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ANALYSING DESIGN BEHAVIOUR: THE DESIGN THINKING RESEARCH SYMPOSIA SERIES

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ABSTRACT

The series of symposia on Design Thinking Research (DTRS) was begun in 1991 with seven symposia and workshops held to date. The series has produced a substantial set of publications in books and journals, with significant research results, and has helped foster an international community of scholars and researchers focused on design cognition. One particular innovation of the series is the use of common data. The second and seventh workshops collected data on design process and distributed these to a large number of research groups for analysis. In the paper we describe how this was done in detail, and argue that as a method 'common data analysis' applies particularly well to design research.

1. INTRODUCTION

A major problem with a much of what goes under the general rubric of 'Design Research' is a poorly defined relationship to empirical evidence. Research papers are often theoretical –

sometimes from a computer modeling angle, simulating some aspect of design, sometimes from a philosophical angle, building a system of logic and language to describe design, and sometimes allusive, expressing a general feeling about design and designing – but more often than not little empirical evidence is given to support individual views about designing and design research. There is a sense of a disconnect between the world of what design researchers talk about and the world of design activity itself. Not in a practical sense, of course, the 'research through design' paradigm is a good example of the two worlds linking together, but more in an academic sense, where the world of theory and practice appear to lie far apart.

That is not to say that there aren't studies of designing based on empirical evidence. The studies that are, come from a wide range of analytical approaches: psychology, sociology, anthropology, grounded theory, management studies, language studies, to name a few. This diversity certainly enriches the empirical-based study of designing but also points up the absence of an agreed research methodology for design study. Instead, design researchers often borrow from areas they are loosely acquainted with, often in ways that would not be regarded as valid within the disciplines themselves. Ethnographers, for example, are often dismayed about what goes on under the name of 'Design Ethnography'. Such diversity in approaches also makes comparisons between studies, and building on the work of others, difficult. It could be argued that this is a reason for an apparent lack of progress in Design Research, as there seems to be little appetite for replication of design studies, or the taking on of results into new studies. Indeed, often there is a feeling of new studies going over old ground.

2. THE DESIGN THINKING RESEARCH SYMPOSIUM (DTRS) SERIES

How can we stimulate new and focused studies in Design Research? The Symposium Series on Design Thinking Research (DTRS) has been in existence since 1991, being initiated by Nigel Cross and colleagues at the University of Delft, The Netherlands, in 1991 (Cross, Christiaans, Dorst 1992). Over the course of its existence the DTRS series has created a wide community of international researchers from many disciplines – the fifty or so participants at DTRS5, for example, came from ten different disciplines and from twelve countries.

Since 1991, and the first workshop on 'Research in Design Thinking', the symposium series has developed and expanded. The second meeting (DTRS2) was held in Delft and distributed protocol data of design problem-solving to research groups for common analysis.

DTRS3 was held at the Istanbul Technical University, Turkey, in 1996, on the topic of *Descriptive Models of Design* (Akin, 1997). DTRS4 was held in 1999 at MIT in Boston, on the topic of *Design Representation* (Goldschmidt and Porter 2004). It was there that the organisers introduced the term 'Design Thinking Research Symposia' as the generic title for the series. DTRS5 was again held in Delft, in 2001, on the topic of *Designing in Context* (Lloyd and Christiaans 2001). DTRS6, at the University of Technology, Sydney, Australia, returned to somewhere near the focus of the original meeting in Delft in 1991, on the nature and the nurture of expert performance in design, *Design Expertise* (Cross and Edmonds 2003). DTRS7, *Design Meeting Protocols*, has recently been held in London, September 2007 (Lloyd, McDonnell, Luck, Reid, and Cross 2007), with common data again being distributed to researchers, this time of design meetings in practice. Throughout this series of symposia, the small workshop format has been found to be a successful way of synthesising the contributions of an international community, of reporting and critiquing current work, and of identifying and promoting necessary further research.

The series of meetings has produced a substantial set of publications in books and journals, with significant research results, and has helped to foster an international community of scholars and researchers focused on design cognition. Sixteen years on from 1991, it is perhaps difficult to recall just how little 'research in design thinking' was going on, compared with today. It is encouraging to see how much the field has grown and developed. Above all the DTRS series has created a legacy with which future researchers can actively engage. The foremost example of this has been DTRS2, where data was collected and distributed to research groups for common analysis. The data collected has been used many times by researchers since the symposium and is still available for study. This process, of collecting and distributing a common dataset has again been used for DTRS7 and it is these two workshops that we concentrate on for the rest of the paper, and in particular what the 'methodology' of distributing common data to research groups can, and has, achieved.

3. THE USE OF COMMON DATA FOR RESEARCH IN DESIGN THINKING

In the early 1990s empirical studies of design activity ranged across a number of areas, outlined in the introduction, but there were a growing number of studies in the area of protocol analysis. This is a research approach, premised on the information processing aspects of human cognition, developed by Alan Newell and Herbert Simon to look at problem-solving (1972), by analysing the cognitions 'thought-aloud' during solving activity. During the 1970s and 1980s this approach was applied to a number of different types of

problem, design being one area. By 1990 there had been a significant number of protocol analysis studies of design activity, in a number of design discipline areas, though with significant variations in methodology – subject numbers, instructions, tasks, methods of analysis, etc.. It was to challenge this somewhat undisciplined approach to protocol analysis in design research that a new format for workshops was introduced into the series on 'Research in Design Thinking' at DTRS2, in 1994. The idea was to focus discussion on design thinking by distributing design protocol data, then gathering together researchers who had carried out separate protocol studies from these data at a workshop.

The fact that only one set of data was collected kept a number of methodological variables constant. This was done by providing the workshop participants with a set of 'standard' data, to be analysed by all of them. They were asked to perform the analysis in any form they saw fit. The intention was that using a common set of data should make it easier to compare and criticise each other's work. The aims of this whole undertaking included:

/ Gaining an overview of the accumulated knowledge on design behaviour of these researchers.

/ Seeking a common language in discussing protocol analysis and detailed design processes.

/ Initiating discussion on the properties and limitations of protocol analysis in design research.

/ Discussing possible ways of using protocol analysis in the future, alone or in combination with other research techniques.

/ Forming the basis of an international research network, and a platform for discussion on these matters.

The common dataset prepared for this workshop were video tapes of an individual designer and of a 3-person team of designers working for two hours designing a typical industrial design product, *a 'fastening device' that should allow a given backpack to be fastened onto a mountain bike*. The videotapes and transcribed protocols were sent to the workshop participants some 6 months before the meeting. The 20 research groups to this workshop were selected from applications with the aim of putting together a group of experienced researchers with a great diversity in goals and approaches to the analysis of design activities.

The focus on protocol analysis of common data in this workshop was an effort to find a more rigorous form for empirical research in design. Protocol analysis is somewhere in the middle

ground between the 'hard' experimental methods of the natural sciences and the 'softer' purely observational methods of the social sciences. Much of empirical design research can be seen balancing between these, trying to lean both ways. The general feeling in the discussions at the workshop, reported by Dorst and Cross (1995), was that the balance might have tipped too much to the side of rigour and 'safe' research techniques, at the expense of the 'relevance' of results for design practice and education.

The concrete outcome from the workshop was a book (Cross et al., 1996) containing 20 different and overlapping analyses and discussions of the same data. Both the individual papers within the book and the collective set have been influential within that section of the design research community concerned with design cognition and understanding the detailed processes of design activity. The original data that was collected has been used in subsequent analyses, and continues to be a valuable resource today. Later generations of researchers have not only benefited from access to the data, but also to all the previously published analyses derived from it.

4. DTRS7: DESIGN MEETING PROTOCOLS

The success of DTRS2, and particularly its long-lasting legacy, formed the motivation for DTRS7: *Design Meeting Protocols*. Since DTRS2, in 1994, studies of designing have shifted from the laboratory to the social and organisational environments of design practice. Designing is now thought of as a situated and social activity, as well as a cognitive activity, and over recent years a wide diversity of studies have looked at designing in a range of disciplines and used a number of methods including: interaction analysis (Tang 1990), computational linguistics (Dong 2005), viewpoint methodology (Detienne, Martin, and Lavigne 2005), semiotics (Medway and Clark 2002, Luck 2003), functional linguistics (McDonnell 1997), ethnomethodology (Hugill 2004), interaction process analysis (Gorse and Emmitt 2003), cognitive ethnography (Ball and Ormerod 2000), and discourse analysis (Reid and Reed 2005, Lloyd 2002).

In 2004, then, we found ourselves in a similar position to that which Cross et al. had found themselves in the early 1990s. There were many studies of designing in practice, but little consistency in method to allow meaningful comparison and critique. Again the question was: how could we bring researchers together around a common dataset? This time the common analysis of data would not be around a single method (protocol analysis) but look at the multiple ways in which a common dataset could be analysed. A common analysis of data in this context would provide a mechanism by which researchers could communicate their

methods and findings. This is of particular value in design research where methods are often poorly propagated and re-invention frequent, either due to poor research into prior work, or because methods are inherently difficult to communicate to be applied effectively enough by others. Additionally, a common analysis supports researchers by identifying where their interests and results overlap and suggests new areas of collaboration and most importantly the opportunity to build on the work of others.

The collection of real-world data of design activity does present a number of problems however. There is the confidentiality associated with products that are close to market. There is the timing of a real-world design process which often has hold-ups and delays for very good reasons. There is the limited ability of a researcher to 'be there' when significant activity takes place. There are also ethical concerns about obtaining permissions to use recorded data for researchers at different (international) institutions.

The main problem, however, is in deciding what real-world data to capture as, obviously, it is not possible to capture a real-world design process in its entirety. The nature of real-world design processes in practice means that designing does not take place in a single environment, with a fixed set of participants. Designing takes place in many, often simultaneous, interactions, and is spread over a constantly shifting physical space. Designers work at computers, talk to other designers and clients, and often solve problems away from work. Information is forgotten or thrown away, and designers often work on a number of different design problems at one time. How could it be possible to capture all, or even the essence of, this activity? Furthermore, the time it would take for an analysis of such a huge dataset, even if it were possible to collect, would be prohibitive. Our intention for DTRS7 was to focus analysis and discussion on the same kind of data, so a small, coherent dataset was essential. The dataset also had to be rich enough to support a number of different analyses, and objective enough for all researchers to agree on what the data was. Note-taking in organisations, a key tool in ethnography, for example, would not support a common analysis.

What we decided was to record a small number of design meetings as a way of sampling a much larger process. We reasoned that design meetings not only allow design activity to take place, but also force explanation of what is happening at a particular point, helping to externalise decision-making. Meetings then are useful sample points of a wider design process. They are also well-bounded, having a defined beginning and end, and typically last an hour or two, which meant that the size of the dataset could be kept manageable. Most importantly a meeting can be recorded objectively, and can be analysed in a number of different ways. For example studies could look at turn-taking in design discourse, political

structures, sketching and gesture as a means of communicating design ideas, emergence as a property of design meetings , types of explanation and reason-giving in design interaction.

The focus of DTRS has tended to be on the more generic aspects of designing, independent of any particular discipline though architecture, industrial design, and engineering have tended to predominate over the years. To keep this focus we decided to film design meetings from a number of different disciplines to allow cross-disciplinary comparisons to be made. We also wanted to capture a feeling for the real-world process by recording a *series* of meetings (sample points in the process) over the course of a design project. Initially we set out with a three by three matrix in mind: three different design disciplines and three different meetings (one at the beginning of the design process, one in the middle, and one near the end). For the practical reasons mentioned earlier, however, this proved impossible. What we were able to collect was a two by two matrix of data. We filmed two meetings in an architectural design process eight months apart, and two meetings in an engineering design process, several days apart, in total around eight hours of data. These data were fully transcribed and, together with all the materials that had been used or generated in the meetings, formed the complete dataset for distribution.

With a core community of researchers and contacts we invited research proposals for the workshop rather than putting out an open call. In the event we also received proposals from researchers we were unaware of through word of mouth, in total around thirty research groups. In contrast to a conventional conference researchers were committing themselves to take part in a managed research project, a significant undertaking in itself. The data was distributed via DVD and CD in February 2007 with final papers submitted in August for the September workshop.

In total we received twenty-four papers which we grouped into eight thematic areas:

/ *Understanding process*: looking at how the normative and descriptive side of designing influence each other.

/ *Values in designing*; showing how values are deeply embedded in the process of design.

/ *Aspects of design cognition*: examining the reasoning and representational processes of designers as they discuss their designs.

/ *Design process models*: showing how existing formal models of the design process can be used to interpret design activity

/ *Language, discourse and gesture*: looking at the ways in which designers talk and use language as well as how 'the language' of gesture reinforces verbal language.

/ *Constructing roles*: Showing how roles are constructed and assimilated dynamically through the design meeting process.

/ *Designing contexts*: examining how designers use and talk about contexts when they design.

/ *Objects, references and representations*: Looking at how designers construct, use, and refer to, objects in design.

There has been a good balance to the papers; some have concentrated on the architectural meetings, some on the engineering meetings, and some on both. About half the papers have dealt with the meetings in their entirety reporting how, for example, problems and solutions co-evolve in discussion. The other half have concentrated on small excerpts from the meetings reporting how, for example, the roles of 'architect' and 'client' are constructed during a meeting. The data has been used as a 'text' then, a source of multiple interpretations of the same event.

The research conducted, and the papers produced for the workshop, are part of an ongoing process of producing a book of the project together with journal special issues. The workshop has been an opportunity for authors to test and refine their ideas before re-writing their paper. The spirit of the workshop was one of constructive criticism. With so much background not needing explanation the discussion was free to concentrate on theoretical issues and particularly the relationship between evidence and conclusion. A happy side-effect of a common data analysis is the rigour that is entailed by having a large number of research groups poring over the data and in a sense we started with the aim of looking at the generic issues of designing, and we've ended by considering the generic issues of research method. A secondary outcome of the workshop has been the data itself. Twenty-four research groups poring over the same dataset reveals many mistakes, amendments and annotations to the original data and we will continue to revise our transcriptions so that they become a resource for future researchers. The accuracy of the transcription will be improved, including transcription of non-verbal activity, with the content being emphasised using tagging, for example.

5. USING THE 'COMMON DATA ANALYSIS' METHOD

We would like to end with a few comments about the general method of using 'common data analysis' and its implications for Design Research. We have shown how using common data can focus a research theme. DTRS2 provided a real impetus for design thinking research, crystallising a new community and becoming a reference point for future researchers. Many academic subjects are based around a consensus about valid research methods with criticism often about methodology. Experimental psychologists are used to testing particular variables, anthropologists to spending time in remote communities, and communication scientists to deconstructing texts, yet design research, if we could characterise it as a single entity, uses a whole gamut of research methods. What the method of common data analysis does is turn this idea around so that, rather than the research method being a fixed point, it is the content that is fixed. Of course it is not quite that simple, content and method are inevitably linked, but common data analysis marks a change of emphasis that seems particularly suited to the multi-method approach of design research.

There are several disadvantages to utilising a common data analysis. One has to invest considerable time and effort in collecting data which is rich enough to support multiple interpretations. Researchers are generally used to collecting data for themselves, but to share *your* data with a whole community requires a leap of faith. Several research councils in the UK now advocate the publication of data collected on their research projects which suggests that 'common data analysis' is a practice which should be encouraged.   The careful distribution of data and organisation of research groups also has to be clear. There are many variables that have to be thought out in advance. For example too much data can lead to unwanted complexity, while too little data doesn't provide enough! Getting the balance right is what makes for a good common data analysis. With digital methods of recording and distribution it is now easy to fall into the trap of providing far too much information, defeating the object of a common analysis. The opportunities for common data analysis would seem to be increasing as the internet becomes more sophisticated and web 2.0 means that information sharing can be achieved much more easily.

Against this, however, there are considerable advantages to the approach. We have already mentioned how it is able to bring a research theme into focus, leading to the establishment of working principles and discussion about research method. What is less obvious, and perhaps more relevant, is that by drawing on the same evidence it is easier to talk about what is true and what is not true, and surely this is what moves a research field forward. The legacy that a well-organised and documented common data analysis can achieve is considerable. DTRS2 now has a body of work associated with it that has influenced a generation of design researchers, and DTRS7 looks set to do the same.

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