

A Decade of Design Research in the Netherlands

Henri Achten, Kees Dorst, Pieter Jan Stappers, Bauke de Vries

1. The changing focus of design research

Design Research in the Netherlands 2005 is the third instalment of a symposium that intends to provide a forum for researchers across the academic and designing disciplines. The five-year interval (1995, 2000, and 2005) allows participants to take a step back from daily considerations and to reflect on their basic methodological assumptions, research programmes, and outcomes. It also provides us with the opportunity to witness the dynamics in organisations that are usually less apparent in annual or bi-annual meetings. Over the three proceedings of the symposium, we can see groups merge, split up, change names, being created, or disappear. The same applies to research programmes. Apart from the general academic dynamics (baffling as these sometimes may appear), do these changes reflect some more fundamental movements within the field of design research?

In the proceedings of 1995, Robert Oxman noted two major orientations of design research: the design cognition orientation which leaned very much on protocol analysis, and the computational models orientation which leaned very much on information processing theory (Oxman 1995). Either orientation was grounded in a variety of theories to guide inquiry. At the risk of oversimplifying, one can defend that many considered at the time an overarching theory or vision ‘what design is’ feasible. Today, this does not seem to be the case anymore, so a shift in understanding must have occurred in the meantime. Perhaps one of many possible answers lies in the formative role that Rational Problem Solving and computation played in design research.

The impact of Rational Problem Solving (RPS) and computation on design research is hard to overestimate. It is fair to say that much of the rigorous, methodological, and scientific content of design research has come into being just because of the concepts and framework introduced by RPS and computation. They proved a liberation from the mainly introspective and “beaux-arts”-traditional body of knowledge on design as present up to that period. Design methodology was introduced to solve immediately present large technical challenges for which there was no time to evolve approaches and typology in the traditional way (a point well-put in Jones 1980:27-34).

On the other hand, by being so successful, RPS and computation “jumped to solutions,” so to speak, rather than introducing time for self-reflection. This seems to be a recurring challenge with innovations, to strike a good balance between keeping the existing and trying the new. Only through confrontation with practice is it possible to learn the value of a new approach, while on the other hand one has to keep in mind the whole context of the problem area. One can note that the applied work of RPS was often performed under (wilful) ignorance of other, sometimes more traditional, ways of working. To be fair, the vast amount of work on RPS yielded a wealth of techniques to tackle all kinds of problems (see Michalewicz and Fogel (2000) for a fine collection), but somehow it seemed that design problems always redefined themselves to stay just out of reach.

The most important victim of RPS's inability to tackle design problems adequately was design methodology. The limited scope of RPS led to the failure of design methodology, which has ever since been viewed with suspicion from the designing community (in particular architecture) – again, this is a simplified account; other considerations that played a role in the demise of design methodology are very well documented in Cross (1984:*Introduction*). Since then, there is a sharp understanding what design *is not* (problem solving), but it is still not clear what design *is*. To answer this, the discipline of design research broadened its view again.

For a long time the only serious contender as alternative to RPS was the work by Donald Schön on Reflective Practice (Schön 1983). This led to an often polarised debate between rational problem solving versus reflective practice-adherents. A lot of work has been done in particular by Dorst (1997; 2005: this book) to put both paradigms in perspective, and the work by Valkenburg (2000) and Reymen (2001) proved important for further structuring of Schön's concepts. The result is a more balanced appreciation when each paradigm is better suited to describe design activity, but it does not yield a unified view on design as such. One of the major contributions of Schön's work is the realisation that design does not proceed from a general breakdown of the problem in sub-problems (as advocated in RPS), but that the question 'what to deal with now,' is a repetitive framing action by the designer as he or she is working on the problem. Obviously, some framing steps can take place along the lines of RPS, but not necessarily so.

The renewed interest in the designer, the designer's situation, and the way the design is understood has led to a proliferation of research orientations that does justice to the varied and kaleidoscopic nature of design, but we are yet far removed from a general overview.

2. Where we stand now

Design research aims to clarify what design is, how designing proceeds, how it can be supported or improved, and to come up with a rigorous scientific body of knowledge to record this understanding. This academic rigour is often at odds with daily practice of designers. The field of design research has a responsibility to clearly communicate its findings to design practice; and vice versa, the professional community of designers has a responsibility to add in a systematic way to the body of knowledge of design. A mutual effort to understand each others position and modes of argument is necessary for this to succeed. The requirements of scientific rigour often leads to a discarding of reflection produced in the designers practice. This is an omission: there is a wealth of theoretical and anecdotal material published by designers on their work. To be true, a sizeable portion of this output is irrelevant, vaguely put, misleading, or outright mistaken, and it is not easy to sieve through it all. Again, here lies a responsibility in the professional community. A comfortable and sensible integration of professional fluidity and scientific rigour has not been established in either design research nor design practice. This is a point of continuing concern.

Design research

The papers of this book in the first part – termed *Design Research* – address the tension between rigorous description of design and bringing the designer back in the picture. This is a theme in the papers by Kees Dorst (pp. 1-12), Petra Badke-Schaub et al. (pp. 23-31), and Jack Breen (pp. 33-48) although each argues from a different viewpoint. Dorst offers a preliminary categorisation of levels of expertise as a framework to study the associated forms of design reasoning at each level. Badke-Schaub proposes a three-track research programme which brings together the

empirical, theoretical, and applied levels of design research. Breen discusses the matter from the practical perspective of the designer faced with the question how to integrate research in his or her design work. Complementing these three papers are the philosophical work by Pieter Vermaas et al. (pp. 13-22) and the survey of design studies by de Jong (pp. 49-54). Vermaas et al. do not claim that their notion of 'use plan' has prescriptive value, but that it functions very well as a retrospective device for understanding what is going on in design. In this sense, their work also respects the distance between theory and practice, and thus leaves room for more subjective working methods. De Jong surveys the many ways of studying design at the Faculty of Architecture in Delft and comes up with a great variety of approaches. The concept of 'context' provides the organising principle for grasping the various approaches presented in the survey.

Design processes

From the contributions presented in the second part of this book – termed *Design Processes* – we can infer that design methods are making a come-back. All of the papers presented here are from the domain of building and construction industry. This is not surprising, as this industry is facing many challenges in the light of complex multi-organisational design problems under pressure of sustainability. Time-tested team organisations and structuring of the design problem are no longer feasible. Mistakes lead to high costs, losses, and eventually poorly performing buildings. In this context, a more fundamental reflection on improved design processes pays off and matters to the end result.

A fundamental reflection on improved design processes requires a more comprehensive view than 'just' design methods, as can be seen from the managerial overview offered by Reymen et al. (pp. 55-61). Their focus is on a balanced study of aspects of design management *and* demand and supply. Concerning the aspect of design management, three authors in particular stress collaboration as a means to tackle the complexity of the design task: Frans van Gassel (pp. 63-70), Rudi Stouffs et al. (pp. 85-94), and Wim Zeiler et al. (pp. 95-107) although the latter prefer the term *integral design methodology*. Collaboration as such is not a method, but it pays particular attention to an equal share of all participants in the design process, and aims to improve the outcome of the design process by making specialised knowledge earlier available to all participants. As a specific illustration of this strategy, Vreenegoor et al. (pp. 109-119) demonstrate how the specialised knowledge of comfort and physical aspects of interior climate can be brought to non-specialists. Al Hassan et al. (pp. 71-84) get closest of all papers towards a methodology for *strategic concept generation*. Their work relies on a comprehensive account of values, senses, and levels of scale to generate structures that may further drive the design process.

Design tools

Continuing a trend already noticed in the previous DRN proceedings, there is a substantial amount of work that aims to support design by offering *Design Tools* – the final part of this book. This work is invariably linked up with computation, since this provides the only responsive medium through which design information, actions of the designer, and subsequent consequences can be processed. It has proven a successful combination since the application of computation presupposes a formalisation of design(er) knowledge – although in all fairness one has to note that having a formalism alone is insufficient for producing sensible results. Koutamanis (pp. 169-177) puts forward a genealogy of CAAD which carefully traces the development from the early 1960's to today. He provides a reasoned account how the chair in Delft has evolved in the past five years, in close reflection to changes in the field in general.

Computer Aided Design balances between *technology-exploration*, *computation theory*, and an *understanding of the designer*. The emphasis on one or more of these aspects characterises the kind of work produced in this area. De Bruin and Scha (pp. 121-129) and Stouffs (pp. 131-137) show work which has an emphasis on computation theory, in particular on formal languages. The work presented by La Rocca and van Tooren (pp. 139-153), van Nederveen (pp. 155-167), and Steijns and Koutamanis (pp. 179-191) are oriented from the technology exploration aspect. La Rocca and Van Tooren present a comprehensive system to generate design concepts for aircraft design. Van Nederveen provides a showcase of applied research projects combined with a grounding in more fundamental aspects of information technology. Steijns and Koutamanis present applied research in the area of school building design and management. To conclude, Pasman et al. (pp. 193-204) and de Vries et al. (pp. 205-214) primarily are designer oriented – both groups do this by focussing on the more cognitive and experiential aspects of design, and develop tools that are meant to enhance the creativity or awareness of design(ers).

Research and methodology

The proliferation of research orientations has come with the loss of an overarching vision or framework in which researchers can piece together the evidence to come up with a picture of ‘what design is.’ In terms of research methodology, we can also see an increase of research techniques without yet a good way of integrating findings from such work. What a future theoretical and methodological framework might look like, is difficult to assess. One question in all cases is whether design research has to look for knowledge or concepts from other research areas to find the missing pieces of the puzzle. If so, then a likely candidate may be *decision-making under uncertainty*, which has seen a lot of research from psychology on how people argue and reason (see for example Baron 2000). Another candidate domain may be *agency* and *multi-agent systems* to provide the formal tools to understand and model group processes and communication (Weiss 2001); and in recent years we have seen work informed by the social sciences, which in particular shed light on the interpersonal dynamics of design (e.g. Lloyd and Busby 2001; 2003).

3. Design research and industrial design

The past decades have shown an increasing role of research in the processes of industrial design, an increasing visibility of design research for practitioners, especially in the human-product interaction fields that have come to fruition in the areas of Computer-Human Interaction, and an increased awareness of the role that designers can play in research programmes.

The first of these developments is witnessed by the growth of BSc and MSc programmes at all technical universities in the Netherlands. In the past five years, both TU’s at Eindhoven and Twente have started Bachelor’s and Master’s programmes in Industrial Design, with focuses on intelligent and mechanical products respectively, and Delft’s Faculty of Industrial Design Engineering has diversified its existing Master programmes into three master programmes with emphases on business strategy, user-product interaction, and general product design, respectively. At all these institutes, the master programmes are linked to existing, or newly formed, research groups on the respective topics, which holds the promise that a richer design research culture in the field of industrial design will develop in the coming years.

The second development is an increased visibility of design research and methods reflection in the field of Computer-Human Interaction. As has happened with many other fields, the computer science managed to create a visible forum for other domains. Especially now that

computers have become the ubiquitous tools of the professional thinking person (over the past ten years we witnessed the transition from occasional use to almost exclusive use of computers as tools) and their form is at the same time disappearing into products, we see increasing overlaps of these research communities. Much of the work in this area doesn't really fit in either the RPS approach or the classical beaux-arts approaches, but is a third, pragmatic, approach, focused around development of tools and methods (Fallman 2003). Exemplary in this area is the tools development work of Mark Gross (keynote speaker in DRN 2000), work at ID-StudioLab (Pasman et al., this book), showing a particular mix of designing, design research and research in the growing list of contributing disciplines, among which psychology and ethnography have become very visible in recent years.

The third development, linked to the other two, is the increased attention in general for the activity of designing as an important part of research itself. Designers are more and more finding their way as key players in research programmes in industries and universities. This reflects and supports the societal need for multidisciplinary research projects centred around phenomena (and ways to make them pay) rather than strict development of theories. Moreover, the solution-oriented mindset of designers lends itself especially for strengthening the generative part of research projects (whereas traditional research education focuses often on evaluative skills). Taken together, we are witnessing a very interesting period in the visibility of design as an academic discipline, a diversification and – hopefully – integration of different types of design research, and an emancipation of designing as an important ingredient in research.

4. Design research and education

Design research is required for establishing a body of knowledge on design that serves professionals as well as the education of students to become designers. In this sense, design education is the main 'market' for the knowledge that design research generates. Consequently, one would expect a close interaction between design research and design education – but alas, that does not seem to be the case. There is a surprising but persistent gap between the knowledge generated in design research and the practice of design education. We will argue here that this is caused by the assumptions that design researchers build into the construction of their theories of design. Some of these assumptions may be inevitable, but we will try to argue that others should be candidate for careful reconsideration over the coming years.

Of course it is in the very nature of constructing any design model or theory, that in doing so we abstract from design practice. In abstracting, we effectively are 'putting things between brackets,' leaving them out because there are other points we want to concentrate on. For instance, much of design research has traditionally been focussed on the dynamics of design *processes*, and has not dealt with the other factors in design (the designer(s), the nature of the specific design problem at hand, and the circumstances in which the design project takes place). Those other factors have really been put between brackets. This is fair enough, but design theories that do focus exclusively on the design process in such a way often claim that, because of this, they are applicable to *any* designer, for *any* design problem, and under *any* circumstances. Just the fact that the design theorist abstracted away from these factors is used as the basis for this claim.

This is a very harmful logical fallacy, that results in a terrible overstatement of the width and applicability of such design process models and methods. And it is in design education that the consequences of this overstatement are most keenly felt. Because in design education, all these factors that the researcher put between brackets in his effort to arrive at an elegant model

or theory of design processes, come back to haunt you. That is why we cannot teach ‘design’ by just teaching our students design process models and methods: the students need to work on a very broad range of design assignments, not so much to train them in the process of design, but to train them in dealing with the factors that the process models and methods do *not* deal with: their own identity as a designer, a real understanding of how to approach specific (unique) design problems, and the adaptation of their way of working to the circumstances that can have such an overriding impact on the practice of design (clients, resources, time constraints, etc). The design assignments require staff to tutor the students on the aspects that design methodology does not deal with.

This can be a real source of frustration for design tutors: the overstated claims of design theory are eagerly taken up in design schools, because they represent an own ‘science’ that thinking about design should be based on. As a consequence, whole design curricula are organised around the teaching of the design process, not around the teaching of ‘design.’

There are two things that urgently need to be done if we want to repair this situation: (1) all design models and methods should clearly state their ‘area of applicability’ and not just claim to describe, explain or prescribe the whole world of design, and (2) the range of factors that is taken into account in the making of design models should broaden considerably.

The good news in this edition 2005 of Design Research in the Netherlands is that the design researchers that present their work here are clearly working towards these goals. Many of the papers in this book already profess to deal with a specific, more modest range of design problems or design situations. And most importantly: the complete set of papers takes an impressive array of factors in the design situation into account. Apparently, these design researchers are finally moving beyond their exclusive focus on the design process. This will enrich design research enormously, and make the models and methods that design researchers develop much more realistic in the years to come.

This richness and realism in design models and methods will then make them much easier to apply in design education. Through this development, the rift between design research and design education will finally disappear.

5. Design research and information technology

Information Technology (IT) is providing tools not only for doing design research, but also for supporting the design process itself. Design research has a much longer tradition than IT. In fact part of the design research presented at this symposium is not related to IT at all, but many researchers are challenged by new computer technologies. The last decade we are faced with new technologies at such speed that there is no time to thoroughly research their potentials. In this book we present an almost complete overview of researchers from the academic institutes from the Netherlands that make this effort. Since the appreciation of the designer for the developed new technology plays such a crucial role, IT related research usually includes the development and/or application of prototypes. Such research is very time consuming but absolutely necessary to make steps forward in this process. The adoption by design software industry is yet another very complicated and often slow process. We are almost used to working with inadequate, error prone, not task-specific design tools. In design research we can notice and experience that better design tools are possible – and much appreciated! Designers in collaboration with IT engineers are needed to develop these tools. It is very promising to observe that these collaborations are established at many research institutes.

Next to the role of IT as a driving research factor, it also provides methods as a common ground for different disciplines. At the DRN symposium we welcome researchers from design and engineering disciplines. Traditionally designers are less skilled in using formal methods than engineers. Therefore there is a serious risk of lack of involvement of designers in the research of new IT applications in design. Absence of designers in the development of new design tools undoubtedly will lead to bad design tools. Again collaboration between the disciplines will prevent these mistakes. In the DRN proceedings you will find many good examples of fruitful collaborations.

6. Conclusion

Just before the Call for Papers for the DRN 2005 symposium, Design Systems conducted an Internet-based survey of institutions and researchers who state they are involved in some way with design research. The survey was based on a list of the 16 universities of the Netherlands, and the information offered on their websites (see www.designresearch.nl/DRN_links.htm). It appears that at 10 universities in some 34 Faculties (or similar organisation level unit) in 88 groups one can find some kind of interest in design(ing). In many cases, and this seems to be a structural feature, this interest is found on the personal level or in a running research project. Design research as an autonomous domain is seldom reflected in the existence of a dedicated design research group. It seems fair to conclude that design as such is acknowledged as an important factor, but that either design as an activity is taken for granted or not reflected upon. Hopefully, initiatives such as the Design Research in the Netherlands symposium and the website Design Research in the Netherlands (www.designresearch.nl) can give a positive stimulus to a more profound exchange of thoughts in the domain of design research.