

7. Developing NPD-Process Knowledge

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7.1 Introduction

This conference on Design Research in the Netherlands 2000 gives us a nice opportunity to show the results of design research which is being carried out at the Delft School for Product Design (officially the Sub-faculty of Industrial Design Engineering at the Delft University of Technology). Since the 1995 conference a lot has happened. In those days the Delft School of Product Design was the independent Faculty of Industrial Design Engineering. Now we have merged with the Schools of Mechanical Engineering and Naval Architecture into the new Faculty of Design, Construction and Production (DCP). The number of students and staff for product design stayed constant for all those years (ca. 100 fte staff and 1600 students).

Originally we had five organisational units: four “Vakgroepen” responsible for teaching and research in the fields of respectively Construction, Ergonomics, Formgiving and Management Sciences, with one shared “Werkgroep” responsible for teaching design.

Now we have three departments (“Afdelingen”), responsible only for research: Industrial Design (ID), Design Engineering (DE) and Product Innovation & Management (PI&M). All education is separately organised, headed by the Director of Education. Design teaching is an integral part of this organisation (although it is separately organised as the Institute for Design Teaching (= IvOO = Instituut voor het Ontwerp Onderwijs) and has the same budgetary status as the three research departments ID, DE and PI&M. The Department of Industrial Design is the combination of the former Ergonomics and Formgiving groups, Design Engineering comes from the former Construction group and Product Innovation & Management comes from the Management Sciences group. Design Methodology was part of the Management Sciences group and is now part of PI&M.

7.2 Design research

It could be argued that all research carried out within a school of product design is a form of design research, but that would be much too pretentious. For instance within the Department of Design Engineering research is done in the field of material sciences on plastics, and within Industrial Design researchers look at the physical limitations of elderly people in order to design better suited products for them. Within the Department of Product Innovation & Management research has been done on market introduction strategies for new products. These and other research projects are not considered as design research projects though.

It would be difficult to make a sharp distinction between what is design research and what is not, especially considering the multi-disciplinary character of design itself. I will limit design research to only those research subjects that are aimed at the development of process knowledge of the New Product Development (NPD) process and not covered by other

traditional mono-disciplinary domains. This gap partly exists because the other disciplines are not interested in them (i.e. intuition and creativity by psychologists) or because they are unable to do it within a mono-discipline (i.e. real protocol analysis of product design projects needs both designers or engineers and psychologists).

I will also limit myself to the research work of the Department of Product Innovation & Management. Others at this conference will take care of the research work that is being done in the other departments.

By doing so I will not go into the research carried out within the Marketing group (a sub group of PI&M), because their research is part of the mono-discipline of marketing. Even though they have, besides marketeers, economists, psychologists, communication scientists and even product designers in their staff. I will only report about the developments within the two other groups of PI&M, the Design Methodology Group and the Management & Organisation Group.

7.2.1 The Design Methodology Group

(Permanent research staff per May 1st 2000: ir. Norbert Roozenburg, dr. Peter Lloyd and 2 vacancies. Temporary research staff: 2 vacancies).

This has been the core design research group at our school, right from its beginning in 1964. Design Methodology is one of the key elements in the curriculum of Delft School of Product Design. According to the research of Hanny de Wilde (1997), about the history and development of this school, explicit attention to design methodology was one of the key elements to start the first product design school in the Netherlands at a university level. The founder of our school, an architect called Joost van der Grinten, borrowed the ideas about design methodology both from the Royal College of Art in the UK and from the Hochschule für Gestaltung in Ulm, Germany. The work of Bruce Archer was quite influential.

The graduation work of our first graduate (Norbert Roozenburg in December 1971) was about the application of a specific design method in product design. He still works at the school and is, not only, very active in the design methodology and design research field, but is also the Director of the School's Institute for Design Teaching. He is unable to be here because he is currently guest professor at the Danish University of Technology in Copenhagen. So I will be his humble representative.

The first professor in Design Methodology was Johannes Eekels (he became emeritus in 1987). Together with Norbert Roozenburg he produced numerous books and articles. The latest Dutch version of their book was published in 1998 (Roozenburg and Eekels 1998). An English version was published in 1995 (Rozenburg and Eekels 1975).

Besides this traditional emphasis on the prescriptive and normative ways of designing, which is still of concern, the research in this field now also embraces empirical studies.

The publication of the book on the Delft workshop on protocol analysis is a landmark in this respect (Cross, Christiaans and Dorst 1996). The workshop was organised to discuss, among leading scholars in design research, the results of different analyses from shared data.

The shared data consisted of a protocol study on both individual and group design work. It was based on the same design brief. The experiment itself has taken place at Xerox PARC in California. The experimenters were Nigel Cross (at that time part-time professor in Design Methodology in Delft), Anita Cross, Henri Christiaans and Kees Dorst; the participating designers came from IDEO, the leading product design firm in the US.

The workshop offered a great deal of insight into how designers actually work. At the workshop invited scholars shared their results, ideas, objections and doubts. It was interesting to watch the discussion because every attendant of the workshop had used the same original

data. It proved to be a very effective way of having detailed discussions about both the content of a design process as well as the way of doing protocol studies.

Another interesting project of this group has been the research of Kees Dorst. This empirically based study proved that the use of different paradigms within the design research field could be used to study different aspects of design. Traditionally within the design research domain the rational problem solving paradigm, based on Herbert Simon's ideas, is dominant (Simon 1967). Kees showed that this paradigm has its limitations, and looked for another paradigm. Donald Schön's idea of "design as a reflective practice" proved to be this interesting other paradigm (Schön 1983). Kees showed that using both paradigms to interpret the same empirical data leads to different views and different conclusions about how designers are really working (Dorst 1997). It is my opinion that this multi-paradigmatic analysis of product design will produce more interesting results.

The arrival, last year, of Peter Lloyd from the UK, an ethnographic oriented design researcher, is the next step to continue the current new stream of conducting further empirical studies.

The teaching of this group is focused on a fourth year course in Design Theory and Design Methods for all our design students. Of course the group is very active in the design studio work within the "IvOO".

7.2.2 The Management & Organisation Group

(Permanent research staff per May 1st 2000: prof. dr. ir. Jan Buijs, ir. Frido Smulders, ir. Rianne Valkenburg, dr. Hanny de Wilde, and 2 vacancies. Temporary research staff: ir. Danielle Hendriks, ir. Remko van der Lugt, and 2 vacancies).

The main objective of the Management & Organisation Group, the group I am responsible for, is to study product design processes in their natural environment, that is in the competitive situation of design projects, within companies, working together with suppliers and customers. Its focus is on design as a business activity. We usually refer to it as "design in context" or "design in business"

We are looking into product design as the result of teamwork. We are interested in both the communication within the team, as well as the influence of the project leader on team behaviour. This approach looks at team behaviour not in terms of group dynamics, but in terms of design work. Of course design work and group behaviour are intertwined, but we are primarily interested in the content of the product design work.

This shift from individual designers towards design groups has been caused by the very practice of industrial product development. Few product designs are the work of just one lonely designer. Nowadays complicated consumer- and industrial products are always the results of multi-disciplinary design teams. However we are not only interested in the teamwork itself, but also in the interfaces between those design teams and the rest of the organisation.

We are continually conducting case studies of product development in real corporate situations. This allows us to compare empirical studies with theories of product development and has resulted in two books on Integrated New Product Development and a new course for our first year product design students (Buijs and Valkenburg 1996 and 2000).

During the discussions of the aforementioned Delft workshop on analysing design activities we discovered big differences in the ways psychologists and design researchers were looking at design behaviour. For example two researchers were looking at the same type of a group design activity. Both looked at a specific action on the videotape. However the psychologist looked at body language and group dynamics, while the design researcher looked at the

content of the discussions within the design team. So for both there was something interesting to see, but the results were completely different. More surprisingly, some times the conclusions were completely different or even opposing.

This has led to some very intriguing research projects. Helga Hohn, a psychologist, started to look at the behaviour of team leaders in helping teams with innovative tasks. She questioned more than 75 international working professionals on how they inspire their (design) teams, how they keep them on track, and how they deal with the company pressure to perform better, quicker or cheaper. Once again process and content were very closely related with “playing” proving to be very important in keeping teams alive and kicking (Hohn 1999).

Rianne Valkenburg, a design researcher, is looking at team design work on the content level. She is comparing two teams of students designing during the Philips Design Competition, and two professional design teams, which took part in the earlier Delft experiment at Xerox PARC. Inspired by Kees Dorst’s work she is using Donald Schön’s paradigm to compare these different design teams. She has operationalised Schön’s theory and is heading towards some interesting conclusions about shared understanding and team communication based on the content of the design project (Valkenburg and Dorst 1998). Her thesis will be published at the end of this summer.

Within this team-based research Danielle Hendriks and Hanny de Wilde are doing research about the role and influence of project leaders on the results of the product design team. Besides interviewing project leaders in Dutch design consultancies, they were also allowed to study the archives of one of the leading Dutch design firms. From a knowledge management perspective these archives have not proved useful. However, they have shown that if designers want to learn from their past they have to be more accurate in what and how to file their actual design work. Recently, an e-mail-based way of making weekly diaries has been developed. In analysing these diaries they hope to find some of the heuristics, project leaders use to solve their professional problems (Hendriks and De Wilde 1999). They are helped in this by a research student, Sjors Witjes, who is doing empirical research in cooperation with Stanford University. He is observing and interviewing project leaders of product development teams in the US high tech industry. Hopefully we can compare the results from the Netherlands with those from the US. These results will be integrated in our recently developed fourth year course on Product Development Management.

In our attempts to study the real life of designers we have discovered that most designers talk about intuition as an important element in their work. Although intuition is difficult to study within the traditional way of doing scientific research, we have taken up the challenge. Robin Groeneveld has interviewed about twenty professional designers. Most of them are very explicit about the influence of intuition and about the way they can rely on it. Hopefully his PhD thesis will be published the end of this year.

Finally within the Management & Organisation Group we are interested in stimulating creativity in product design. Not only have we developed a fourth year course on Creative Problem Solving (CPS), we have also started a research project in this field. Creative Problem Solving (i.e. brainstorming or synectics) is usually verbally based, while product designers tend to be visually oriented. The research project of Remko van der Lugt is trying to bridge the gap between the original CPS-rules and the more visual attitudes of product designers. The first results are promising (Van der Lugt 1998). An extended version of minddrawing, as opposed to brainstorming, seems to be an effective tool for product designers. His PhD thesis is scheduled for early next year.

Beside the already mentioned courses we are also teaching a third year course on Strategy and Organisation (Frido Smulders is responsible) and we all participate in the design studio work.

7.3 Final remarks

The research in both the Design Methodology Group and in the Management & Organisation Group is aimed at getting better insights into the process of New Product Development (NPD). With this insight we hope to improve the quality of product design work.

By sharing a selection of our work with other design researchers in the Netherlands we hope to get enough energy not only to continue, but also to improve.

7.4 References

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