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DESIGN FIXATIONS AMONG INFORMATION DESIGN STUDENTS: WHAT HAS BEEN SEEN CANNOT BE UNSEEN

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ABSTRACT
This research explores the phenomenon of design fixation by studying undergraduate design students undertaking an information product design problem. The research is based on a case study, with 64 students. The students were given a design problem, and their design processes were documented in a weblog, which was analyzed jointly with handouts and slide presentations. The research suggests that the formulation of ideas in and recording of an early group brainstorming sessions may contribute to fixation of the finale design solution.

Keywords: Information design, design education and design fixation

1 INTRODUCTION

This paper explores design fixation among undergraduate students studying Information Design (ID). The School of Innovation, Design and Engineering at Mälardalen University in Sweden facilitates three Bachelor Programs with ID as a major, namely Informative Illustration, Spatial Design and Text Design. The students study the visualization of information text, pictures and space in theory and in practice. More broadly, information products can be defined as artifacts that facilitate assembly, installation, or the way a working space or way finding system is organized. It could be a part of another product, or a product that is used for internal communication in a design team or in business-to-customer relations. As design educators we noticed that some ID-students tended to choose their final design solution at an early stage of the design process. This might be explained by factors such as their inexperience or time constraints when undertaking design tasks. Another alternative explanation however, might be due to a phenomenon called fixation, which is explained by Jansson and Smith as 'a blind, and sometimes counterproductive, adherence to a limited set of ideas in the design process' [1]. The research objective was to explore ID-students' design fixation as part of a design brief they were undertaking as part of their undergraduate studies. The research questions are as follows: How do design fixations appear within an educational context when ID-students work as part of groups? What might be the possible causes of fixation? We hypothesize that teaching and training students about the design fixation-phenomenon and making them aware about their cognitive processes while idea generating may lead to novel information design solutions.

1.1 Theories of design fixations and creative cognition

There are numerous reports dealing with how past examples can lead to design fixation, or that individuals become fixated on solutions from an early phase of the design process [2]. Design fixation may appear in several forms [3]. Mental images and mental models play a crucial role for the fixation [4]. Designers or design students use existing solutions or modification of existing solutions [5] while designing. This could be conscious or subconscious, and could be explained by the fact what has been seen cannot be unseen. That means if an individual has been exposed to a design solution, it might dominate their thinking during the design process. There have been a number of studies that suggest experienced designers [6] and researchers [7] can experience fixation. Indeed, some psychologists have said fixation is normative but malleable [8]. For example, Goldschmidt suggests that it might be more fruitful to deploy thinking outside the immediate task domain [9].

In summary, new design concepts may have a strong resemblance to previous ones, in shape, functions and/or features [10] [11]. Design fixations do not necessary have to "block(s) successful completion of a problem." [12]. Our standpoint is that fixation is a human cognitive ability when it comes to solving problems, since reproducing previous successful practices may be a necessity of survival. In that sense, fixation may not be a barrier to problem solving. The use of other previous media metaphorically when designing information can lead to increased product usability [13]. We acknowledge that there is more than one significant model or theory of how individuals interpret and experience information products; hence, there is usually more than one optimal solution, especially when it comes to complex information problems. Nevertheless, the purpose of designing information and creating novel information products is often based on the fact that previous ones are not good enough and have to be redesigned. In such situations, unconsciously "copying" elements in earlier design concepts and/or not trying out any alternatives may lead to a reproduction of the former information problem.
In this paper, we acknowledged design fixation as normative and something we recognized in our ID students and therefore wanted to explore further as we thought it will help us as design educators. We hypothesized that explicit instruction to students on design fixation, as well as making them aware of certain mental processes whilst generating ideas might help them avoid fixated responses and lead to novel design solutions. Ward, Smith and Vaid present four cognitive processes relevant for a novel entity [14]. Conceptual combinations are cognitive processes that relates to how an individual merge two or several concepts, which may possibly result in a novel entity. Metaphorical thinking is described as the process where people compare likenesses of properties in diverse phenomena. Analogical thinking and mental models is the process of mapping attributes in one familiar system/structure to another that may be unknown to us. Finally, conceptual expansion is a process that extends 'the boundaries of a conceptual domain by mentally crafting novel instances of the concept' [15]. The descriptions of these cognitive processes can be developed much more, but due to space limits they are not further problematized.

2 RESEARCH METHODOLOGY

We conducted an exploratory case study as a methodology, in accordance with Yin [16] and Stake [17]. The design fixation phenomenon is explored in a classroom working context, since it is common that designers work in social environments. The data for this study has been collected in an obligatory design course. The student worked in design teams, which are the analytical object of the study. The course is called *Information Design in Practice,* is 10 weeks long, and is taken by second year undergraduate students who have prior knowledge in theories, methods and practices in designing information products. The aim of the course is 1) to apply methods and techniques to deepen the students' knowledge in how to plan, analyze, shape and test information products and 2) for students' to understand how principles in ID can be applied in design practice. In the spring of 2011, the course was based on a design project, to redesign the website of the County Council's maternity wards. The design challenge was to create a visual design with diversity and equality aspects in mind (including design). For instance, the students had to take into account that the visual design (e.g., images, text, and animation) should take people with different ethnical background, religion and HBT-people into consideration. The students were informed about the research. We followed the research ethnical principles by the Swedish Research Council [18].
During the first lesson, the students were introduced to the project, and were then divided into eight design teams with students representing all three Bachelor programs (text, illustration and spatial design). During the first lesson, students were made aware of design fixation as they undertook Ward et al's experiment on drawing animals [19]. The result was that drawings tended to depict life-forms already existing on Earth, in accordance with Ward et al's experiment. Two days later, the course plan and the design challenge were introduced. We deliberately avoided presenting or discussing previous and accessible design solutions. At the end of the first week, six midwives from the County Council's maternity wards visited the university and discussed their need for information and their requirements for an ethical approach. They were also available for a question and answer session.
The following week, students had a lecture and a workshop a rage of strategies to help them explore metaphors, analogies, conceptual combinations and extension as a means of avoiding fixation. During the third week, students had a workshop to reflect on their initial design ideas and to discuss alternative solutions based on de Bono's six thinking hats. In addition to this, students had one lesson on information structures on the web, one in visual communication, and one lesson in how to present

ideas for a client. Furthermore, each design team was tutored by the course coordinator on six compulsory supervision occasions and five optional ones. Each supervision lasted approximately 30 minutes. The course coordinator continually stressed the importance of problematizing and not settling for an initial design idea without trying out alternatives strategies described above. No sub-deadlines were announced. The only scheduled deadline was a seminar at the end of the course, when the students presented their design solutions for the other students, the teachers and the clients. The teachers initiated three methods in the course. One was to describe the design process and activities in a weblog. The second involved writing questions regarding the project (using Post-its) to understand the mission and highlight eventual challenges. The third was for each student to come up with ten design concept and discuss them within the team.

2.2 Methods for collecting and analyzing data

Empirical data was collected via documents (handouts and slide presentations) that described each design teams' process, design concept, and their finale web design solution including illustrations, photos, texts and interactive pictures etceteras. Furthermore, empirical data was collected via weblogs on Internet (log books) provided by the university. The blogs are based on multimedia, and the students' post/messages consisted of text, pictures and hyperlinks to other websites. The teachers had access to each blog and tracked the progress. Each student was provided with five main directives for blogging (see table 1 below).

Table 1. Directives for blogging

<table>
<tr><td>1) Describe your design activities.</td><td colspan="2">What are you doing at this moment, how, and why? What methods do you use to be creative/to understand the design situation/to test design concept/to test usability or user experiences? How do they influence the design process? What would happen with the design if you worked in another way?</td></tr>
<tr><td>2) Describe and analyze your creativity.</td><td colspan="2">What inspires you when designing? Have you thought of combinations, expansions, metaphors or analogies when thinking of ideas? Do you sketch? How do you present/visualize your ideas, and how may it help you in your work? Is your idea innovative and sustainable, and why? When you criticize the idea, does it lead to new ones?</td></tr>
<tr><td>3) Describe the literature/theories used.</td><td>4) Describe your ethical considerations.</td><td>5) Describe other issues of importance to you.</td></tr>
</table>

The 64 students have an average of 15,5 posted messages in their weblog. The blogs differ in length, from five A4-pages to twenty. The empirical data is about 700 pages all, and there are 200 attachments. Due to space limits, the results of 4 of the 8 design teams are presented.

3 RESULTS AND ANALYSIS

Each blog has been printed, reviewed and summarized shortly after the course, and eight months later. Every student's blog has been analyzed as a part of a whole along with the other blogs in their design team, jointly with their handouts and slide presentations. Empirical data was coded into themes that emerged from the data, namely: supervision; methods used by students; the team work; and the development of design concepts.

Supervision: When analyzing the empirical data, it became clear that all the design teams started developing their design concepts after their second optional supervision occasion and after the workshop with Edward de Bono's six thinking hats; approximately the second and the third week of the course. Even though no sub-deadlines were announced, the optional supervisions seemed to be perceived as deadlines by students, as they wanted to show their progress and design work. One design team started to doubt its design concept in the fifth week and wanted to change it. After another supervision, they decided to stick with their initial ideas. A student from another team declared that their groups' design concept was actually the teacher's idea initially. However, the teacher claims that students had discussed their brainstorming, and he highlighted one of their ideas.

Methods used by students: There were many methods used by students such as brainstorming, content analysis, visits and observations, target groups analysis based on interviews, focus group discussions

and questionnaires. Additional methods were sketches, the testing of sketches, and developing persona. The methods are used to generate ideas (creativity), collect empirical data (research), and to develop and test the design. These methods were used without any guidance from the teachers.
In their blogs, students used photographs and handwritten Post-its notes as well as pieces of paper from when the design teams brainstorming. The written notes focused on web functions, diverse design ideas, and questions of importance to the project or the design. Only one student used the word content analysis in her blog. However, all design teams conducted a kind of content analysis via brainstorming. Despite the teachers' advice, all design teams visited similar websites to be inspired or to know what to avoid when designing. The design teams let two or more students pay a visit to the City Council's maternity wards. They observed the built space and the technical and human resources. Two students used the word target group analysis while blogging. Nonetheless, all the design teams conducted a target group analysis by using interviews with family and friends who were pregnant or already parents. One design team collected 30 questionnaires from maternity health clinics. One design team conducted an interview with a mid-wife. It is unclear if the other teams did. Two design teams developed personas representing the target group. The personas were based on a few interviews or the students own previous knowledge and not involving statistical data.
The design teams used the same method when determining a design concept. They came up with ten design concepts each, and later they converged in the teams to discuss and select one of the concepts. One student stated that she used a mood board to present her design ideas. Each student drew sketches to visualize a design for themselves or for presentations to others. The sketches were low-fidelity pictures or text synopsis. They were tested on family members, other students, or members of the target group. These test persons are not always specified in the blogs. All the design teams visualized basic information structures, representing the website's menu items. One student used site maps as a method to picture a couple of web pages, its content, and information structure. High fidelity prototypes are used in the handouts and the slide presentations for the clients.
The team work: Two design teams stated that they used Facebook to communicate. The design teams held regular meetings, which were documented through the taking minutes. The students met from four to eight times and some of the meetings were minuted, which were documented in their blogs. Informal meetings were not minuted. The students decided how they worked within team and signed contracts. No design team appointed a project manager. One student stated that such a person might have to work harder than the others. The students worked individually or in pairs to find relevant empirical data. They reported their findings at the regular meetings. They brainstormed individually and within the design team, and together they determine a design concept. The design concepts were determined during the third and fourth week of work. Afterwards, the students work individually or with those who have the very same competencies. In the two final weeks, they consolidated the web site content (for example, pictures, texts, and motion pictures). That is the first time a complete webpage and/or the website is visualized and fully realized. They had problems uniting their individual design work into a complete website. As one of the student blogs stated, "We have divided into several small groups…What may be difficult is to make everything fit together…"
The development of design concepts: The students claimed that design concepts are supposed to be a theme running through the project. Having compared their initial design concepts with their final design solutions, which are visualized in handouts and slide presentations for the clients we found there to be a modest correlation with the final design solutions. Each team chose a design concept. The concepts are presented below:
The design concept "The tree of life". The empirical data in the blogs and the slide presentations suggested that the concept has been turned into a logo, a tree symbol, in order to match the website's graphical design (that was already made by one of the students). The tree symbol is only used in handouts and the slide presentation for the clients. The students claimed that the tree symbol related to some of the functions they had planned for the website. One of the functions highlighted was written stories describing how women gave birth to children in different decades. The design team's early meetings were documented through the use of photographs attached to their weblogs. One photograph shows a handwritten piece of paper with the words "History – childbirth stories – through all times"; hence, this function was indicated previous to the design concept, which the team decided on two weeks later.
The design concept "A safe guide to a new life; in a comic paper/magazine". The empirical data suggests that the concept had no correlation in form or function to the final web design, since none of the

students drew pictures or wrote text in a comic magazine style. The design team explicitly changed their concept to “A Handbook” since it fitted a layout one of the students had made previously. Furthermore, this new concept also fitted their existing idea, that is, their texts, images and animations. The blogs revealed that the comic magazine and the book ideas were generated in the beginning of process as was evident from photographs from the team’s early brainstorming session when they use Post-its and plain paper to document the session. One of the photographs shows a paper with the words "comic magazine." Simultaneously, one of the students summed up the session, and both a wordbook and an encyclopaedia came up as design concepts.
The design concept “Nature/Natural (Giving birth is natural)”. Empirical data suggested that the concept became diluted during the design process. There were no coherent visions within the team. One student confirmed that the theme was “Nature, in combination with art nouveau-style." In the middle of the course, another student blogged that their concept had changed to “Safer, none can be." In the end of the course, a third student claimed that their design concept is “There was once a mother to-be,” and this concept was presented to the clients. Nevertheless, their design concepts ended up in a web design based on pictures made by young children allowed to choose their own motive and colours. There was evidence of this concept, in texts and photographs in the blog during the team’s first brainstorming session.
The design concept “Expecting a child. The ride of your life; a carousel; in an interactive comic paper/magazine”. The concept ended up vaguely correlated to the final web design solution. The website’s home page contains a picture of a carousel and the headline “To be a parent. The ride of your life”. Additional web pages had no correlation to the home page, in the graphical design, the pictures, or in the texts. The students noticed this. One of them recounts a team meeting when they reflected upon the differences in style and how they tried to resolve them. Furthermore, in the end of the course, two of the students announced that they did not visualize the concept in the same way. Another student claimed that her design work and the design concept had a vague relationship. Additional student points out that nothing guided their work.

4 CONCLUSIONS AND DISCUSSIONS

In this research we have explored the phenomenon of fixation among ID undergraduate students within an education context. The design process employed by the students and their design activities were followed via a weblog. Empirical data was analyzed based on how they blogged about the following four categories: supervision, methods used by students, teamwork, and the development of design concepts.
We tentatively conclude that students seemed rush through the planning and idea-generating phases of the design process. The research also suggests that supervisions may have constrained the students’ ability to stay in these phases, since design teams wanted to present their ideas to their supervisor. This could explain why students started to rush their design concepts, at the expense of testing alternative, less fixated designs. Empirical data reveals that the students initially worked systematically in their design teams and came up with several ideas. Subsequently, the teams split up, and the students spontaneously constituted subgroups, replacing the work in the teams. The subgroups consisted of students with similar skills. The design teams did not elect a project leader. They had regular meetings within the teams but their actual design activities were not incorporated into teamwork. Consequently, the design concepts they preferred were not manifested in the final design solution since the project and/or the process overviews were missing. We conclude that design students with less experience in established methods tend to fixate on the final design solutions at an early phase of the process.
By the end of the course, the students realized they had worked in different directions, and seemed to return to earlier ideas the team had originally generated. This could be explained by theories about influences of visual input. Initially, all design teams had brainstorming sessions. The pictures or ideas from the brainstorming sessions were probably kept in the students’ visual or semantic memory and were brought up when they looked for a solution to bring their work together at the end of the course. This might explain that which has been seen cannot be unseen, and that which has been formulated or/and recorded visually or verbally (on Post-its, whiteboards, plain paper or in other kinds of media, for example) will affect the design process. Therefore, an early solution to a design problem will be presented during the whole process, consciously or subconsciously, if one does not systematically try to avoid it. The research corresponds to what Perttula and Sipilä concluded: “…a more thorough understanding of the influence of idea exposure could result in new knowledge that could be embedded

into idea generation methodology."[20]. Nevertheless, working systematically and methodologically may not necessary lead to fewer design fixations. The study indicates that methods used to generate design ideas by group of students, such as brainstorming methods, may contribute to design fixation. Generating design ideas in groups is a crucial phase. What we tentatively suggest is that design fixation might be as much a socio-cultural phenomenon as it is a cognitive one. More studies are needed as to how idea generation methodologies in groups sessions may contribute to design fixation, and how these methods can be used (by designers) to avoid these fixations, or at least to be aware of them. Finally, we hypothesized that educating and training students about the design fixation-phenomenon and making them aware of their cognitive processes while idea generating might lead to more novel design solutions. The hypothesis can be neither verified nor falsified via this research. The empirical data does not indicate that the students who participated in the study really applied these theories while idea generating. Naturally, just because an individual is educated in a specific theory does not mean that she or he applies it in practice. However, there may be differences over time, and students may apply the theories more consciously later in their education. This hypothesis requires further research.

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