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Proceedings of the Symposium
held on 20-21 May 2010

Eindhoven University of Technology

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THE WIDENING SCOPE OF DESIGN RESEARCH IN THE NETHERLANDS 2005-2010

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Design Research in the Netherlands 2010 is the fourth symposium on research on design following earlier editions of 1995, 2000, and 2005. The audience for the symposium cuts across all the designing disciplines. This edition features contributions from architecture, industrial design, civil engineering, machine engineering, landscape design, management, curriculum design, and electrical engineering. Most of these can be characterised as engineering studies, which already have a long tradition of scientific reflection on the nature of design. This does not mean however, that in other domains of design (such as graphics, fashion, or games) which are less characterised by an engineering background, there is no reflection taking place. Rather it indicates that there are likely two different worlds of discourse – each with their established scholarly traditions and channels of output – that simply do not mix. This is a pity and a disadvantage for each of the domains.

Developments in industrial design engineering and architecture

The last five years showed several developments in the field of Industrial Design Engineering in the Netherlands, concerning the Dutch situation, international practice, the tools and objects of design, and a further maturing insight in the relation between design and research. Regarding the Dutch situation, there is now a clearer, and more varied, design research landscape with not one but three technical universities (TUs) having established research portfolios and taking part in research visitations, and with a growth of research links between the TUs and the universities of applied sciences (HBO) increasing the connections between research and practice outside the research departments of larger industries. At the same time, grand themes, such as emerging markets, global production, and sustainability are fuelling the research agendas and visibly direct programs.

Regarding tools and tools research, issues of how can creative processes of individuals and teams be supported are still strong, and broadening to new concerns, often with an emphasis on interaction design, and increasingly focusing managing complex information sharing and sense-making in teams. User-centered design, traditionally strong in areas of usability, had grown in the previous period into cover emotion and experience, a trend that continued and has extended to contextual studies and design ethnography. In these areas we see a tight coupling between research, education, and practice, with equal emphasis on developing measurement techniques to evaluate *design* (e.g. *products and product concepts*) as well as frameworks and techniques to support *designing* for these concerns.

These developments reflect changes in design practice, where emphasis is growing on understanding and supporting early design, often referred to as the fuzzy front ends, and bringing attention for evaluating, modeling, conceptualizing and prototyping user experiences. The last period has shown an increase in attention for user involvement (contextual studies, co-creation), and covering more perspectives into design. We also see a broadening of the range of outcomes that design is producing: besides classical 'products' and interfaces or interactions, the outcomes can include services (on their own or in combination with products), and solutions often span traditional domains, such as product design, interaction design, communication design, architecture, and service design. Design is becoming more complex, and involves more people (users, varieties of experts and stakeholders).

As a result, the tools and skills of designers are changing, and research projects are emerging (or maturing) that explore, instantiate, and evaluate new tools and principles.

Nevertheless, classical topics of creativity and expressiveness are still going strong, and the last five years have shown a consolidation of the role of design in research. Earlier discussions on how to define the relation between design and research, with the colorful phrases of research for/through/by/in/etc design, are settling down, with a clearer understanding of the ways in which design and research are related, and a more confident variety of ways to combine research and design.

In design research in architecture no major shifts can be observed over the period 2005-2010. Most issues that were discussed in 2005 like the effect of digital tools on architectural design, the need for integral design and the legitimacy of scientific design research still exist in 2010. These issues returned on the research agenda but they have become more prominent. Advances in digital design tools make it much easier to use these tools for modelling support but also new areas are explored such as scripting. In 2005 no architectural designer was interested in applying scripting languages for form generation. Recently new intuitive form scripting platforms have been picked up by architectural designers enthusiastically. Free form shapes are generated while maintaining constructability. Technical changes in computer aided design challenge design researchers to reconsider design methods and requires significant effort from teachers and practitioners to catch up. Integral design has found its counterpart in the Building Information Modelling development. Concurrent work process models can be put into practice now communications standards have been implemented by software industry.

Many disciplines in the building design and construction process are reconsidering their role. Integral design requires designers with the right attitude and with the right technical and social skills to be part in a successful collaboration. Since design offices increasingly operate in an international context, international standardization of design data and processes is needed. Obviously standardization is in conflict with the architectural demand for free form design. Future design research has to find the right balance between the inability to communicate on a free form design and unobtrusive communication on uninteresting architecture. The debate whether or not design research is science or not continued from 2005-2010. The gap between fundamental research and applied research seems to widen. Technical universities over the past years inclined to fundamental research but recently more attention is paid to innovation in collaboration with industry. Design education has become more professionalized. Practitioners from outside the university play an important role in design education. The number of full time architectural design academics is decreasing which limits design research capacity. Design research in the next five years is probably driven by global issues like climate change, security, health, etc. In these contexts design competences are crucial and will develop further.

Design research in the Netherlands 2010

We are very fortunate to have John Habraken as the keynote speaker at this year's symposium. In many ways Habraken is connected to the symposium. As the founding father of the Faculty of Architecture, Building and Planning at TU Eindhoven, he has set the initial direction and characterisation of the Faculty. When he was appointed Head of the Department of Architecture at MIT, Cambridge (MA) 1975-1981, his work was continued in the Design Methods group. The chairs of that group, at the time Robert Oxman and Thijs Bax, initiated the first Design Research in the Netherlands symposium in 1995 (Oxman, Bax, and Achten, 1995). The Design Methods group investigated and

developed methods for architectural design up until the merger with the Building Informatics group in 1997-1998 into the Design Systems group (reported in Achten, de Vries, and Hennessey, 2000). The new Design Systems group combined the strong methodological approach with Information and Communication Technology, in this way preserving a strong interest in the characteristics of design, designers, and designing (as presented in Achten, Dorst, Stappers, and de Vries, 2005).

The contributions in the current proceedings show a wide variety of design research across many disciplines. In this edition of the symposium, we have invited both group papers as in earlier cases, and we have introduced PhD position papers. The PhD position papers are presented in pecha kucha sessions, in which each researcher has the change to present their work. Following the presentations an intensive discussion round is planned in which all participants are invited to take part. The PhD position papers can be found everywhere in the proceedings, as we did not find it necessary to group them separately. Group position papers are about twelve pages long, and PhD position papers are about six pages long.

Although each subdivision has some arbitrariness, we have grouped the papers according to the following main themes: Group one deals with *methods, processes, and design*; group two deals with *design, research, and education*; and group three deals with *methodology and practice*.

Methods, processes, and design

In this group there are contributions from (1) Innovation, Technology Entrepreneurship and Marketing group – TU/e, (2) Reliability and Durability group – TU Delft, (3) Human Information Communication Design/Medisign – TU Delft, (4) group consisting of Green Building Innovation & Product Development; Electrical Sustainable Energy; Applied Ergonomic and Design; Technology Dynamics and Sustainable Development; and Valorisation Centre – TU Delft; (5) Design Systems – TU/e; and (6) ID-StudioLab – TU Delft.

The papers in this group have a strong focus on the process of design, and how to design processes. Reymen, van Burg, Romme, and Berends (pp. 13-22) are concerned with management processes which up to now have not benefitted much from insights from design research. In their work they demonstrate how creating business processes are in fact design processes, and how traditional approaches can be changed to take this aspect more into account.

Jiang, Freudenthal, and Kandachar (pp. 23-28) deal with two issues: design for the so-called Base of Pyramid group (people who live on less than three US\$3 per day), and introducing user-centred design for this group in China in the area of healthcare design. As this approach is virtually unknown in China, they are dealing with both a learning and change process.

Freudenthal (pp. 29-40) outlined the work done in the Medisign group, which deals specifically with developing multimodal and interactive support for medical applications. Their work is highly collaborative between industrial designers and medical specialists – therefore again a typical example of learning and change processes. This process has more or less matured through a series of dedicated projects, and now they are looking at industrial applications that can be realised for a wider market.

Van Timmeren, Bauer, Silvester, Beella, Quist, and van Dijk (pp. 41-52) present the results of an interdisciplinary design team that created a future plan for the use of electric vehicles on Schiphol. Electric vehicles have many benefits but pose high

demands in terms of available charging stations because of limited range. In the project the authors show how these demands can be met through a network of green energy powered charging stations and dynamic and static inductive charging lanes.

De Vries, Beetz, Achten, Dijkstra and Jessurun (pp. 53-63) argue that in order to support architectural design processes it is necessary to have a formalism that can precisely describe products of the design process as well as the process (product and process modelling), and that in order to improve architectural designs, it is necessary to have a rigorous understanding of human behaviour in the built environment – they aim to achieve this through simulation techniques.

Van der Helm, Stappers, Keyson, and Hekkert (pp. 65-78) present the ID-StudioLab which is a multidisciplinary collaborative work environment at the Faculty of Industrial Design Engineering. They show that collaboration or cross-fertilization of ideas does come about simply by putting a number of people together, but that it requires a careful balance of personal approach, environment, and facilities. In their contribution they outline the development of the studio and present a number of key projects that have benefitted from this setting.

Design, research and education

In this group there are contributions from (1) Design Theory and Methodology – TU Delft, (2) Landscape Architecture group – Wageningen University, (3) Product Innovation Management – TU Delft, (4) Product Development – TU Delft, (5) Architecture – TU Delft, (6) Netherlands Institute for Curriculum Development – Enschede, and (7) Product Innovation Management – TU Delft.

Badke-Schaub, Cardoso, Daalhuizen, Lauche, Jalote-Parmar, Neumann, Roozenburg, Secomandi, and da Silva Vieira (pp. 79-90) note that current general theoretical frameworks of design do not offer many handles to address the design needs of designers. Therefore they look in more detail at the cognitive, information, and process needs of designers and try to gain more knowledge about the specific needs of the designer. This in return feeds back to the general models.

Koh (pp. 91-100) outlines similarities and differences between landscape design and architectural design, as in particular in the modernist period landscape design was influenced a lot by an architectural approach. As landscape design deals with different issues however, it has generated its own strategies and methods. In particular the connection between research and design seems to be underdeveloped and needs more attention. Koh shows how this is done at the Wageningen University and presents a number of research-design projects as examples.

Deken and Lauche (pp. 101-106) use cultural historic activity theory to study interorganisational designing. From many different possible approaches they choose to focus on the objects of design (sketches, drawings, models, and so on) and investigate how parties from different organisation deal with these objects in the design process. Through so-called disruptions they hope to find more information about these dynamics.

Lockefer (pp. 107-112) investigates the influence of the computer in the design of free-form shapes. For this purpose he reconstructed the design of forty free-form shaped buildings by means of the computer. After analysing similarities in these projects, he defines four different strategies of computer use that each has a different method and impact on the design process.

Van Dooren (pp. 113-116) studies the education of designing, in particular what should be made explicit for a student while (s)he is learning to become a designer.

Various frameworks are investigated among which Schön's reflection-in-action approach.

Nieveen, Folmer, and van den Akker (pp. 119-128) look at the design process of curricula in general. They notice that in general there is no methodical evaluation phase, so that mostly programmes are created but not checked whether they actually fulfil the stated goals and purposes. Therefore they propose a more design-oriented process in which such evaluation actually does take place, and test this within their institution which is responsible for the development of learning programmes.

Finally, in this group, Sobotie, Deken, and Kleinsmann (pp. 129-134) investigate what is actually happening between novice designers such as students and experts. This is quite relevant research given the fact that the major pedagogical model to teach designing is in a design studio setting under guidance of a (master) designer. Through a number of studies they find that where novice-expert engage in a collaborative design mode, the exchange of knowledge and information becomes more dynamic than in a traditional teacher-student relationship. Both novice and expert are actually together learning about the problem and potential solutions.

Methodology and practice

In this group there are contributions from (1) Product Development, combined with (2) Octatube International – TU Delft, (3) 3TU Building Research – Delft, Eindhoven, Twente, (4) Installations – TU/e, (5) Building Physics and Systems – TU/e, and (6) Building Technology – TU Delft. All papers are from architectural design. At one point in design research history, architectural design was one of the forerunners in terms of design methods. However, after the first crisis in design methodology (see Cross 1984, Introduction chapter for a historical outline), architecture for a long time resisted methodological research. The returned interest in methods and how they apply in architecture seems to be prompted by two main causes: the demand for more sustainable designs which require intensive collaboration between various partners in the design team, and the appearance of a new generation of design methods and support (see for example Achten (2009).

Van Gelder and Eekhout (pp. 135-141) look at methods for support of free-form designs – buildings that typically have a non-rectangular shape, the design and realisation of which depends on innovative use of materials, design support, and design processes. By means of case studies they aim to identify key aspects of successful design methods, which can then be generalised to architectural design.

Eekhout (pp. 143-154) investigates the often problematic relationship between research as an academic activity and design as an office-based activity. He notes that working by means of prototypes research and design can be integrated in a quite productive way. Doing this however, requires a specific methodology that still is in development. The most part of this contribution is aimed at showing how he approaches this question.

Eekhout (pp. 155-165) presents a new integrative approach between the faculties of Architecture of the three Universities of Technology Delft, Eindhoven, and Twente. Research in architecture is fragmented and has a very low scientific impact compared to other engineering domains. The so-called 3TU spearhead building research programme must bring more focus to the research and enable more and better communication between various research groups. He proposed four major themes for research: mobility, environment, health, and energy. Each theme has two sub-themes that give a more

direction. These sub-themes are respectively: space & infrastructure; town & renovation; health & safety; and energy & sustainability.

Zeiler, Savanic, Quanjel, and Harkness (pp. 167-184) propose Integral Design as a design methodology to incorporate expert knowledge of the various parties in a design team in a better way. The work presented here has two tracks: first is the development of the design method – integral design, and second is the testing of the method by means of a series of workshops. In the analytical research they demonstrate that integral design does seem to be an effective way to generate novel designs.

Harkness and Zeiler (pp. 185-190) continue with the Integral Design method as investigated in the earlier chapter, and investigate additional requirements to successfully implement this method in practice.

Shahnoori and van den Dobbelsteen (pp. 191-198) also investigate methodological support in architectural design. They keep the specific method as an open question and first aim to arrive at a general process model by which they can capture complex architectural designs. Through literature study they draw up an overall model (Glocal Process Model) that forms the basis for further research.

Conclusion

In previous editions of Design Research in the Netherlands there was a substantial amount of theoretical and philosophical models about design. We can see that there is a shift from these theoretical models to a larger involvement with the designer and practice. The theoretical models give us a base approach that is now being tested – and confronted – with reality. It provides new insights and enriches our understanding of the complexities of design. We can also see a more intensive application of design methods and theories in particular in architectural design. Many of these investigations are in an early stage. Therefore, it should be interesting to see what the next Design Research in the Netherlands 2015 will show as result. Most likely it will be a more colourful palette of options and understanding of design, the foundation of design, and the relationship between practice and theory.