A Comparison of Diary Method Variations for Enlightening Form Generation in the Design Process

Maral Babapour, Design and Human Factors, Product and Production Development, Chalmers University of Technology

Björn Rehammar, Design and Human Factors, Product and Production Development, Chalmers University of Technology

Prof Ulrike Rahe, Design and Human Factors, Product and Production Development, Chalmers University of Technology

This paper presents two studies in which an empirical approach was taken to understand and explain form generation and decisions taken in the design process. In particular, the activities addressing aesthetic aspects when exteriorising form ideas in the design process have been the focus of the present study. Diary methods were the starting point of this research for investigating the form generation process through collecting self-reflective comments from the participants. The main focus of this paper is to address potentials and limitations of the three variants of diary method used for data collection, namely, unstructured diaries, structured diaries and visual diaries. A set of method evaluation criteria was developed to compare the structure of the diary variants. By qualitative analysis of the results and comparison of the diary variants, strengths and weaknesses of each variant were identified. One of the prominent factors in the diary variants was pegged to be due to the logging delay after the occurrence of the activities.

Key words
design process, form generation process, research methods, diary research, diary formats

Introduction
Different models have been proposed over the years to portray the design process, generally describing design as a logical and methodical procedure (Cross, 2000; Lawson, 1997; Roozenburg & Eekels, 1995; Ulrich & Eppinger, 2008). Design is considered a divergent task requiring imaginative processes, which also include stages of convergent thinking (Lawson, 1997). Designers employ different means to exteriorise their imaginative thinking process (Archer, 1991) such as drawing and sketching (Goldschmidt, 2003; Lawson, 1997; Purcell & Gero, 1998), verbalisation (Dong, 2007; Jonson, 2005), the use of models and prototypes (Brereton & McGarry, 2000; Evans, Wallace, Cheshire, & Sener, 2005) , and computer aided design (Lawson, 1997). The externalisation of shape ideas is an essential part of the design process, which not only freezes and represents one instance of the designer's cognitive process (Lawson, 1997) but also influences the design process (Menezes & Lawson, 2006). However, the interrelations between the design process and the visualisation activities are not yet clear (Purcell & Gero, 1998).

To understand the design process has always been considered a challenge within the design research community (Blessing & Chakrabarti, 2009; Cross, 2011). Investigating the design process, since the 1980's, been has in an experimental phase to find out how designers work and what impacts new tools and methods have on the design process (Blessing & Chakrabarti, 2009). Different research methods and approaches have been used in empirical studies to shed light on design activities, for example, interviews (Lawson, 1994), protocol studies (Cross, Christiaans, & Dorst, 1996) and observations (Bucciarelli, 1994; Schon, 1983). Regarding interviews, Cross (2011) mentions that the designers are not very good at explaining how they work since they mainly focus on the result of their projects when they are asked to explain how they design. On the other hand, Pedgley (1997) argues that designers are the only source for finding information about the underlying thoughts when designing, and therefore observation methods are not sufficient to investigate the design process.

Diaries are a research technique concerned with logging activities by the participants in a study during a certain period of time in chronological order (Rieman, 1993; Zimmerman & Wieder, 1977). They have been predominantly used in social sciences for gathering ethnographic data, and psychology for investigating autobiographical memory (Koriat, Goldsmith, & Pansky, 2000; Robinson-Riegler & Robinson-Riegler, 2009). Diaries have also gained popularity in the human-computer interaction domain and more recently in the engineering domain (Wild, McMahon, Darlington, Culley, & Liu, 2009). However, according to Pedgley (2007) diaries have rarely been used for investigating the design process. The formats of dairy studies vary in terms of structure, complexity and layout which can influence the outcome of the study as e.g. shown in Hyldegård (2006) and Pedgley (1997). Diaries also vary in the format they are collected such as paper- or electronic based (Wild et al., 2009).

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In the present study, an empirical approach for research into design was taken to understand and explain the form generation activities and the decisions taken in the design process (e.g. Dorst, 1995; Frayling, 1993). Diary method was the starting point of this research for investigating the form generation process through collecting self-reflective comments from the participants.

Aim

The aim of this paper is to compare the three variants of diary method, which were used to investigate form generation process and acquire an insight into the underlying cognitive processes when exteriorising shape ideas in the design process. A set of method evaluation criteria was developed to address the potentials and limitations of the three diary method variants, employed for data collection in two empirical studies.

Research Design

The proposed empirical approach for investigating the design process was adopted in two studies conducted by the authors at Chalmers University of Technology in Sweden. Students of a Master program in Industrial Design Engineering participated in seven-week design projects[1], working roughly 20 hours per week. The design projects were to follow a five-stage framework: Exploration, Categorisation, Interpretation, Generation, and Structuring. To investigate the design process from the designers' perspective and let the researchers empathically participate, the participants were to document their working progress with a focus on form generation activities. The main difference between the unstructured diary and the structured diary was a template in the structured diary, addressing different aspects of the design process, explained further in Empirical study II.

Participants

A total of 35 students who were registered in Industrial Design Engineering master program participated in this study. They were taking part in a course on Advanced Form Design. All of the participants had a common experience from a prerequisite course on the same subject[2]. They were encouraged to form groups of two or three students for conducting the design project.

Data Collection and Analysis

The participants were instructed on how to use the diary formats in the course briefing. The diaries were handed in via an electronic uploading function on the course homepage. During the project, the researchers also participated in weekly supervision sessions to observe the students' process.

Analysis of the diary data was carried out based on the qualitative data analysis approach suggested by e.g. Miles and Huberman (1994), consisting of three phases of (i) data reduction, (ii) data display, and (iii) conclusion drawing and verification. The initial phase involved searching for themes, summarising, coding, categorising[3], and registering excerpts from the diary data in Excel matrices (separately for each participant). Finally, conclusions were drawn by interpreting the emerging meanings based on the patterns and by identifying regularities and possible explanations. The conclusions were verified by going through the diaries once again and by searching for corresponding results in other literature in the domain.

Method Evaluation Criteria

A set of criteria (Table 1) was developed throughout the empirical studies based on the similarities and differences experienced in the implementation of the diary methods, the analysis and the results. Four of the criteria in the table below; namely, Solo Effort, Mobility, Endurance and Delimitation (subject delimitation) are adapted from Pedgley (2007) on characteristics of data collection methods for investigating design activity. These criteria were used to compare the diary method variants.

Empirical Study I

Twenty-four master students[4] (22-29 years old, 17 men and 7 women) took part in the first study, carried out from March to May 2010. This group had a free choice of topic for their form generation projects. They were briefed to use aesthetic values (e.g. Hekkert, 2006) and product novelty (e.g. Cross, 1997) as driving forces in their design process and not to focus on technical functionality. In addition, they were asked to document their form generation process in an unstructured diary, submit a diary draft after four weeks and a final version at the end of their project.

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[1] The projects were the main obligatory part of a course in Advanced Form Design. Within the framework of the project, the students were to look for approaches that would lead to a creative and experimental yet structured generation of formal product solutions.

[2] The prerequisite course comprised of a number of exercises to explore form generation and to experiment with different design tools, such as CAD-software – solid and surface modelling, clay and paperboard modelling.

[3] The categories were starting point, activity, goal, use of tool/method and the motivation behind it, output, issue/conflict for different stages of the project.

[4] Ten students held a Bachelor degree in Industrial Design Engineering from Chalmers. The fourteen remaining students were exchange students with similar backgrounds.

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Data Collection

Unstructured Diaries – The participants kept a retrospective diary during the seven-week design project. They were asked to describe and reflect on the activities related to their design process and the given framework of the project. They were also to report on the use of tools and methods during the project e.g. use of brainstorming methods, sketches, physical models, CAD modeling, etc.

In addition, visual samples such as sketches and photos were required to be included in the diaries to facilitate studying the students' creative process. The length of the diary had a 10-page limit, excluding the visual content. The students were encouraged to keep a continuous track of their design activities and document them on a regular basis.

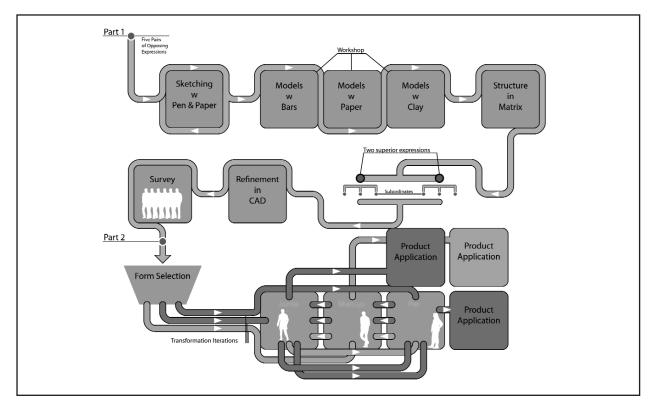| Criteria		Description
Method execution	Solo Effort	The possibility to apply the method without employing a second researcher for data collection or analysis.
	Minimised intrusiveness	The extent to which the method intervenes with the design process.
	Mobility	Since designers have to work in different location during one project, the method should be accessible in different places e.g. at home, studio or different workshops.
Time aspect	Endurance	If the diary format is suitable for studying the whole design process regardless of its duration and not limited to capturing short segments of the process.
	Regularity	If the diary format offers the possibility to track the design activities regularly.
Data quality and quantity	Richness	If the method results in gathering rich data through descriptive and detailed explanations and inclusion of necessary visual information to assist representation of the design process.
	Integration of visual content	If the format enables the designer to include externalisation of form ideas using sketches, renderings, etc.
	Minimised data overload	If the method results in a too large amount of data.
	Minimised data loss	If the diary format results in losing important data.
	Facilitate data analysis	If the method facilitates analysis phase due to the amount and structure of the data.
Delimitation	Subject delimitation	If the method focuses on a specific aspect of design activities to avoid data overload, for example through specific questions.
	Delimitation on the verbal content	If the diary format enables free self-reflections and does not limit the verbal content through e.g. answers to specific questions.

Table 1. Method evaluation criteria

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Figure 1. The design process referred to as "the complex process" (Participant J, diary excerpt, page 3/24)

Introduction
An artist can have many methods of expressing his/her art; it could be on a canvas, with a sculpture or as an installation. The work of an industrial designer always has the (at least potential) result of an actual physical product. On the way towards this goal, the designer has many choices to make; eventual tools to use to develop the most interesting form. But traditionally you have the image of an artist just letting his/hers imagination flow.

I'm interested in the difference between the creative processes within these two art forms. I want to find out if there is an alternative to the intuitive artwork for the artist and the opposite; if the industrial designer might work completely without formal form generating tools and still receive a comparatively good result? Could the form generation of the designer be purely intuitive and could the artist use form tools?

Central question
Are there examples of artists using form tools similar to the tools of the industrial designer - and are there industrial designers that strictly create forms in an intuitive way? How does this work and which are the tools?

Aim
My aim is to search for form tools that are used today and new ways for artists and designers to generate forms.

Method
I will refer to my own group work and others.
Analyzing the professional interview we had with Lars Falk, and some other written sources.
I might also try to find information through making my own interviews.

Implementation

Figure 2a. The whole diary draft document received from Participant M

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I developed it as a top of a pitcher first, thought that the shape looked similar to an opening of a pitcher. This also made me come to the idea of a more edgy back part merged into the soft organic opening; picture 15.

I divided the top shape as I wanted some new form. The top curve of the opening was drawn down to the left, while the right hand tip stayed. This gave the shape more curvature at the bottom - quite the opposite of what it had been before; picture 16.

Picture 16: Round 2; step 7

The shape was then rotated so that it stood up; picture 17, and then a bit widened for the final function: a door handle; picture 18. The widened upper part makes it easier to get a hold of the upper part of the handle, when pulling the door to you.

Picture 15: Round 2; step 6

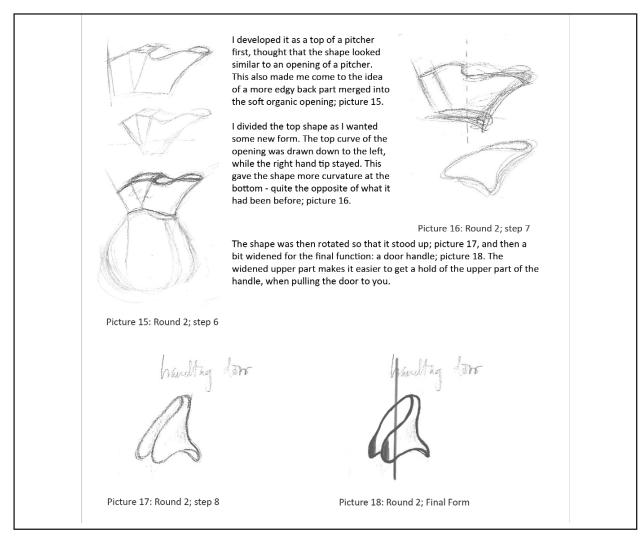Picture 17: Round 2; step 8

Picture 18: Round 2; Final Form

Figure 2b. This page was taken directly from a 34-page long diary (Participant M, page 19) in which detailed explanations, and annotated sketches were included to give accounts of the underlying thoughts when developing the sketches

Results

A total number of 24 diaries, 7-34 pages long (excluding appendices), were gathered. They were documentation of different design projects with varying amounts of visual and verbal data. The unstructured diary format resulted in an extensive amount of data containing rich self-reflections and detailed descriptions (e.g. by explaining their activities in terms of tasks and sub-tasks) with annotated visual material. The diaries were often well structured as the participants had tried to represent a linear flawless design process, which led to the final results. Some of the participants had summarised and illustrated their design process using descriptive explanations, info-graphics and diagrams. Figure 1 shows an example of design process illustrations from one of the participants.

In some cases, the participants focused more on presenting the final result than describing their process. Although the students were encouraged to keep regular diaries in the course briefing, the mid-term diary drafts did not represent all of the form generation activities presented in their final diary. This indicates that the participants had not kept regular diaries, instead they had written most of the diary in the last weeks of the project. Figure 2 shows a draft document and a one-page diary excerpt, to exemplify characteristics of the unstructured diaries and the mid-term drafts.

Having no restrictions on the content, the students had not limited their documentations to form generation activities but included other issues mainly regarding technical functionalities, for example:

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The segment on the helmet absorbs the shock and transfers the damage to the connecting point on the side of the head. The design allows a more lightweight solution than helmets on the markets with the same protection. (Participant P, page 16)

In an overall view, the results from this study indicate that iterations, in terms of recurring steps and use of tools and methodologies, played an essential role in the form generation process. For example iterations between sketching and use of CAD-software were documented in more than half of the unstructured diaries.

Empirical Study II

The empirical study II was carried out from March to May 2011 in which eleven master students[5] (21-29 years old, five men and six women) participated. The project topic for this group was predefined as "tableware", without any restriction regarding choice of material or manufacturing technique. In the course briefing, the participants were

instructed to document their form generation process using structured diaries and visual diaries.

Data Collection

Structured Diaries – Based on the experiences from using an unstructured diary format in the first study, modifications were made to the diary format. A structured one-page diary template with fixed response categories was developed for this study, to facilitate data analysis, to focus on form generation activities, to seek the underlying motivations behind the decisions made during the design process and to record participants' retrospective reflections on their form generation activities. The template (figure 3) consisted of several parts including steps, decisions, motivations, methods, conflicts, etc. Another modification was the incorporation of the instructions into the fixed-response categories of the template, as a need for repeating the instructions was found important in the first study. In order to track the chronology of the design process, the participants were to fill in the template

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Personal Form Design Process Diary

List the (3 to 10) *most important steps* in your process regarding the past week:
    1   Step…
    2
    3

List the (3 to 10) *most important decisions* of the past week:
    1   Decision…
    2
    3

Please describe briefly (in one or two sentences) *why these decisions were made*:
    1   This decision was important because…
    2
    3

List the used *design tools and/or applied methods* of the last week:
    1   Tool or method…
    2
    3

Please describe in one sentence *the reason why you chose the respective tool or method*:
    1   This tool/method was used because…
    2
    3

Have any difficulties or conflicts occurred during the past week? Please list and describe them:

Please feel free to list any additional reflections of the last week (optional):

Figure 3. A part of a visual diary, showing early phase sketches

[5] *Eight students had a bachelor degree in Industrial Design Engineering from Chalmers. The three remaining students were exchange students with similar backgrounds.*

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weekly. The diaries were kept in electronic format and uploaded on the course homepage every week.

Visual Diaries – To compliment the structured diaries and include the visual data as a central part of the design process, a weekly documentation of the visual outcomes of the process was additionally required. This visual diary format was defined as A4 landscape, and could consist of scribbles, pictures, CAD-renderings and any other form of visual information essential for understanding the creative form generation process. Furthermore, the participants were encouraged to refer to their visual data in the corresponding structured diaries.

Results

After each week, 11 structured diaries and eleven visual diaries of varying length and details were collected. Figures 4 and 5 show sketches from two participants, to exemplify differences in visualisation skills noticed in visual diaries. The varying characters of the diaries also reveal a great difference in writing and articulation between participants. For example, when giving motivations on the use of CAD-tools, participant R (week 7) had only mentioned *"...to get a 3D feeling but also more and more developing final design"*, whereas another participant gave more detailed and comprehensive motivations:

In CAD we used both Catia and Alias and we noticed that Alias was a better tool for the kind of shapes we wanted to create, mainly because it was easier to create
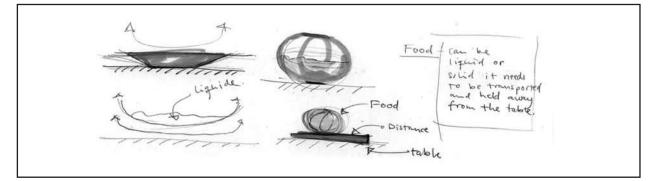

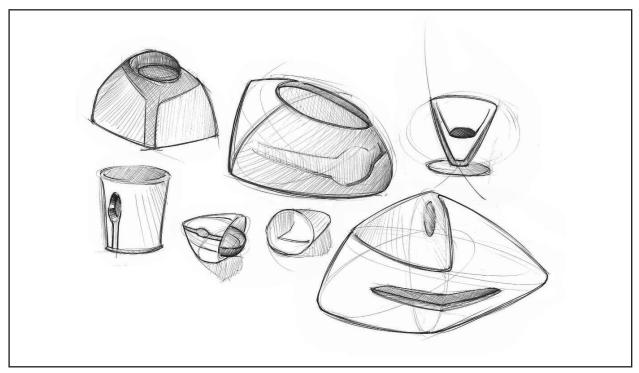*Figure 4 . A part of a visual diary, showing early phase sketches (Participant A, week 1)*

Figure 5 . A part of a visual diary, showing early phase sketches (Participant J, week 1)

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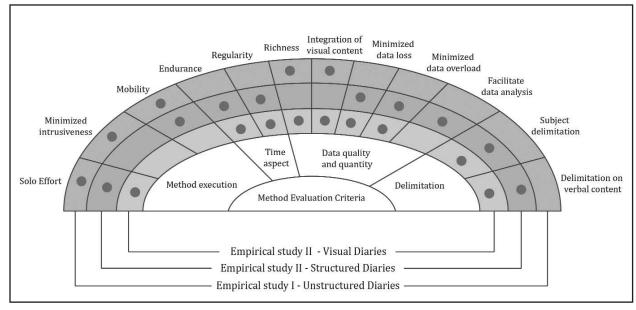

Figure 6. Comparison of diary variants based on the method evaluation criteria. Fulfilling the criteria is marked with circles

the sharp transitions in Alias. CAD is an easy way to generate many form variations and to manipulate forms into new ones. (Participant K, week 4)

The analysis of the structured diaries revealed the chronology of the form design process in addition to its iterative nature. For example, participant A reported on recurring steps of gathering different inspirational material in different occasions.

> To get inspiration I have also been looking [at] porcelain on the internet, to get a better idea on the possibilities of the material. (Participant A, week 1)

> One step was to start benchmarking, to see if we had any main competitors on our concepts and also to get some inspiration on different solutions. (Participant A, week 3)

Side-tracks were also noticed in the structured diaries, for instance, participant A referred to selecting specific concepts, sketches, and sources of inspiration during weeks 3, 5, 6, and 7. This indicated an underlying evaluation stage, but the participant did not directly report on how he had evaluated, chosen and refused specific ideas. Furthermore, reflections on conflicts and difficulties regarding form generation were documented:

> It is difficult to make the different parts fit together (in a sculptural way) and at the same time make them look good one by one without loosing our expression. (Participant V, week 5)

A holistic reflection on the whole process from the participants' perspective was however lacking in the structured diaries, since the responses were limited to one-week chunks of the process. Furthermore, to understand the structured diaries, it was necessary to go through the visual diaries in parallel.

Integration of Results
Based on methodological experiences from the two studies and the method evaluation criteria, a comparison was made between the three variants of the diary method. Figure 6 shows the result of the comparison. The combination of the structured diary and visual diary were identified as more appropriate for investigating the form generation process than unstructured diary, as they fulfill the criteria regarding time aspect, and delimitations.

Method Execution
Solo effort – It was possible to apply all of the diary variants without employing a second researcher for data collection or analysis. However to facilitate the analysis of the unstructured diaries, a second researcher who had no previous insight into the project was employed. It was proved possible to accelerate the data analysis with a second researcher, although a demanding initial stage for detailed explanations of the coding scheme was required to avoid misinterpretations.

Intrusiveness – All diary variants required logging from a later point in time and therefore were not directly intervening with the design process. However, the

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structured diaries called for a weekly reporting and self-reflections, which may have resulted in more awareness of the process and therefore influenced the planning for proceeding steps.

Mobility – The logging of data was found possible in different locations when using both structured and unstructured diaries. The visual diary was, in contrast, not equally accessible, as cameras, smart-phones or scanners were required to log the visual data.

Time Aspect

Endurance – All diary formats were suitable for capturing a seven-week design project, but the extensive data from the unstructured dairies was found difficult to analyse.

Regularity – The structured diary format and visual diaries with weekly intervals resulted in less logging delay after the occurrence of the activities, in comparison with the unstructured diaries. Reduction in logging delay limited the possibility of post-event modifications, which were noticed in the unstructured diaries. Moreover, the results of the unstructured diaries did not clearly reveal a time-line for the design process. Using structured diaries with fixed time intervals helped capturing the chronology and order of the design activities by freezing the design process at regular stages.

Data Quality and Quantity

Richness – The free self-reflections encouraged in the unstructured diaries, resulted in a richer content, which had a more descriptive language, detailed explanations and occasionally inclusion of illustrations to better explain the design process. The structured diaries with the fixed response categories, in contrast, imposed limitations and in some cases may have resulted in brief and insufficient reflections.

Integration of visual content – The unstructured diaries accommodated the visual information, which made it easier to read and understand them. The structured diaries, however, did not accommodate visual data since this role was taken over by the accompanying visual diaries. The presence of a separate diary for visual data resulted in a more comprehensive visual content compared to the integrated visual information in the unstructured diaries.

Minimised data overload – The unstructured diary format led to an extensive amount of data, which in some instances was irrelevant to the focus of the present research. This was to a great extent avoided in the structured diaries.

Minimised data loss – The longer logging delay in unstructured diaries was associated with more recall effects which resulted in losing parts of the information necessary for fully capturing the design activities. For example, side-tracks were not included to the same extent as in the structured diaries.

Facilitate data analysis – The structured diary format facilitated the analysis phase, since the response categories were in line with the coding scheme used in the matrices. The extensive amount of data gathered from the unstructured diary format, on the other hand, required intensive work for data reduction, coding phase, analysis and interpretation.

Delimitations

Subject delimitation – All diary formats focused on form generation, as the students were encouraged not to include other aspects of the design process during the course briefing. However, the free self-reflections in unstructured diaries resulted in inclusion of other aspects such as technical functionality, group activity, etc.

Delimitation on the verbal content – The structured diary format imposed limitations on the verbal content as it sought answers to specific questions. For example, reflections on conflicts and difficulties in the structured diaries were mainly focused on the form generation activities in contrast with unstructured diaries.

Discussion

Design Process

The unstructured diary, structured diary and visual diary methods generated useful and rich data on participants' form generation process over seven-week design projects. This is consistent with previous applications of the diary method for studying design activities (Pedgley, 2007). A key finding to emerge from the use of the diary methods was the iterative nature of the design process. Returning to the preceding steps in the form generation process is one of the key characters of the design process which has repeatedly appeared in previous works (Cross, 2011; Lawson, 1997). However, it should be noted that the results presented here mainly focus on evaluating the diary method variants used in this study.

Memory Accuracy and Logging delay

One of the most prominent findings from the methodological experiences was the effect of regular logging and minimised logging delay in the structured diaries which have resulted in more reliable information. In contrast, the unstructured diaries involved longer logging delays and therefore resulted in less reliable data.

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According to cognitive psychologists working with a focus on memory accuracy, forgetting is more likely to happen if there is a long delay between the occurrence and recalling of an event (Levitin, 2002). One explanation to retrieval failure is the interference and distraction caused by the following events and exposure to new information (Gronlund, Carlson, & Tower, 2007). Furthermore, Robinson-Riegler & Robinson-Riegler (2009) mention that repeated episodes of events lose their individualised character and therefore are more likely to forget. As certain activities occur repetitively in the design process, it is possible that the designers forget or exclude them from the diaries. Explaining the factors influencing the quantity and quality of the remembered data, Koriat, et al. (2000) state that there is a progressive loss of memory for details and that the gist of an event is remembered rather than details. Therefore, a minimised logging delay is preferred in diary studies to achieve detailed recollection of events.

Contradictory evaluation criteria

Some of the method evaluation criteria were identified as contradictory. For example, imposing a high degree of verbal delimitation facilitates the data analysis but can lead to data loss as the side-tracks were not included in the unstructured diaries. Conversely, a lack of delimitation may result in an extensive amount of information, making the data analysis difficult. More importantly, lacking delimitation can lead to losing the focus on relevant areas, e.g. covering issues regarding group dynamics in the unstructured diaries. This is consistent with previous recommendations from Pedgley (2007) for imposing subject delimitation on data collection tools for capturing accounts of design activity. In order to tackle the contradictory criteria of data overload, data loss and yet collecting rich and relevant information, using "open-ended" response categories, which allow self-reflections are recommended.

Other contradictory criteria were "minimised logging delay" and "intrusiveness". As mentioned, the less the logging delay, the more accurate the retrieved information. It is therefore plausible that concurrent diaries will better contribute to accuracy of information retrieval. On the other hand, there is a risk that largely minimised logging delay might intervene with the design activity (Pedgely 1997; 2007). Therefore, the logging time should be carefully considered in order to avoid interfering with the designers' line of thoughts, yet collecting accurate data. Thus, retrospective methods without too long or too short logging delay are potential candidates for investigating design activities.

Explaining design activity

The findings from the first study indicate that the participants had focused prominently on their outcomes instead of the process, in contrast to the second study. There were also indications of difficulties to articulate and express the design activities. This notion is consistent with the arguments of Cross (2011), that designers focus on their project results when they want to explain how they design. Zimmerman and Wieder (1977) also had mentioned the importance of articulation for gaining valuable information from diary studies. To understand the underlying thoughts and motivations behind design activities, the designers are however the only source of information, regardless of their articulation abilities.

Limitations

Both studies required a high degree of participants' engagement and devotion for using the diary method. In previous diary studies, the importance of participants' dedication for sustaining diaries has been highlighted (Rieman, 1993; Zimmerman & Wieder, 1977). In the present study, the course examination was a strong incentive for the participants, as the diary documentation was a part of their examination. A major limitation for undertaking diary studies involving professional designers is therefore to provide incentive and motivation for expending dedicated efforts. It is therefore of great importance to familiarise the participants with the overall aims of such studies, the importance of their contributions by keeping diaries and the benefits that they would receive as a result.

Although the combination of the structured diary format and visual diaries were found more suitable for capturing design activities, they have some limitations to consider. For example, they were limited to weekly reflections and therefore did not reveal a holistic overview on the design process from the participants' perspective, which could be resolved with including an overall review submission in the last week of the project.

One other concern in conducting diary studies is the degree to which we can rely on the collected data. As the accounts given by designers can be intentionally vague, or in a way that they want to portray themselves (Cross, 2011), for example by excluding their side-tracks, iterations, quick and dirty sketches, and instead faking the sketches that they submit. Further, designers' creative process is not limited to the designated working time, and the creative ideas might come any time after the diary submission.

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Concluding remarks

Three variants of the diary method were employed for data collection to acquire an insight into the form generation process. Evaluation criteria were identified to address the potentials and limitations of the three diary variants. One of the most important findings regarding the diary variants was the relation between the logging delay and the reliability of the gathered data. This was found to be mainly due to the retrieval failure and memory changes over time. The combination of the structured diary and visual diary were identified as more appropriate for investigating the form generation process than unstructured diary. Furthermore, the fixed response categories led to acquiring more focus on form generation activities, and demanding less effort for data analysis. To conduct diary studies, it is important to consider the contradictory evaluation criteria, in particular, finding a balance between logging delay and intrusiveness. Additionally, to collect relevant data, appropriate delimitations are required.

Future work should be directed at conducting similar studies in other design disciplines and more importantly with professional designers. In addition, possibilities of improving the diary structures should be investigated. Practical guidelines for implementing diary method in design research should be provided as well. Finally, since the visual information plays a central role in form generation process, great consideration is required for interpreting and analysing the visual data gathered from the diary methods.

Acknowledgements

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maral@chalmers.se
bjorn@rehammar.se
ulrike.rahe@chalmers.se

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