

PERFORMING HIGH QUALITY RESEARCH INTO DESIGN PRACTICE

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ABSTRACT

This paper deals with the complexity of doing research in design practice. More and more projects and papers appear dealing with this topic and the time has come to draw up the balance sheet. This paper starts with explaining the status of design research until now, in which we indicate the challenges to overcome to become a mature research field. We discuss nine issues which are - according to our experience - important to overcome. Within each issue we indicate the problem that we encounter (or have seen being encountered) while executing design research in practice. For each problem we propose a solution that fit both to the quality standards and methodology of scientific research and to the quality standards required in daily design practice.

Keywords: Design research, research methodology, design practice

1 INTRODUCTION

From its origin in the early sixties one of the main topics in design research is the development of design models for optimizing the working processes of designers and engineers [1,2,3,4,5]. It was soon realized that design problems were not as amendable to systemization as had been hoped. This made the research focus changing from developing systematic models towards understanding the apparent complexity of the design task [6,7,8,9,10]. Although (some) empirical studies in design practice were executed from the early beginning of design research [11], research in design practice was executed on a larger scale from halfway through the 1980s [7,12, 13, 14]. By studying design practice, design researchers found out that designing is 'just' one of the activities of a designer's daily work. From that moment it was realized that design is a rational technical activity as well as a complex creative human endeavor [15]. Since designers in practice act most of their time work in design teams, there was also a shift from studying individual designers towards studying design teams in the 1990s (e.g. [16], [17], [18], [19]). By studying how a designer behaves in a design team while executing his design task, a design researcher had to do two things at the same time; following a design activity and undertaking social science research [20]. Therefore, by the decision to study design teams (in practice), design researchers enter a new field of research with accompanying knowledge and research methods.

Since social sciences are more mature than the relative young field of design research, one would think that design researchers could and should benefit from other studies executed in organizations that focus on complex tasks like design. However, the theories from social sciences are not extensively used in design research. This can partly be explained by the fact that most sociological or psychological research is not written for consumption for us as design researchers [22]. Another aspect is that many explanatory frameworks could simply not be applied since design tasks differ in many ways from other complex problem solving tasks [23]. These two aspects make that design researchers are not equipped with standard methods and procedures to execute their research. Many design researchers adopt the previous statement. Since more and more designers themselves become design researchers, the research community is overwhelmed by these creative persons that like to develop their own way of doing research, often with valuable results (see e.g. [24], [25], [26], [27], [28], [29]). However, also bad examples exist, because researchers did not apply the basic rules of scientific research. Over the years we reviewed several papers that showed research that contained a misalignment between research method and research question. We also red studies that did not exceed

the researcher's opinion about a particular situation, distilled from the researcher's own practical design experience. Another trap design researchers fall into is that they execute good consultancy projects and 'confuse' this with research projects. These mistakes harm the overall quality of design research and should therefore be avoided.

We believe that the lack of rigid methodological approaches does not provide a design researcher with a permit to execute his research project without any (scientific) rules or without any knowledge about how other researchers investigated similar topics. We think that a design researcher could learn from previous research and that he should apply existing knowledge in the field. With others [15, 30], we honestly believe that it is about time that we, as design researchers, attempt to take the next step in professionalizing our practice. Eventually the design research community will then be able to grow to maturity, not only on its outstanding content, but also on the accompanying research methodology.

In this paper we present the first step into this discussion. By analyzing various research projects that we executed ourselves in the last ten years, together with discussions with other design researchers and literature on methodology in design research, we formulated nine lessons for executing design research in the real world that are presented in this paper. The lessons do not provide the design researchers a straitjacket, since we do not want to kill the creativity of the design researcher. He needs his creativity to develop useful research methods in the complex nature of design research in industry with its numerous uncontrollable variables [20]. Our intention and hope is that the rules presented in the paper do avoid reinventing the wheel and that they will provide design researchers with guidance for executing high quality scientific research.

2 LESSON 1: MAKE CHOICES FOR DATA COLLECTION EXPLICITLY AND DESCRIBE THEM CLEARLY

Many projects in design research are explorative in nature, since design is a complex phenomenon to study with multiple interesting subjects in a relatively young research field. This means that we often deal with qualitative research methods with small samples that consist of rich data. Since there is not much existing theory yet, more often than not researchers went into the field with an open ended question like, '*I want to know more about collaborative design*' [31], or '*I would like to know more about the use of information sources in design projects*' [32]. This open formulation of research questions hampers the creation of a well thought sampling strategy. However for fitting the means, it is exactly the explorative nature of the research that benefits from carefully selected (real life) design projects.

In order to execute high quality research projects, a researcher must find a balance between the purpose of the research, its relation to existing theory and his sampling strategy [33, p. 81]. Although many methodology books prescribe that you should start with the purpose of your study and work your way towards a sampling strategy in a structured way, the balance can also emerge throughout your study by creating a flexible research design [33, p.81]. This is important for explorative design research projects since they tend not to have a clear delimited purpose and there is no mature body of existing knowledge about the topic under research. These aspects make developing a sampling strategy difficult. Flexible designs provide you with the freedom to do explorative research with open questions, because they allow a (systematic) co-evolution of purpose, theory and sample. They, however, do not prevent you from choosing, since data only fit the research purpose when it is consciously and well-considered chosen. Whereas many researchers executing an explorative study start with a complicated multiple case study consisting of various facets, we – on the contrary – recommend to start with just one representative case in which you think that the phenomenon of interest is observable in a rather uncomplicated way. This will give you a better understanding of the phenomenon of interest. This better grip could provide you with the insight that an existing body of literature (from e.g. social sciences) is applicable to your study. It may also narrow down the scope and purpose of your research. These changes in your original (broad) research plan will enable you to choose another data sample more purposely. Of course a second sampling step may lead to a third round of redefining your aim, including new bodies of literature and defining a new sample etceteras.

3 LESSON 2: TRAIN YOUR SOCIAL SKILLS AND USE THEM IN DIALOGUE WITH YOUR ANALYTICAL SKILLS

By comparing successful qualitative design research with the less successful ones, we were surprised about the differences in competences of the researchers. Successful researchers are on the one hand very smart on choosing their research topic and they have good analytical skills. Yet, they must also be social intelligent to confront and adapt to the situations they meet in the design context. Put together one may conclude that design researchers must be schizophrenic since they need many contradicting skills that they have to use in the many different (social) contexts in which they operate. (For an overview of the skills see [20].) However, we think it is *reflexivity* that distinguishes good design researchers from schizophrenics.

For example, in order to get a good grip on the content of the design project under research, as a researcher, you have to be smart and naïve at the same time. You need to have the basic design skills in mind and start asking questions about the design project under study in a rather naïve way: be genuine curious. What you are trying to do in this way is connecting your general design knowledge to the current project, which requires smartness and a strategic way of questioning. Being enthusiastic, curious and a good listener enable you to transfer your general design knowledge and jargon into a general understanding of the design project under study. This will enable you to speak the language of the company people and research the design project under study without a preexisting bias. Additionally, you must be able to get people interested in your research so they want to cooperate. Be conscious about the fact that they can only provide you with the data necessary. Even when the participants of your research are obliged to provide you with data, your data will become richer when you approach them showing your interest and knowledge about their design project. It is our experience that participants are really willing to provide you with data (designers and engineers love to talk about their work!) as long as they perceive you being competent, adaptive and interested. Reflexivity comes with experience, which makes it recommendable to start with research projects that do not contain all complexities of a real time project in practice. Maybe you can start with a laboratory study, a retrospective study with company people or you replicate an existing study by using a previously tested research method. There are many possibilities, yet be conscious of the fact that it needs training to create credibility and experience in doing design research in practice [28].

4 LESSON 3: BE EMPATIC TO THE COMPANY PEOPLE

Getting a company interested and involved in scientific research is often a difficult process. There exist many (cultural) differences between the company people and you as a researcher. Companies prefer you to solve their daily problem, which is often not related to the design behavior of the design team in which you as a researcher are interested.

Another problem is that companies are not willing to let you look into their daily life practice. They are afraid that competitors take advantage of this, or that bad habits will become public. Sometimes you manage to convince a person in the company of the value of your research, but management does not allow you to do your research, etceteras. How to overcome these barriers? Patience, empathy and pragmatism are keywords here.

Patience since it takes time to convince people. You really need to build up a relationship with the company. The disadvantage of a formal approach is that it is easy for companies to reject your proposal. More often than not you have to use an informal way to approach people. By developing a relationship of trust with the company people, it will be easier to get access to a company. In a first meeting it is helpful to listen carefully to what the company people have to say about aspects that are related to your topic. By understanding their needs in relation to your topic, you will find an approach to convince the company people of the value of your research. Important here is that you should adopt the language of the company people, to explain your research topic [34].

Developing this research plan together with the company can be seen as an investment in the relationship with the company. It will create support for the research plan and is therefore recommendable. It is important to have a common understanding of the research aims since the company needs an understanding what you are going to do [34]. The company needs to be able to

estimate what type of data you need, how much time it will take for them to participate and what they get out of it. Less obvious, yet maybe even more important is that when a company understands your research aim en is willing to participate you have avoided that you research a phenomenon in practice that is not relevant to them.

As a researcher you should not be afraid to present your research plan gradually yet with the final goal in mind. When you overwhelm the company people with your entire research plan, they get anxious that it will either take too much time, or that they have to provide you with too detailed information. However, for each research step you should be clear about the things you expect from them and how much time that will take and what you will provide them with after the research.

Another part of the strategy is to find a ‘research champion’ within the company. This is a person that really believes in your research and is therefore willing to help you find your way in the company. This person is also the one that can convince other people to join the research project. Finding a ‘research champion’ requires showing empathy to the company people. You have to show a deep interest in their daily work and you have to understand the politics and the procedures of the company. In this way the company becomes part of your research and sees itself as more then a data supplier [34]. This will enrich your data both quantitatively and qualitatively.

The last attitude necessary is pragmatism. Building a relationship with a company cannot be planned. Quoting Robson [33, p. 50.]: *“The researcher does not set the agenda in isolation, but acts in partnership with a variety of client groups”* Therefore you have to adjust to the situation and develop your research plan and methodology according to the existing situation in the company. Understanding working schedules and habits is important here [20].

Concluding we can say that research management is much more than managing your research project. It also involves stakeholder- and context management.

5 LESSON 4: FORMULATE TWO AIMS: A RESEARCH AIM AND AN INDUSTRY AIM

The complex empirical situation and the richness of the data directly relate to the next pitfall: the problem situation is seen as THE complicated research problem with many different facets. However, a design researcher is interested in the behavior of the designers involved in the case (requires descriptive research), while the company is interested in improving their performance (requires prescriptive research). For design researchers separating and fulfilling the two interest can be difficult since engineering design researchers are often graduated in engineering [20]. They are used to solving engineering problems and generating solutions, which fits the prescriptive and solution oriented approach that is reflected in the company wishes better. Observing and understanding social attitudes and the behavior of other engineers is not a natural attitude of many design researchers. While reviewing articles, we saw many examples in which design researchers operated as consultants instead of researchers. However, for generating new knowledge and for theory building it is important to behave as a social scientist and observe designers working by using your design knowledge. Defining a research aim and explicating your contribution to literature is important for you as a researcher.

We believe that the problem is solved when two aims are separated explicitly: a research aim and a company aim. This also leads to two sets of questions; research questions and case questions. Explicitly investigating the two aspects at the same time will avoid confusion. This will improve the research results, as well as, the insights and recommendations for the company. Of course there must be synergy between research aims and industry aims [34].

6 LESSON 5: DARE TO GET DRAWN IN THE LARGE AMOUNT OF DATA

The art of research is to apply focus and restrict variables. However, once in design practice you will find yourself in littered reality with its many variables. You struggle in complex situations you take part in (to make it even more intriguing!). You will see, hear and feel more than you had indented resulting in much data. There will be a phase in your research project where you will be drawn into the large amount of data. In this stage, you have a deep understanding of the research project that you are investigating. Yet you are not capable of answering your research questions. You will even feel the fear that you never will be, since there seem to be no structure at all in your data. However, getting

drawn is necessary because you do not know which data you will need upfront and often there is no chance to gather the data in a later stadium. The struggle with large amounts of rich (audio and/or video) data is also necessary to be able to identify profound relevant patterns in the data necessary to answer your research questions.

The ability to switch between the complex and unpredictable design practice and your focused research project lies in your capability to deal with uncertainty. You do not have any guarantee that you will find what you are looking for. It might also be the case that at the time you are in the company, none of the activities that you want to investigate are happening (or at least not in the extend you expected things to happen). This can for instance be the case because you replicate a laboratory study in a real life setting.

Despite these uncertainties, it is most important that you have the confidence that the data collected contain patterns that are interesting to share with the research community. A thorough data analysis will allow you to publish interesting results since it cannot be the case that practice is not interesting enough to investigate! The worst thing that can happen is that you have to revise your original research plan (slightly). Nevertheless, the danger of not collecting much rich data and sticking to rigidly to your original research plan may cause that you do not find anything interesting, since the data collected do not closely represent design practice or they simply do not have enough content.

7 LESSON 6: CLARIFY THE CO-EVOLVEMENT OF RESEARCH METHOD AND RESULTS

If one thing becomes clear about qualitative research in industry, it is that the logical, step-wise approach of quantitative empirical research (literature search – hypothesizing – experimenting – analyzing) does not fit the organic, iterative character of qualitative empirical research in design. In design research projects, there is often a co-evolvement of the research method and its results since design research is explorative and there are hardly any normative frameworks (from other research fields) that are hundred percent applicable.

This means for instance that coding schemes have to be developed (or finalized) while analyzing the data (see e.g. [35]). Or it can be the case that once you are analyzing the results you discover that you need a different type of data or data source or additional data (see e.g. [36]).

This flexible approach requires a designerly way of thinking, that provides the ability to stay open for unexpected discoveries [33, p.46/47]. This improves the validity of the study. In order to guarantee the scientific attitude and the reliability of the study, it is necessary to be honest, clear and explicit about the research process followed and the decisions made along the way [37]. The process of design research is much like designing. Just like a design benefits from a '*design rationale*', qualitative design research needs a '*research rationale*' that should be explicitly present during the entire research project.

8 LESSON 7: FOLLOW THE GAME RULES OF SCIENTIFIC RESEARCH

Entering a new field of research – it may even be considered as a new paradigm of researching - does not mean that basic rules of science no longer apply. The design research community must have the ambition to progress. We need to get out of the free explorative phase of qualitative research, where we accept analyses based on single quotes from interview material or conclusions based on single-case projects. The explorative and complex nature of design research make many design researchers develop their own research methods, without testing them properly. It is often unclear to what type(s) of design projects, contexts and designers the results are applicable for.

The basic game rules of scientific research concern its validity, reliability, replication and generalization. But in the design research field there are no clear examples of studies that can be replicated in different contexts, or with different types of designers. To overcome this problem, Dorst [8] proposed a stronger collaboration with designers and more experimental research in order to get a better grip on the design process, its context and the designers themselves. Although we believe in the

holistic approach Dorst proposed, we think that there are many examples of laboratory studies that did not show much validity with reality. Of course experiments can be used to test particular phenomena found in practice, but we believe that the solution lies in adopting and applying existing methods from more mature fields like sociology and psychology, as Lauche [22] proposed.

We are aware of the fact that these methods are not one to one applicable. A design researcher has to adjust the existing methods. He has to redefine the rules for validity, reliability, replication and generalization, in a smart way and within the chosen research paradigm. Replication, for instance, is difficult for case-based research, for there will be no exact copy of a new case. However, similar case research must lead to similar results and conclusions, so the researcher has to define the game rules, boundaries and similarities of settings. The same applies to generalization; the researcher has to define the way in which this applies to contexts and variables such as designers or design behavior, in order to be able to be specific on application and non-application of results. Playing the game of research implies to stick to the rules of science, although these rules have to be adjusted to the type and context of the research. Eventually these new rules can form the new fundamentals of the field of research.

9 LESSON 8: YOUR RESULTS MUST CREATE A BRIDGE BETWEEN RESEARCH AND PRACTICE

In order to satisfy both the company and the scientific community, your study must create a bridge between research and practice. This means that you have to deliver two types of results. On the one hand you have to provide an answer to the theoretical questions stated. Additionally, you have to provide the company with applicable practical implications that they can use to improve the way they deal with the problems and situations that you studied. It is significant that these two types of results are related to and complement each other.

To be able to deliver the two types of results, it is wise to start with analyzing your data in a scientific manner and work first on the answer to the theoretical part of your research. This enables you to analyze your data objectively and structured, as is required by the scientific rules.

Doing it the other way around has the risk that you jump to conclusions, which you cannot prove scientifically with the data available.

Once you have your theoretical results, you can take a step back and reflect upon the results, connect it to previous studies and think what the company can learn from this. What you are actually doing at this point is that you transform your (most of the time descriptive) study into prescriptive rules and/or a model that is based upon the current study and that is connected to theory developed in earlier studies. Do not be afraid that some of the guidelines you provide the company with seem open doors. The fact that they can help the company improving their processes makes the guideline already worth mentioning. Try also to keep your recommendations and implications to be pragmatic and feasible for the company people that have to implement them. Try to connect it to existing procedures and working patterns, since the change of successful implementation will be the greatest.

As conferences and journals are a good way to share your theoretical results, presentations and (a series of) workshops are good ways to share and implement your results in a company. For a company, a report will serve as a nice backup, but does not provide the strength of a presentation or a workshop.

10 LESSON 9: POSITION YOURSELF IN THE RESEARCH COMMUNITY

Standard research projects start with an extensive literature review, from which research questions are distilled that contribute to the literature stream reviewed. The previous lessons showed that this approach is not applicable to design research, since there is no strong theoretical base. However, it is clear that the time is over that researchers could place themselves on an island and do their research without any connections to other fields of study. As a researcher it is important to position yourself in a research community. This expands the chance to get your research published and it enables the creation of theory that is based upon multiple studies and thus larger data sets. It will also bring the design research community to a more mature level.

The dilemma the researcher finds himself in, is to position his research project in the cultural scientific landscape without limiting himself by what we don't know. Or as Robson states: "*Research literature provides a background resource instead of an essential starting point.*" [33 p. 50]. This can be accomplished by reading and reflection upon the existing knowledge and let that inspire your own aim and research questions. Literature is a starting point for research, to sketch the area and the outline of the research. By reading existing literature you get a grip on what might be important aspects to investigate. You also build your own opinion about earlier studies. This provides a focus, without being put in a straitjacket.

But how to deal with this in a rather young field with no mature and well-developed research methods? Do we believe that we have to behave as in a standard research project? The answer is no, since we do not think that this helps design research further. To illustrate why we, again, quote Robson [33, p. 55]: "*Research starting with a mechanistic linear thinking, closely tied to the known, may be clean and tidy, but is unlikely to be of any significance. However something that starts out as poorly understood, given considerable theoretical effort to convert it into something which is clearly defined, logical and rational could be of great value.*"

After analyzing the data and when the results are clear, it is important to do a second literature study to see if you can connect the results of your study to existing literature. (This can be another stream of literature then your original starting point.) This will help you to make your results more clearly (to yourself). It also enables to position your study strongly within a research community. Sometimes this needs an adaptation of your original research aim and questions. It is important that you find out what part of your research creates the most theoretical value.

We think that this approach suits design researchers (with a design background) well, since it fits a designerly way of thinking. This can be of great value of for the final quality of the study. In this way a design researcher could and should learn from and adapt to previous research, without losing the creative leap. As a design researcher you are part of a community and the only way to grow as a community is together.

11 CONCLUSION

We honestly believe that it is about time that we, as design researchers, attempt to take the next step in professionalizing our practice. The design research community must have the ambition to progress. We need to get out of the free explorative phase of qualitative research, and grow into a mature field of science. This also implies that we – the community – start the discussion about successful research and the quality of research. We have presented the first step into this discussion. We identified nine problems that you encounter entering the design field as a researcher. Based on our experiences we present nine lessons for executing qualitative design research in industry. We hope to prevent unnecessary mistakes or iterations, but above all, we hope to contribute to the design research community and start reflecting upon our shared understanding of design science.

ACKNOWLEDGEMENTS

We would like to thank all our colleagues, students and practitioners in the field of design and design research. For the many discussions that we had over the years really sharpened our thoughts and opinions about how to execute qualitative research in design practice.

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