". Correspondingly, the processes set in motion are equally different to each other.

Thus, a characteristic of programs like this is that they seem to blend what we otherwise might consider questions and answers. Instead of presenting a question to be answered, they present propositions or proposals that need to be substantiated. However, much like how the way we phrase and rephrase a question as we develop an understanding of what an answer could be like, and thus make questions and answers evolve together, this approach builds on the idea that certain insights depend on a process of change driven by an interaction between program and experiment.

We have described a number of programs and experiments like this, such as Slow Technology (Hallnäs & Redström 2001), IT+Textiles (Redström et al 2005), Textile Interaction Design (Hallnäs & Redström 2008), and Switch! (Mazé & Redström 2008), It is experiences from this work that form the basis for this discussion. An early description of our programmatic research process may serve as a way of introducing the basics of the work process (Redström 2001, p. 26):

Thus, we have a process of:

i) formulating a design program;

ii) realising the program by designing, implementing and evaluating design examples;

iii) reflection and formulation of results, e.g., reporting on the experiences gained, formulating new working hypotheses, reformulating the design program.

While at some point satisfying a need for a compact and rational description of a work process, it is also quite clear that this picture of what programmatic research is like is much simplified and in some ways raises as many questions as it answers. For instance: where does the first program come from? Is it always the case the program comes first? And if it doesn't, what does that imply when you say that the program acts as a foundation for the experiments? Given the complexity of design processes in general, is experimentation simply a matter of 'realising' a program?

This text is an attempt to outline what we might call a *program/experiment dialectics* (cf. Binder & Redström 2006). Like dialogue and debate, the term dialectics stem from philosophical practices in Ancient Greece (e.g. Plato 1998). In the dialectic, participants start with different views, but unlike debate, in which the participants typically remain with their original opinions trying to win each other over, what then happens is a matter of reaching a deeper understanding by using the opposing views to discover short-comings and flaws in the original argument. Later Hegel used notions such as abstract-negative-concrete to describe a historical dialectics through which a richer understanding of a notion is developed by moving from the 'abstract' to something 'concrete' (Hegel 1873, p. 237):

The absolute idea may in this respect be compared to the old man who utters the same creed as the child, but for whom it is pregnant with the significance of a lifetime. /.../ So, too, the content of the absolute idea is the whole breadth of ground which has passed under our view up to this point. Last of all comes the discovery that the whole evolution is what constitutes the content and the interest. It is indeed the prerogative of the philosopher to see that everything, which, taken apart, is narrow and restricted, receives its value by its connexion with the whole, and by forming an organic element of the idea.

While Hegel certainly is very far from what is dealt with here, the idea of a dialectic process that moves from the abstract to the concrete is relevant also here: it talks not about going from abstract idea to material thing, but from an empty concept –'abstract' referring to something void of relations and context– to something 'concrete', an understanding rich in relations and experience. Also in this sense, the initial program is

indeed ‘abstract’ and the process of experimentation a matter of making it more ‘concrete’.

And so, let us now look into how programs come about, what happens with the relation between program and experiment as the research process unfolds, and finally if we can say something about when such a process comes to a closure.

BEGINNING

As an illustration of how a process like this may come about, let us look at one of the most influential programs ever proposed in design: the Bauhaus. Having far-reaching effects not only on how we consider the design of industrial products (and indeed for the formation of the discipline industrial design), it has historically also served as role model for much design education. The Bauhaus is also interesting because of the many rather strong statements made by Gropius and others regarding its ambition and purpose (Gropius 1926, p. 95):

The Bauhaus wants to serve in the development of present-day housing, from the simplest household appliances to the finished dwelling. In the conviction that household appliances and furnishings must be rationally related to each other, the Bauhaus is seeking — by systematic practical and theoretical research in the formal, technical and economic fields — to derive the design of an object from its natural functions and relationship.

Even in this short passage, we can clearly see the main components of this program: the interest in the everyday where each object belongs to a system, the aim to find a rational basis for design, as well as the influence from other fields and science. Programmatic statements like this certainly have provided both direction and depth, but were they there from the start?

It seems they were not.

The work of Anni Albers (b. Fleischmann) provides some interesting glimpses into the early days at the Bauhaus. Here follows a transcript of an interview with her made for the oral history archives of American Art (Albers 1968):

SEVIM FESCI: Yes. Before we leave the Bauhaus, because we were still there -- I would like to ask you what is this creative atmosphere of the Bauhaus?

ANNI ALBERS: This is what I mentioned there in the article -- well, the Bauhaus today is thought of always as a school, a very adventurous and interesting one, to which you went and were taught something; that it was a readymade spirit. But when I got there in 1922, that wasn't true at all. It was in a great muddle and there was a great searching going on from all sides. And people like Klee and Kandinsky weren't recognized as the great masters. They were starting to find their way. And this kind of general searching was very exciting. And in my little articles this is what I called the creative vacuum. But the word “education” was never mentioned. And the people we think of as the great masters -- Klee and Kandinsky -- they weren’t available for questions. They were the great silent ones who talked among themselves maybe, but never to small little students like me. But we knew that what the Academy was doing was wrong and it was exciting that you knew you had the freedom to try out something. And that was fine. But, as I say, it wasn’t that you went there and were taking something home from there. You were a contributor.

SEVIM FESCI: It was more a kind of laboratory.

ANNI ALBERS: Yes, from all sides. Everybody tried his best and we didn't know in which direction we were going. Because there was nothing. You only knew that what there was in other schools or academies was wrong and didn't satisfy.

Clearly, the strong programmatic statements were not present at this time – but other fundamentals of a design research program certainly were: the creation of an experimental environment, the urge to do things differently, and a substantial openness to what might come out of it.

With respect to the emergence of this ‘new’ practice, Albers writes elsewhere:

At the Bauhaus, those beginning to work in textiles at that time, for example, were fortunate not to have had the traditional training in the craft: it is no easy task to throw useless conventions overboard. /.../

But how to begin? At first they played with the material quite amateurishly. Gradually, however, something emerged which looked like the beginning of a new style. Technique was picked up as it was found to be needed and insofar as it might serve as a basis for future experimentation.

Unburdened by any considerations of practical application, this uninhibited play with materials resulted in amazing objects, striking in their newness of conception in regard to use of color and compositional elements. (p. 3)

As it seems, the first explorations were far from the systematic practical and theoretical research Gropius proposed in the quote above. Further, Albers writings indicate that the turn towards a more disciplined effort did not appear top-down, but that such foundational aspects of the program actually appeared in and through their explorations:

A most curious change took place when the idea of a practical purpose, a purpose aside from the purely artistic one, suggested itself to this group of weavers. Such a thought, ordinarily in the foreground, had not occurred to them, having been so deeply absorbed in the problems of the material itself and the discoveries of unlimited ways of handling them. This consideration of usefulness brought about a profoundly different conception. A shift took place from the free play with

forms to a logical building of structures. /.../ Concentrating on a purpose had a disciplining effect, now that the range of possibilities had been freely explored. (p. 4)

The formulation "suggested itself" may appear somewhat mystical, and the circumstances for the emergence of the functionalist turn are certainly more complex than this. But there is something of great importance in this, and that is how the introduction of a new conceptual framing re-contextualised the experiments by suggesting a new direction ahead.

We can see traces of very similar processes in our work. As in how early experiments with the aesthetics of computation made us formulate the Slow Technology program (Hallnäs & Redström 2001), or in how the IT+Textiles program (Hallnäs et al 2002, Redström et al 2005) emerged out of experiments initially not at all focusing on the particular combination of computational technology and textiles, but rather on open explorations on the usage of alternative materials in interaction design. These experiments involved not just textiles, but also redesigned IKEA furniture, waste materials at the office, etc. (Hallnäs et al 2001).

So, to return to our basic question: does the program always come first? There is no single answer to this question, but it appears as if programs for practice-based design research to a certain extent depend on the existence of a kind of "proto-practice" for them to emerge. The importance of the critical milieu, the open experimentation calling for a conceptual reframing to make sense of early intuitions, etc., are all central properties of the context that opens up for the formulation of a strong program. Still, the program comes 'first' in the sense that all this fall in place only when that conceptual framing suggest that clear direction forward. It is through this move that the basics of the program/experiment dialectics that from this point will drive the process is first established.

UNFOLDING

The mutual dependency of program and experiment stems from the program's need for materialisation –that which will make the hypothetical world-view of the program into something 'real'– and the experiment's need for precise frames –that which makes the experiment into something more than tinkering or undirected exploration. A program is not just a program, but a program *for* something, and it is this *some-thing* that the experiment materialise.

Further, an experiment needs some kind of intention or direction to really work as an experiment in research. In other areas of research this could be the hypothesis to be tested, the problem to be solved, etc. The design program, however, is more suggestive in nature. Of course it takes a stance in relation to some key issues, sometimes even including practical matters such as how to work and with what. Yet, it must be open for interpretation and in some respects even only tentative; it needs interpretation to become explicit. It must respond to an urge to change.

We interpret the program through experiments. Through the way we set up the experiment, we present a certain perspective on the program. Using the metaphor of a design space opened up by the program, we might say that we use the experiment to explore this space, positioning us somewhere to be able to say "this is what the design space looks like over here".

The experiment makes these interpretations of the program through the addition of constraints, by making certain issues, such as work method and material, more specific, etc. We might say the experiment setup act as a kind of specification of the program with respect to some subset of issues.

Let us compare this with the situation in more traditional research were we design an experiment meant to address the hypothesis. On basis of the results of the experiment, we may then either affirm, refute, or, more likely, rephrase the hypothesis and iterate the process – and we will do so not only on basis of the results of the experiment, but also on basis of how well the experiment as such actually addressed the hypothesis.

Clearly, there is more to this than just affirmation or rejection of hypotheses. Thus, design plays a central role also here (the experiment *is* a design), as do interpretations of issues and questions through design (as in how the experiment is designed to address issues suggested by the hypothesis). In a sense, the experiment is an interpretation of what is important about the hypothesis; an interpretation expressed through the way it is set up, through the way it is designed. Just consider the diverse character of the actual experiments in different traditions in psychology (e.g. behaviourism, cognitive psychology, ecological or gestalt psychology).

In this experimental design research, this practice-based approach driven by design experimentation, we work with programs rather than hypotheses but they too have this characteristic of depending on experiments to come to life, to become something we not only speculate about. Though our programs are not affirmed or rejected through our experiments –as it rarely is of much value to us to simply refute or accept a given program since our interest lies with what it can *do* for us – we still use experiments to explore what the program means.

STABILISATION

The perhaps most important difference between the design program and other constructs such as a hypothesis, is that while the hypothesis ideally should be quite precise and 'testable', a design program needs to be suggestive and open for the unexpected. Whereas the hypothesis ideally is addressed through one experiment, the design program needs to open up a space where innovation and future development is possible, thus typically requiring us to perform series of experiments to illustrate the diversity it affords.

This means that our design experiments not only need to expose the logic of the program – they must also illustrate it by means of exhibiting a logic in relation to each other. Though the program should afford a rich space, it must not be random but a structured one – or else we could as well do without it. As a result, the issue of interpretation becomes rather central here: the interpretation of the program we make as we design experiments, the interpretations of the experiment we make as we analyse the results, the interpretation we make as we look at a collection of experiments belonging to one program, etc.

Given the inherently open and suggestive nature of the design program, and how experiments can be considered interpretations of the program, we see another reason why program and first experiment often seem to develop more or less simultaneously.

When designing, we typically design *some-thing* given, i.e., an object of a familiar kind such as a house, a certain piece of furniture, a communications device, etc. These things function as a baseline against which we may relate program and experiment. It might even be that such existing objects act as the key we need to form our initial program. Besides relating to everyday object categories, we may also relate in this way to design experiments and examples stemming from other programs, as when other researchers elaborate on ideas introduced by someone else.

Importantly, that *some-thing* given is more than a concept, it is also form – and this particular form (also in a very concrete sense) has an influence that is hard to escape, at least without conscious effort. It is quite interesting to see that in many projects –our own and other's– where it has been assumed that the precise form of an early proposal or design example is not that important, we still see that the concrete form of such early proposals have a tendency to survive throughout the design process. In the same way, early design examples tend to get a strong normative function as they help establishing the program (and thus the program/experiment dialectics).

As an illustration from our work, consider the Interactive Pillows. Developed just before the IT+Textiles program begun as a way of both initiating collaboration and for expressing basic intentions behind the program, they seemingly received a rather strong normative function for what would come in at least three different ways: not just using textiles as material, their usage and place in everyday life are also tightly related to a traditional textile domain; they use dynamic patterns of light as their primary temporal expression; and they are re-interpretations of existing objects rather a new kind of object in itself. These three characteristics, neither of which are really in focus in the actual research program are afterwards present in a number of examples created within this program.

DRIFT

Given that experiments play an important role when interpreting the program, it is also clear that the program is not the only thing determining what happens as we perform our experiments. Just as the program creates a frame for experimentation, so does the experiment create a frame for design work – and into this design work we of course also bring our own ideas about the program and yet other matters. The kind of research dealt with here is often inter-disciplinary. Such settings highlight the fact that the interpretations participants make typically differ from each other – not only do we bring different skills and perspectives into the process, we also look for different things. In case the participants have strong individual agendas, these will of course influence the course of events, and to some extent compete with the agenda put forward by the program.

The issue of how participants' agendas might compete with the design program in terms of influence, leads us to another aspect of how program and experiment are related, that of how the program maintains influence on the experiments, thus not only acting as a starting point but as something continuously present in the work. That the program has such a presence is essential, as we otherwise will risk uncontrolled drift.

The influential power of the program depends on its suggestiveness, i.e. in what ways it is able to suggest a (consistent) way forward in the situations that occur, e.g., by enabling the participants to see certain potentials, to interpret what is going on, to decide what to do next, etc. This is a difficult role for the program, our provisional regime: while being open for the unexpected, it must at the same time be strong enough to maintain influence even when we are improvising, when spontaneous and intuitive.

When thinking and doing are intertwined, as they are when we make things, how things unfold also depends on what works, what can be done here and now with the materials of the design situation. Especially in collaborative work, what quickly establishes a way to move forward is likely to gain influence over something more difficult or time-consuming. The reason is that the latter in practice means almost stepping aside the process for a moment to figure it out, a moment during which the context might have changed rendering the idea less relevant to the movement forward. It is like a discussion or a debate – once a moment has passed, it is gone and hard to recover…

All this puts a certain demand on how we manage the materials of the design situation, as well as how we manage the many agendas that influence what is going on. In practice, it means that both program and experiment need to be set up in a way that will make the drift caused by all these things put into motion within the realms of what we are interested in investigating. That the program is able to 'talk to' the participants is therefore one of its most important features.

In relation to this, we can get another perspective on why some experiments, be that they have not been fully interpreted as such, often exist before the program is formulated: experiments may guide the formulation of the program in order to make the program tell us more precisely what it is about the experiments that is important. Having seen the outcome of such early experiments, we can make the program compensate for aspects not that important in the outcome, trying to calibrate the conceptual frames so that they don't guide us in the wrong way. This can not really be done without the kind of interpretation of the program that an experiment embodies. But this also means that early experiments often obtain a strong normative function. Thus, further experimentation need not only challenge the program, but also the experiments that helped establish it – or else we risk getting trapped in variations of the first experiment.

Let us now return to the example of an early normative design example, the Interactive Pillows, presented above. Towards the end of our work with IT+Textiles, we developed a new program, Static!, and although this program certainly builds on many of the ideas we had developed in previous programs, it was a step in a new direction as we then turned towards issues of sustainability (cf. Redström 2010). Now, if we look at the design experiment that became the pivotal point in the shift from the first program to the other, the Energy Curtain (described as a design example in both programs (Redström et al 2005, Mazé 2010)), there are again some strong similarities to the Interactive Pillows: the relation to a very traditional textile domain, the use of light patterns for dynamic expression and the re-interpretation of the interaction with an everyday object.

That design examples have this stabilising normative function is not in itself problematic, as there is a need for both stabilisation and drift. In the case of professional practice it might even be something we look for, as in our interest in the canonical examples that define a brand identity. Here, however, the possibility to expose these examples from a new point of view as we initiate a shift between programs is crucial as it can allow us to articulate ideas we might have developed in the practical experiments but that are not explicit in the actual program. In this case, this can be seen in how we developed the idea about critically re-interpreting the interaction with familiar objects into a central *leitmotif* in Static!

CLOSURE

At some point, there is a need for distillation, of bringing things together into something that can be set in relation to the world outside. That a key feature of the program is how it establish mechanisms for pushing the process forward, creates a certain difficulty when it comes to the issue of termination or closure. Since the program's influence exists on basis of how well it supports taking the next step, it becomes difficult indeed look to the program itself for termination criteria.

Firstly, the program is not only a response to a set of issues or questions, but also some sort of assemblage of the resources needed for its realisation. In practice, termination of programs is often just as much a matter of the amount of funding, time, material and other resources available as it is a matter of when a set of experiments are finished. Still, what allows us to continuously calibrate and craft the research process is how well we can align research content within such constraints.

One way to answer the question about when a program is finished, would be to say the work is done when what is intended to be seen is truly present in the expressions meant to present it. If the fidelity is not good enough, if there are other expressions standing in the way obscuring the view, if the expression is not strong enough… well, then it is simply not ready.

Perhaps we can compare this situation with that of when a prototype is 'ready'. In the case of prototypes, it is quite clear that this question depends on what we want the prototype to investigate and express. In some cases, a scale drawing is sufficient to capture what we intend, whereas other issues might require scale models, functional mock-ups or experience prototypes. For instance, when it comes to prototyping interaction with technology there is often significant disagreement about what it takes, ranging from proponents of the use of simple mock-ups to enact scenarios since it is really in the social realm the most crucial aspects are to be found, to proponents of the necessity for fully functional prototypes to capture detailed technical interaction with the device. Depending on who we ask (and when), we will get quite different answers to the question of when a prototype is 'finished' with respect to the questions asked as it depends on what we look for and what we think needs to be there for us –and, importantly, also for others– to *see* it.

Again, however, this is indeed a decision we make, and not an objective observation about the work. With respect to issues of knowledge and research, this is somewhat unsettling, and it is therefore important to understand the wider context of making this decision to stop the process. When evaluating a program, it is placed in relation to other programs. Asking questions about strengths and weaknesses, possibilities and problems, we try to find out what the program can do, often with a focus on what new ways of thinking and doing it opens up. Such a critical examination of the program can only be done when there are examples enough to really express the design space opened up; the extent to which the experiments take advantage of and present what is 'new' in the hypothetical worldview proposed in the program is central here. And so, another termination criteria, is when we see that this critical examination is not only possible, but fair to make as all the basic components necessary to make the basic argument are in place (cf. Buchanan 1995).

If the evaluation of the program in the context of competing 'knowledge regimes' represents an outside-in view, the corresponding inside-out view can perhaps be described as when the process stalls. While stalling might happen from time to time in any creative process, what is referred to here is when we come to a point where it is not possible to re-formulate the program as a response to the drift caused by the program-experiment dialectics over time, but when it becomes more or less necessary to do so. This might be seen in that new experiments do not seem to express much not already expressed in previous experiments, or that their most intriguing aspects seem to point to a need a shift in basic framing to be further developed. Another indication we might have reached a critical point is that we begin to rephrase earlier experiments as we begin to see them differently. Or, in other words, we come to a point where the program loses its ability to suggest a way forward.

CONCLUDING REMARKS

As seen in the Bauhaus, new practices often have to transgress disciplinary borders in their pursuit of alternative ways of thinking and doing. One should, however, not confuse this with the issue of academic multi-, inter-, post- etc. disciplinarity. Of course, some of the proto-practices explored in programs like these might end up forming (parts of) new disciplines, but most of them do not. What is crucial here, however, is that one would not capture what is interesting about them by reference to how different disciplines come or do not come together in a given process. It is probably more useful to think of the programmatic approach to design research as orthogonal to more disciplinary concerns, similar to how Gibbons et al describe Mode 2 research (1994, p. 5):

it develops a distinct but evolving framework to guide problem solving efforts. This is generated and sustained in the context of application and not developed first and then applied to that context later by a different group of practitioners. The solution does not arise solely, or even mainly, from the application of knowledge that already exists. Although elements of existing knowledge must have entered into it, genuine creativity is involved and the theoretical consensus, once attained cannot easily be reduced to disciplinary parts.

The possibility of using design programs to establish a kind of 'provisional knowledge regime' (cf. Binder and Redström 2006), has made this approach very useful in contexts that on one hand depends on experimental design work but on the other does not really build on a strong and well-established practice in itself – but where the very search for foundations for, and examples of, a practice-in-the-making is a core issue. Albers descriptions of the Bauhaus clearly show that the use of a program to support a practice-in-the-making is not new.

With accelerating technological development and new societal challenges, the need to develop 'new' design practices to address their potentials and problems has increased as well. Many of these will end up as local and temporary micro-practices far from the large academic structures we refer to as disciplines. But there is a need for such alternative 'proto-practices'. You can not explore the sea only using super-tankers.

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REFERENCES

Albers, A. (1968). Oral history interview with Anni Albers, 1968 July 5, Archives of American Art, Smithsonian Institution.

Albers, A. (2001). Selected writings on design. Middletown, CT: Wesleyan University Press.

Biggs, M. A. R. (2006). Modelling Experiential Knowledge for Research. In M. Mäkelä and S. Routarinne (ed.). The Art of Research: Practice in Research of Art and Design. Helsinki: UIAH.

Binder, T. and Redström, J. (2006). Exemplary Design Research. In Friedman, K., Love, T. and Corte-Real, E. (Eds.) Proceedings of Design Research Society Wonder- ground International Conference 2006.

Brandt, E. and Binder, T. (2007). Experimental Design Research: Genealogy-Intervention-Argument. In Proceedings of International Association of Societies of Design Research 2007, Emerging Trends in Design Research. The Hong Kong Polytechnic University School of Design, November 12 - 15, 2007.

Buchanan, R. (1995). Rhetoric, humanism, and design. In R. Buchanan & V. Margolin (Eds.), Discovering design: Explorations in design studies (pp. 23-68). Chicago: University of Chicago Press.

Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., and Trow, M. (1994). The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies. London: Sage.

Gropius, W (1964) Principles of Bauhaus production (Dessau), in U Conrads (ed) Programs and manifestoes on 20th-century architecture.

Cambridge, MA: MIT Press, pp 95-97 (originally published in 1926)

Hallnäs, L., Melin, L. and Redström, J. (2002). A Design Research Program for Textiles and Computational Technology. In Nordic Textile Journal, No. 1, 2002, pp. 56-63.

Hallnäs, L., Jaksetic, P., Ljungstrand, P., Redström, J., & Skog, T. (2001): Expressions - Towards a Design Practice of Slow Technology. In: Proceedings of Interact 2001, IFIP TC.13 Conference on Human-Computer Interaction, pp. 447- 454. IOS Press.

Hallnäs, L. and Redström, J. (2001). Slow Technology; Designing for Reflection. In: Personal and Ubiquitous Computing, Vol. 5, No. 3, 2001, pp. 201-212. London: Springer.

Hallnäs, L. and Redström, J. (2006). Interaction Design: Foundations, Experiments. Textile Research Centre, Swedish School of Textiles, University College of Borås and Interactive Institute.

Hallnäs, L and Redström, J (2008). Textile Interaction Design. In Nordic Textile Journal, 2008:1, pp. 104-115.

Hegel, G.W.F. (1873). The Encyclopaedia of the Philosophical Sciences; The Science of Logic, III The Doctrine of the Concept, transl. Wallace, W. Oxford: Oxford University Press.

Koskinen, I., Binder, T. and Redström, J. (2008). Lab, Field, Gallery, and Beyond. Artifact, Vol. 2, No. 1 (Special Issue: Issues in design research and design research methods), pp. 46 - 57.

Lakatos, I. (1978). The Methodology of Scientific Research Programmes. Philosophical Papers Vol. 1. Cambridge: Cambridge University Press.

Mazé, R. (Ed.) (2010). Static! Designing for energy awareness. Wtockholm: Arvinius.

Mazé, R. and Redström, J. (2008). Switch! Energy Ecologies in Everyday Life. International Journal of Design, Vol 2, No 3.

Plato (1998). The Republic, transl. B. Jowett. Project Gutenberg.

Redström, J. (2001). Designing Everyday Computational Things. Ph. D. Thesis. Gothenburg Studies in Informatics, No. 20, May 2001. Dept. of Informatics, Gothenburg University.

Redström, J. (2010). Research Frames. In Mazé, R. (Ed.) Static! Designing for energy awareness. Stockholm: Arvinius.

Redström, M., Redström, J. and Mazé, R. (Eds.) (2005). IT+Textiles. Helsinki: Edita Publishing Oy/IT Press.

Rosengren, M. (2007). Lära av erfarenhet: Sätt att närma sig erfarenhetsdelen i praktikbaserad kunskap; En kommentar till Michael A R Biggs. ArtMonitor 1/2007 p. 103-111.