

## **Future Issues in Design Research**

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### **Introduction**

While making notes during the conference and trying to summarise what had come out during two days of intensive discussion, it became more and more clear that the three issues had started to merge. The rather distinct questions that were formulated before the conference, were reformulated and refined during the first discussions into a set of questions that guided the subsequent discussions. Although this was done separately in each of the thematically different streams, some overlap started to emerge. The subsequent discussions, formal as well as informal, showed that from which point of view this research area was considered - individual, group or computer support - common issues emerged that turned out to be concerned with the effectiveness and efficiency of the process of doing design research, rather than its research questions.

When presenting these in the summary session of the conference, some additions and refinements were made, but a general agreement seemed to exist that these were the issues that needed resolving and the need was expressed to finalise the conference by setting priorities and suggesting ways of resolving the issues.

This chapter contains in its first part the core issues and some of the discussion as well as personal reflections. The second part presents the most urgent issues and ways to proceed.

### **Issues**

#### ***Terminology and common understanding***

Although the participants formed a specialised part of the design research community as a whole, the issue of differences in terminology became very clear. Terms borrowed from other disciplines had been interpreted in different ways, the disciplines represented by the participants had their own terminology unfamiliar to the others and the same terms coming from participants from different cultures had a different meaning. This resulted in confusion, discussion and a clearly expressed need to have a common terminology. A common terminology, was seen as essential for a research area. Only in this way a common understanding and building on existing work can be realised. Both are necessary for progress. One major stum-

bling block are the links between the terms: if one term changes, others may have to change too. When defining conceptual design, the definition of the preceding and following phase have to in line with this definition, at least within one school of thought. These interrelationships hinder the formulation of standard definitions.

The issue of terminology has been addressed in the past, e.g. Hubka wrote a dictionary in three languages [Hubka, 81], at the Engineering Design Centre in Cambridge an attempt was made to develop a glossary in one language, accepting multiple definitions to allow for different definitions in different schools. [Chakrabarti, 94]. Unfortunately these and other attempts did not lead to a generally accepted common source.

### ***Closer collaboration between disciplines on theories, methodologies and research methods.***

This issue is related to the issue of terminology. Terms and research methods have been borrowed from other disciplines, but not always correctly because the paradigms and theories were not known. A closer collaboration with other disciplines could not only prevent terminology confusion but provide theories, such as action theory and group dynamic theory, that could be very relevant starting points for design research. Other disciplines can further provide interesting research methods to study design, as the research in this conference showed. The conference enabled the exchange between researchers, several of which had not known each other, despite the fact that many of the participants have been working in this area for many years. An overview of those involved in this area of research is obviously missing.

### ***Common model***

The wish for a common model or a set of (partially shared) models came up frequently. Few models exist, most research results remain unconnected. Such a model would indicate a better understanding of design and would provide a shared understanding, a basis on which to do research. It remained open as to whether the development process, the product, the thinking process or a combination of aspects should be modelled. Formulating an all-encompassing model seemed, at least for the time being, unrealistic. A far better understanding of all the aspects is needed before such a common model could be developed. Model, rather than theory was used as term, indicating the fact that common models would be a first step to be taken.

### ***Consolidation***

The two previous issues lead to the wish for consolidation. An increasing number of researchers has been involved in empirical design research, focusing on different aspects of design, using different methods. Referencing islands have emerged and few attempts exist to bring it all together. A consolidation is necessary in the form of an overview and subsequent analysis of the research and its findings. This

will allow researchers to build on each other's work, to gradually come to common models and to a more fundamental understanding of design. This would in turn help the development of methods and tools for design, by providing the input necessary to develop support that addresses core issues and has a higher likelihood of being accepted.

### ***Classification of research area and research findings***

Design research is one of the few, if not only, research area that, despite the wide variety of topics that it covers, does not have a commonly accepted classification (ontology, taxonomy) of its research topics and findings. This is not only visible in the different and broad listings of topics covered by design conferences, but also in the problems authors sometimes have to assign their paper to a particular topic. A classification would help to structure the research topics and findings and to identify their interrelationships. It furthermore would provide an overview in this exponentially grown research area and allow the identification of areas in which research is still lacking. Care has to be taken that this classification will not lead to larger, but more disconnected islands of research.

### ***Development of a research methodology***

Design research is multi-faceted, focusing on process, product, organisation, tools, etc. and covers a large number of strongly interconnected aspects. This results in a large variety of research questions and the need for a large variety of research methods to be able to answer these questions. Design research does not have its own research methods (yet) but uses those from other disciplines. The problems are that many possibly useful methods are not known, that the paradigms on which these methods are based are often not considered (emphasising the need for collaboration), but more importantly, many of the existing methods have to be adapted to the special characteristics of design. Not even the research approach proposed in other disciplines can be applied directly. Design research could use its own research methodology, based on existing methodologies and the typical characteristics of design as field of study.

### ***Research objective and goals***

In design research, research objectives and goals are often stated at a very holistic level (improving design) or remain fuzzy. A study of the proceedings of two ICED conferences showed that in 47% of the 331 papers on tools and methods, motivations are absent: only in 33% of papers were they defined precisely. The issues of implementation in industrial settings is only dealt with in 37% of the papers [Cantamessa, 01]. The latter is interesting, as the goals are often formulated as an industrial need, such as reducing lead time. A validation as to whether the goals have been achieved, does not take place. Validation may not be possible, because of the available research time (it may be years before the effects of research influences an aspect such as lead time) or because the goal is formulated at too high a

level (a large number of interrelated factors may have influenced the goal, not just the one we are addressing) A possible consequence of the lack of validation or at least evaluation may be the fact that many research results are not used in practice.

### ***Common set of criteria for good research***

The preceding issues give rise to the need for a commonly accepted set of criteria for good research. This will give guidance to researchers and help the identification of research results that form a solid basis. This set should address which of the many methods are suitable for use in design research, which modifications are allowed, and what validity and objectivity in the area of design research mean.

### ***Communalities and specificities between research findings and domains***

The conference showed differences in findings in the different domains that had been investigated (machine design, architecture, etc.). The need was expressed to clarify the communalities and specificities in the various domains to obtain a better understanding of design in general and of design in the different domains.

### ***Changing models, dynamics of models***

The need was expressed for models that can change to take into account the dynamics of models. Most models are static descriptions.

### ***Activities***

During the discussion of the identified core issues, the need was expressed to come up with concrete ideas on how to address at least some of these issues. The discussion revealed that several initiatives existed of which many participants were unaware, confirming the observed islands of research. A more collaborative effort and overviews of existing research findings and experiences was considered to be of utmost importance for the research community to become more established. The Design Society ([www.designsociety.org](http://www.designsociety.org)) was considered as a worldwide platform through which to address some of the issues. The following is a listing of the proposed actions and some of the initiatives that exist.

### ***A Special Interest Group on Human Behaviour in Design***

A Special Interest Group within the Design Society will be set up (Lindemann), which will act as a forum to start common activities and become at least a repository for events and work resulting from the area of empirical design research.

***Map of research areas and researchers***

This map supports communication and provides a basis for consolidation. The Design Society could help establishing at least the network. As the list of researchers and research areas grows, the earlier described classification of research will become increasingly important.

***Courses in research methods applicable in design research***

Some of those courses already exists, but are not known. These courses should be announced more widely, e.g. through the pages of the Design Society.

***Summerschool to learn about design research***

The International Summer school on Engineering Design Research, is an example in which PhD students are taught about existing research and about how to do design research (Andreasen and Blessing). An overview of such summer schools should be published.

***A web-based database with empirical design research methods***

The unique feature of the database would be the inclusion of the purpose for which specific research methods were used and the experiences - both positive and negative - with these methods. The discussions this information will give rise to, will improve the methods, give guidance to new researchers and gradually form an established set of methods for doing design research.

***Database of empirical studies in design, their setup and findings***

This database is under development in Berlin (Blessing) based on an earlier database which was not publicly available. Taking up other relevant findings from other disciplines in this database seemed a useful addition.

***A set of test problems / test tasks***

Building on the idea of providing overviews, the development of a repository of test problems and tasks for use by other researchers was proposed. Developing a design (or other) task for an empirical study requires several iterations. Using those developed and tested by others will not only save much time but also make research results more comparable. An example is the wall-mounted swivel mechanism used by several research groups (see Ehrlenspiel in this book).

***A set of protocols for common use***

Not only the developmmt of test problems is time-consuming, data collection and in particular transcription occupies a large amount of time. Making available tran-

scribed protocols, including all the details of the empirical study itself, could reduce research time and make results more comparable. Those protocols could be particularly useful in explorative studies for new researchers to obtain a feeling for the type of data particular methods provide and to help them find a focus. An example of the use of one protocol analysed by various researchers using different methods is [Frankenberger et al, 1998]

### ***Database with teaching material***

(as above but for teaching design)

### ***Contact/communication with other societies***

The conference showed that the researchers collectively knew a large number of other societies, global as well as regional, but that this information had not been shared. The Design Society and its members were asked to start listing the interesting societies and make this list available.

## **Conclusions**

Many of the issues listed in the first part of this chapter will not be addressed by these activities, at least not directly. General agreement existed, however, that a basis of shared knowledge, information and data is necessary before the issues can be addressed in an effective and efficient way.

The conference confirmed my feeling that human behaviour in design is not only a necessary, but also an interesting and exciting area of research with a richness that offers an enormous potential for further exploration but with a lack of interconnection. Collaborative efforts are required to put this research area on a firm basis. The agreed activities will help form this basis.

## **References**

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