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TEACHING PRINCIPLES OF QUALITATIVE ANALYSIS TO INDUSTRIAL DESIGN ENGINEERS

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ABSTRACT
Doing qualitative field research has become a standard part of academic human-centred design education. Part of the challenge is to bring design students a thorough understanding of research methods, and practical skills in performing small scale user research as part of design projects. This involves understanding and ability at interpreting data, categorizing information, and appreciating how theories are built. This paper reports on an exercise sequence in which students go through the analysis process of a transcript from a field study, and discusses how a relatively simple exercise can serve to equip students with both a practical know-how of carrying out analysis as well as instantiation and experience for discussing underlying concepts such as triangulation, abstraction levels, and the relations between data, information, and knowledge.

Keywords: Qualitative research, analysis, design research, method

1 INTRODUCTION: DESIGNERS STUDYING USERS

Increasingly, designers need to know about things beyond the product and how it is manufactured. Elements of business studies, organisation, ergonomics, and psychological theory have already found their way into many design curricula some time ago. In the past decade or two, software, interaction design, experience design, and service design have increased the need for designers to understand the life situation of the user, and the way the product interacts with the user on this (Figure 1).

At first, this meant introducing elements of psychology, especially human factors, into the design curriculum. The emphasis here lay on teaching how to apply theory to a design problem, e.g., using Miller's law of 7+2 to manage the complexity of interfaces.

But especially in the last five years, an emphasis on gaining specific understanding of the target group, and especially an 'empathic understanding,' has been promoted, indicating that abstract principles from theory are not sufficient to guide designers in creating solutions for the products, systems, and services to which they contribute. With empathic understanding, the designer is able to, as it were, 'step into the user's shoe', 'walk their walk', and 'see the world through their eyes'. These popular descriptions indicate a thorough understanding of the many ways, large and small, in which the to-be-designed thing affects people's lives on functional, practical, emotional, and social levels. These days there is the feeling that the practicing designer needs to be equipped with the skills to form this understanding themselves.

As a result we see that elements like observation studies, interviews, and generative techniques are introduced in design curricula [1], in order to equip the next generations of designers with not just *knowledge about* general human-centred design principles and the ability to consult experts and literature, but also *skills in conducting field research* themselves to ground their understanding about the users in fieldwork. Part of this is showing the students the way in the abundance of new and old tools, techniques, tricks, and methods that exist in practice and academia (e.g., the books [2, 3]); another part is found in the changes occurring in the design education [4], and including doing research in the design curriculum.

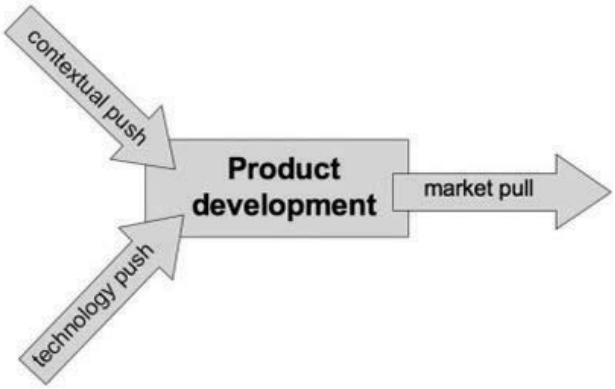

Figure 1. Contextual understanding as a new force on product development (from [5])

2 THE CONTEXTMAPPING ANALYSIS EXERCISE

The contextmapping method [6,7] was developed to create a rich documentation of the context of use, to inspire and inform the design of a product or service. To meet the needs for 'empathic understanding', the method aims to deliver a rich variety of insights on that context, including functional, emotional, and social needs of the user. Figure 2 shows the steps in the process, including an intensive interaction with the users participating in the study. The step of qualitative analysis starts with all the data gathered in that interaction (typically consisting of workbooks, visual materials, and a transcript of the discussion session; see [1]), and is followed by communicating the 'selected and distilled insights' with the other stakeholders in the design team. In the course 'Context and Conceptualization' we teach the analysis and communication process as a structured exercise to some 200 hundred MSc design students each year.

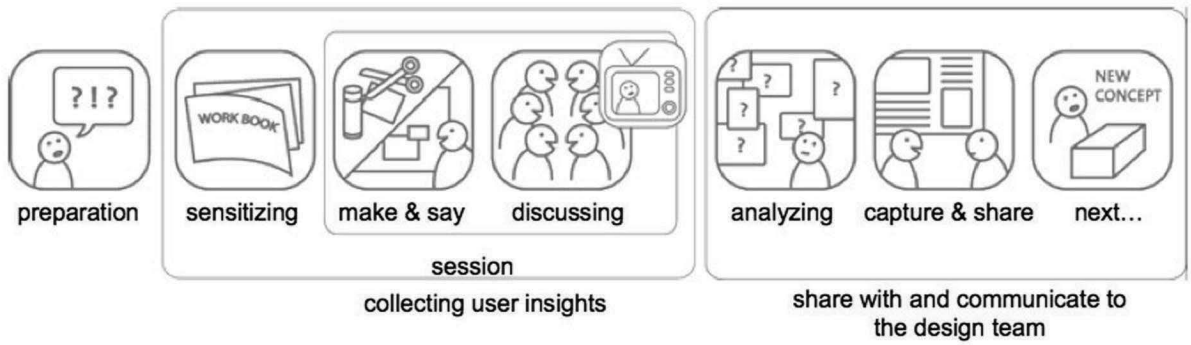

Figure 2. Steps in the contextmapping process

In the exercise, teams of 5 students all receive a transcript of about half an hour discussion by participants about a design context, e.g., 'shaving and bodycare', or 'keeping in touch with friends'. Their task is to study the transcripts, and come up with an infographic poster presenting their insights to another team at the end. The process consists of a series of 3 two-hour group exercises, each preceded by an instruction, and followed by a theory lecture.

In preparation, the students individually read the transcript, and mark possibly relevant passages, called *quotes*. They then consolidate the selection by turning some 10-30 quotes into explicit interpretations in the format of a *statement card*. Key part of the format is the *paraphrase*, in which they make explicit in their own words what the quote is saying.

At their first meeting, the team of students study each other's cards, cluster the 100 cards into manageable groups, which are in their turn labelled and described. Finally, they try to find a structure between the groups. These steps are shown in Figure 3.

Figure 3. Steps along the exercise: transcript, statement cards, clustering session, and final poster

In the second meeting, the team creates a design for an infographic poster, using words and images to convey the insights they gained from their analysis to design team members who have not seen the data. When the results are reviewed in the lecture, we usually find that the conclusions are too general and abstract to convey an empathic understanding.
In the third meeting, the team reworks the posters to also 'convey the feeling' for the real lives of the participating users, typically by adding quotes from the original transcript, and adding realistic visual data.
In the fourth, final, meeting, the teams review posters made by other teams about a different subject, and reflect on what inspires and informs them.
Table 1 shows the steps in the exercise, and some issues encountered in them.

Table 1. Steps in the exercise

Phase & activity	Issues	Tips
Preparation: Selecting quotes and paraphrasing	Determining what is useful; Committing to an interpretation Creating a paraphrase rather than a general topic indication; Choosing a level of interpretation;	Make sure the paraphrase conveys the meaning even if the quote is left out.
Meeting 1: Clustering	Finding meaningful labels; Dealing with different interpretations;	Label groups with a *noun+verb*, instead of only a noun. Two different interpretations of the same quote does not mean one is wrong, the other right.
Meeting 2: Creating an infographic	Leading the attention of the reader; Giving meaningful descriptions; Not reducing insights to abstract generalities	Use the AIDA principle (see, e.g. [2]); Make sure you have a clear 30-second message; Guide the reader along; Support your message with visuals
Meeting 3: Creating an empathic poster	Avoiding stereotypes, especially in images	Add nuance and realism through quotes and anecdotes Watch out for idealized stock photos or Hollywood images
Meeting 4: Reviewing other teams' posters	Being critical of other interpretations	Apply your criticisms back to your own poster.

3 DISCUSSION: BASIC PRINCIPLES AND DIFFICULTIES

In this section we briefly review the key learning points that lie at the basis of the courses.
The exercise confronts students with some fundamental notions of research, and of qualitative, human-centred research in particular. The main learning lessons, in my opinion, are (i) understanding of the levels of data, information, and knowledge, their relations and the differences between them, (ii)

awareness of levels of abstraction, and (iii) understanding the social nature of sense-making, and the value of triangulation in constructing more dependable insights.
In the earliest editions of the exercise, we tried to give the theory on this before the exercises, but noticed that it didn't stick. One reason is that the notions involved are really difficult and fundamental ones, another is the urge that students (and especially designers) have to get started right away. By giving the lectures after the practical exercises, and before the next step, the students have already wrestled with instances of the theory, and the theory helps them to understand and mend practical defects in their work.

3.1 Data, Information, Knowledge, and Wisdom (DIKW), but also the Phenomenon

Data, information, and knowledge (and phenomenon and wisdom) are three levels in the DIKW hierarchy (see e.g., [8]). Table 2 describes the levels. Typically, the middle three (data, information, and knowledge), are what scientific methods deal with, and each is physically represented in the exercise. The transcript and quotes are pieces of *data*, obtained by selecting evidence from the phenomenon (e.g., a part of the transcript). The paraphrases of the statement cards make the interpretation into information explicit and open for discussion. The groups of cards are simple theories of how the interpretations fit together in a greater pattern. The outer two, wisdom and the phenomenon, both are outside the domain of science, and a mature researcher (or designer) knows how to separate them out. At the top end, the wisdom layer indicates there is a level of contemplation needed in dealing with science that exceeds science itself. The theory itself cannot give you certainty whether it should be applied, and often designers face having to make decisions in the absence of complete scientific criteria. At the bottom end, philosophers of science emphasize that our data is 'all we have left' for building theories, but is no longer part of the phenomenon itself.

Table 2. Example of a table

level	for example	explanation
wisdom	Decisions to use a theory or not	How to make use of the other layers
knowledge	Theories, categories, patterns	Abstracted, generalized relations between information
information	Paraphrases, codes	Symbolic code of interpretations
data	Photos, video, transcripts	Selected pieces of evidence from the field research
phenomenon		That what happens in the world

3.2 Levels of abstraction

Levels of abstraction come into play when committing to an interpretation of data. It is a decision of the researcher (student) to interpret a quote such as "I send a lot of tweets" as either "he likes to be heard", "he often sends messages", "he often uses his mobile", depending on the context of the quote and the focus of the research. All three can be correct at the same time, but in the meeting students can vehemently disagree, and sometimes think they have to settle 'the' interpretation by a vote in an early stage.
In the lecture, the awareness of levels of abstraction is given by showing the students a picture of someone performing an activity and requiring them to write down, in a few words, what they see. The resulting interpretations often nicely cover the spectrum from 'someone scribbling on paper', through 'a woman writing a letter', to 'a manager signing a contract', and 'the CEO taking an important decision for the company'. Such different interpretations fit into a means-ends hierarchy, and are connected to the level of analysis chosen for the research (or often not chosen before, but during the analysis).

3.3 Triangulation and the social construction of theory

In the social sciences, the notion of knowledge being constructed by researchers (as opposed to the positivist view that knowledge pre-exists in the world and needs only be uncovered). Discussions between researchers play an important role in this, in part as triangulation (when two or more sources of data, or two or more researchers, agree on an interpretation, its validity increases; see, e.g., [9],

[10]), and also because the discussions around interpretations help the team to further develop the focus of their research (a feature to which designers who are experienced in teamwork are open). In the exercise, the meetings serve to structure these discussions.

3.4 Value of the paper format of the statement cards

The format of the *statement card* turned out to be a fortuitous choice for exemplifying the above principles in the clustering meeting exercise. It gives the theoretical notions a physical handle, and also optimizes the efficiency of carrying out the exercise itself. The format instructions are shown in Figure 4, and require students to reproduce the selected data (quote) and include an explicit interpretation (paraphrase). The reading and interpreting assignment is carried out by the students individually in the preparation for the meeting, with the effect that the meeting gets off to a quick start (everybody has something to show, and is curious as to what the others selected). Through font style and size, the paraphrases draw more attention than the quotes, because grouping the cards into categories is done on the basis of the information level, not the raw data. Finally, the colour bar is used to identify the researcher, and helps the students to efficiently see how they (dis)agreed in their interpretations (e.g., when someone doesn't understand a card, its author is easily asked; also, the distribution of colours over the categories helps to judge the agreement between the authors).

Every year, a percentage of the students fail to adhere to the instructions, and the groups immediately suffer the consequences, and generally recognize what went wrong in the lecture after. For instance, some students fail to write a clear paraphrase, indicating only the general header, 'practical issue', which makes it difficult to retrieve the interpretation itself, or assign the card to a category. Some students did their work late and decided to bring hand-written cards instead of printed ones. As a result, their contributions are difficult to read, and often get put aside by the group.

Over the years, the cards have worked well. Although they were created originally as a learning tool, to be superseded by, e.g., computer-supported analysis tools later on, many students (and we ourselves) often reuse the method, especially because it structures the group discussions. Our motivation for the physical cards originated in not wanting the students to start their learning curve with the complex interfaces of statistical and qualitative analysis software (e.g., Atlas-TI). But for many design projects, sorting the cards turned out to be effective for the scale of the analysis performed.

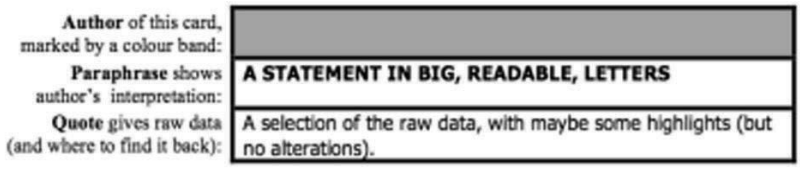

Figure 4. Format of the statement card

4 CONCLUSION

The academic human-centred design curriculum is growing, and calls for (some) design disciplines to include a greater emphasis on (qualitative) research skills. There is a growing set of resources in the form of books on research method, and tools for qualitative analysis, and an increasing arsenal of techniques for doing the research, communicating the results, and applying them in product conceptualization. But most of these are either very time-intensive (because developed for scientists rather than designers), or superficial (because developed for direct use, but not forming an underlying model of research).

The method for structuring the qualitative analysis process with the help of physical statement cards provides a boundary object between the philosophy of research (the theory behind the methods) and efficiency of practice. Although it is limited in scale (some hundred cards is quite manageable, but larger ethnographic studies deal with many more data points), it has served as both a practical starting point, and a tool with handles for reflection and insight into how knowledge is constructed.

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