DUBIOUS ROLE OF FORMAL CREATIVITY TECHNIQUES IN PROFESSIONAL DESIGN

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Abstract: Formal problem-solving and creativity techniques have repeatedly been promoted to designers by consultants and scholars. However, there has been little research about the adoption and usefulness of these techniques among practitioners. In this paper, we investigate the prominence of different design methods among design companies in Europe and North America. We interviewed 17 professional designers from companies of different orientation. We inquired about working practices and the significance of different methods and practices in everyday design work. We found that designers from industrial design as well as engineering design backgrounds relied mostly on established design methods – generally characterized as "design thinking" skills – rather than on specific creativity tools. Sketching, rapid prototyping and in-house testing were typical ways for the designers to invent. We suggest that the emphasis in design creativity studies with pragmatic goals should be on studying *design practice* and *everyday situated creativity* rather than on examining isolated creative techniques per se.

Keywords: creativity techniques, brainstorming, design practice, design thinking

1. Introduction

The term *design creativity* can be seen as a construct that captures the essence of designer's work. It refers to the constant need for creativity in the designer's profession. This is implied by the realities of design work, in which designers are required to produce insightful and feasible ideas constantly. It is therefore only natural that creativity in design has gained significant attention over the years both within academic research, and within educational and professional literature. The scientific studies on design creativity have focused primarily on the following aspects; design processes, cognitive behavior, and interactions (Gero, 2010). As such, the interest is not new. The creative aspect of design has been well acknowledged since the studies of design thinking as a subject of scientific study of design research began (e.g. Thomas & Carroll, 1979; Akin, 1986).

However, it has been recently argued that research on design has not sufficiently addressed issues of practical value, or the needs of the design practice (Liikkanen, Laakso & Björklund, 2011). Design research fails to be relevant for design practitioners and it has been unsuccessful in its core mission: establishing a sustainable discourse between research and practice (Jung, Sonalkar, Mabogunje, Banerjee, Lande, Han & Leifer, 2010). So what could be a potentially more fruitful direction for research on design creativity? Alternative approaches for studying design creativity might involve the

study of creativity support tools (Shneiderman, 2007) and how designers interact with them (Gero, 2010) or systematic methods utilized in design industry to create new designs (Lindemann, 2010).

In this paper, we explore a research direction that considers both approaches suggested in the cited literature. Putting our focus on design practices of present day designers, we present some findings from interviews focusing on the working methods, practices, and approaches of 17 professional designers from 7 different organizations in the US and in Finland. The interviews were conducted with the aim of building a foundation for longitudinal, observational field studies to be conducted at design companies. The interviews covered the working approaches, practices, tools, and methods utilized by the interviewees and within their organizations. The purpose was to identify themes and issues that have been left unattended or are underrepresented in present-day design creativity research from the viewpoint of design practice. Our interview results suggest there might be a misleading emphasis on structured creativity techniques, such as ideation methods, which overlook the daily practices related to "routine creativity" in professional design, and hence make it difficult to have an impact on the design practice with academic research.

We begin our treatment by discussing the existing research on design creativity in terms of creativity practices and ideation and move on to describing the research methodology. Next, we present the results of the interviews, and conclude with a discussion about the implications of the findings for future research.

2. Background: Studies of creative design practices

We see that that an important part of research on design should concern practice; the behavior and thinking of design professional operating in the real world. These types of studies are rather rare in design research, maybe with the exception of the seminal work by Schön (1983) on professional development and reflective design. Recently published studies of design practice have revealed some interesting characteristics of professional design. Hinds & Lyon (2011) studied cross-cultural differences in design practices. Their report describes the different challenges of practicing design in Asia, Europe and North America. They have found that design practices are influenced by different regional client expectations. For example, in the US, the relations are seen as more collaborative, whereas in Europe and particularly in Asia, the professional designers' sole responsibility in design decisions and deliverables is emphasized. This reflects a difference that re-emerges with prototype presentations. European and Asian designers prefer to display polished and detailed prototypes where as the American clients were seemingly satisfied with rougher sketches.

A study by Nov and Jones (2006) investigated the creative practices in an advertising agency by means of interviews and observations. The investigation yielded a model of the organizational roles contributing to ad design. Formal creativity techniques, such as Brainstorming originate from advertisement industry, were surprisingly marginal in the discussion. Brainstorming was considered as a method to utilize different types of knowledge existing in the company. They also mapped the creative influences into a circular model of creative practice. They identified six "inner circle" organizational principles and activities contributing crucially to overall creativity. These included knowledge distillation, task focus, feedback functions, accountability, recognition, and career development. The outer circle of the model included less central, but influential factors that aim to maintain the creative atmosphere of the work place. They concluded that creativity in the studied advertising agency hinged upon a delicate balance of formal processes and informal practices, which together feed the progress.

Petre (2004) documented an extensive field study. She studied design activites over the span of two years in twelve engineering consultancies. Although not presented in full detail, she identified fourteen practices, aimed mainly at knowledge gathering by either considering more potential solutions or broadening the definition of the problem. Petre notes, that although seemingly contradictory, deliberate and systematic practices foster inspiration and innovation in the studied firms. She gives an account of why exceptional performance in design and development is rare by highlighting the complex balance among contributing factors. Specifically she draws attention to the reliance of the identified practices on expertise (particularly expert skills) and a reflective, supportive, and collaborative culture and communication among design professionals.

Hargadon and Bechky (2006) identified interactions that precipitate moments of collective creativity in organizations in a field study of six professional consulting firms (four product design and development consultancies and two management consultancies). Their evidence, collected through ethnographic methods, suggests that while some creative solutions can be viewed as the products of individual insight, others are clearly the products of a momentary collective process. In essence, their study illuminated how the locus of creative problem solving shifts between individuals and the collective. Hargadon and Bechky present and discuss four sets of interrelating activities that play a role in triggering moments of collective creativity: help seeking, help giving, reflective reframing, and reinforcing. In summary, based on the review of the literature, we find little documents addressing the presumably heterogeneous ways in which designers in the early 21st century work. Thus we see that there is a motivation to investigate the situated creative design practices further.

3. Research methods

To understand the realities of design practice with regards to different types of designers and companies, we conducted 17 interviews in Finland and the US. The interviewees represented seven different organizations, five of which were design and development consultancies and two were companies that manufacture their own products. Six of the interviewees were based in the US in three different consultancies and the remaining twelve interviewees were from four different organizations in Finland; two design consultancies and two manufacturing firms. The intention was not to be representative of any specific branch of design, but rather than to get a rich sample of different types of organizations and designers.

Typical job titles or backgrounds of the interviewees were industrial designers and mechanical engineers. However, especially in the case of small design consultancies the job descriptions or titles were not clear, with descriptions of employees such as "mechanically-inclined designer". Majority of the interviewees had worked as designers or design engineers in two to four companies during their career and they had been working as professional designers from 2 to 25 years, averaging at 11 years. Designers working as consultants for external clients and those working as in-house designers have both been included. Information on the interviewees is depicted in Table 1 on the following page.

The interviews were semi-structured. They were built around open-ended questions probing both the working habits and the utilized tools and methods of both the individuals and the companies. The focus was on the present, but reflection across the working career was also urged. The interviewees were asked to reflect on their entire career and not to focus solely on the organization they were currently employed in. The background and working history of the interviewees and the practices of the companies in terms of team composition and hierarchy were inquired. In order to stimulate recall and avoid a too abstract or generalized level, the interviewees were asked to discuss specific examples of projects they had taken part in recently or were currently involved in. The open-ended question format of the interviews served the purpose of probing the realities and real-life practices of the designers on a tangible level.

The interviews lasted between 25 and 120 minutes, averaging at 76 minutes. They were conducted at the designer's native language (English or Finnish). Straightforward content analysis was used to analyze the data. The interview transcripts were screened for reported actual, concrete practices, ways of working and utilized methods or tools. For this paper, specific attention was paid to references to social and individual activities related to idea problem-solving and framing activities. We avoided including subjects' own generalized statements or interpretations on their approaches or practices.

4. Results

In this section we describe the interview findings. We focus on the prominent practices and approaches to everyday design work, including generation of ideas and creative problem-solving. The main findings can be classified into three categories:

1) *Knowledge acquisition*,
2) *Informal and spontaneous problem framing and solving* activities as routine practices, and
3) The significance of *external representations* (i.e. models and prototypes) of the design challenge.

Table 1. Interviewee profiles

Interviewee #	Background/title	Professional work experience (years)	Country	Consulting or In-house design
1	Engineering design	7	FI	IH
2	Engineering design	25	FI	IH
3	Engineering design	7	FI	IH
4	Industrial design	13	FI	CO
5	Industrial design	14	FI	CO
6	Industrial design	7	FI	CO
7	Industrial design	10	FI	CO
8	Industrial design	11	FI	CO
9	Engineering design	16	FI	CO
10	Engineering design	13	FI	CO
11	Engineering design	17	FI	CO
12	Industrial design	2	US	CO
13	Industrial design	2	US	CO
14	Industrial design	23	US	IH
15	Industrial design	10	US	IH
16	Industrial design	7	US	IH
17	Industrial design	10	US	IH

4.1. Knowledge acquisition

The interviewees independently gather knowledge relevant to design. Knowledge acquisition was described both as an ongoing routine activity apparently driven by the designer's intrinsic motivation. The need to learn about the latest developments in the domain was taken as an integral part of practicing design profession. This activity was not always directly associated with any company or project specific goal in a contrast to more deliberate and purposeful action driven by the needs of ongoing design and development projects.

Typical sources for knowledge acquisition were the *internet*, *professional magazines*, and *books*. Designers described constantly following design websites and blogs (e.g. Core77), designer portfolios, and technology websites and blogs. A few interviewees also mentioned trade fairs or exhibitions, but this was not focal.

The motivations to learn fell into two categories: *goal-oriented* and *inspirational* search. The latter, inspirational information gathering occurred without a very specific focus and appeared mostly as maintaining and developing personal skills. Goal-oriented searches were usually motivated by pressing needs, such as the form factor of a product or mechanical solutions suitable for the project at

hand. Certain phases of projects demanded more intensive knowledge acquisition. This included benchmarking relevant solutions or related products.

Internet searches were the most typical form of information gathering and inspiration. In this context, several interviewees described design in a classical way as getting inspiration from something already existing and transferring it into a new context. As an example, interviewee 8 describes his practices of knowledge acquisition at the start of a project:

> "I end up using quite a lot of time - hours if not days - just going to the library of the university and browsing through all kinds of magazines and books they have with no specific focus. I have my notepad and pen with me and I make notes of ideas I have, like, maybe there could be something like this in the product"   Interviewee 8

None of the interviewees described any company-driven, formal knowledge acquisition practices, such as tracking patent databases. However, if the company held a patent portfolio, it was considered to be a significant constraint in their work. Exceptions to this, however, were the methods used for gathering user requirements, in which some interviewees described a disciplined use of user research methodologies (interviewees 5, 17). Other interviewees however, had a more informal approach to user research.

4.2. Informal and spontaneous problem framing and solving

Informal interactions between designers were important for idea generation, problem framing, and creative problem solving. These occur spontaneously without a prior agreement. They typically take place at the desk of an employee or in the the immediate vicinity of the work stations. A clear majority of the interviewees (interviewees 1, 2, 3, 5, 6, 7, 8, 9, 10, 13, 14) unpromptedly described a highly informal and spontaneous style to ideation and problem framing either as typical approach to or the preferred way of doing design. In addition to spontaneous discussions taking place at the work desks, informal routine gatherings, such as going out for a cigarette and coffee breaks were reported as venues for ideation and problem-solving. The following was described by interviewee 7:

> "The method I use is going out for a cigarette. That's where the problem crystallizes and the solution appears. Sometimes I go alone, but if I bump into any of the other smokers on the way, I ask for them to join me"   Interviewee 7

Structured idea generation methods were mainly to be used when working with clients or other external stakeholders. These sessions were typically organized at the start of the project or at major decision points. However, even in these cases the satisfaction level to the structured approach was not very high. Some interviewees described ideating with clients highly challenging because the client representatives were cautious and not in the right mode for creative ideation (e.g. interviewee 7). Interviewee 11, a project manager, described the ideation sessions with clients at the project initiation phase to be aimed mainly at collecting the relevant initial and background information on client needs and constraints, rather than generating new solutions. This view was supported by other interviewees who also initially focused on problem framing.

The use of structured methods or formal approaches of creative design (ideation, rapid prototyping etc.) was scarce. None of the interviewees reported actively using structured methods internally. Furthermore, more than one of the interviewees explicitly pointed that structured group idea generation methods were poorly suited for internal idea generation needs (interviewees 1, 5, 7, 11). Structured methods were seen to at times compromise the natural flow of the ideation and hinder the dynamics of building on others ideas (interviewees 1 and 5). Attempts of utilizing structured methods had in some cases been clearly rejected by the working community. Interviewee 5 who tried to inspire colleagues by providing them with commercially available methodology cards:

> "For about a week I tried giving everybody one card each day, but nobody went for them. I immediately got them back like 'you can keep your cards' (laughs) and I didn't bother pushing it for very long"   Interviewee 5

In addition to idea generation, none of the interviewees brought up utilizing structured methods for problem framing and solving unprompted. When directly asked about using them, singular instances

in which light-weight methods such as scoring attributes of different concepts to develop a concept combining the best possible set of most desirable attributes.

4.3. The importance e of external representations

The traditional skills of design, or craft, played a crucial role in creativity. The creative design practices were often initiated or facilitated by concrete representations of the idea under development. For instance sketches, visualizations, 3D CAD, and different types of physical models and prototypes. These representations were described as key means of approaching the task at hand individually and collaboratively. This often took the form of a single designer creating representations which then acted as a catalyst for collaborative work (interviewees 2, 3, 4, 5, 6, 7, 8, 9, 12, 13, 14, 15). Interviewee 8 specifically describes how these representations spark conversation and ideation:

> *"It's like a magnet when you model, draw or render something so it's visible on your screen or desk. It always attracts the others... ...it always creates discussion and debate about the possible approaches and solutions"*   Interviewee 8

The role of early prototyping and a hands-on approach is highlighted by the interviewee 15, who describes how a certain employee is often taken in to the process early on due to his ability to approach problems in a tangible fashion, which the whole team can build and reflect upon:

> *"So, if it's early on and it needs to be kind of just, he usually gets it really early on. And he's more of a tinkerer, so he'll just tinker with it."*   Interviewee 15

The need for quick external realization of ideas was wide spread. This was also intimately tied to the technology that augmented designers' abilities. The important creativity-support tools included different computer visualization tools (Photoshop, Illustrator, and CAD) but also sophisticated hardware such as 3D printers for rapid prototyping of 3D product mock-ups.

5. Discussion

In this paper we presented findings from interviews conducted with a number of professional designers globally concerning their everyday working practices. Our approach to creativity in design has been that of "nothing special" perspective (Weisberg, 2006; Ward, Smith & Finke, 1999), treating creativity foremost as a property of the output received from the design process. In this study of creative design practice, we intended to map which aspects of design creativity would be potential focal points for research on design creativity and might in future have a high relevance to design practice. We grouped our central insights from the interviews into three categories: *knowledge acquisition practices, informal and spontaneous problem framing and solving practices, and practices related to producing external representations of design.*

Our findings reveal that there are multiple practices and tools that contribute to design creativity. Some are design domain specific, some more general. The role of supporting tools seems tremendous in professional design. The long debate on the influence of CAD to creativity seems pointless. It seems that designers are ready to adapt any new technologies that will help to improve their output, facilitate the process, and improve means of communication. What's more, these creativity support tools are not only inventions specific to design, such as Wacom tablets or 3D printers, but generic tools (blogs, Google search) which facilitate knowledge acquisition. In some respect, the technologies are simple if not even dumb. They are clearly tools to be used according to the designers' best intention, not active agents in the creative process, hardly reaching the level of "nanny" in the taxonomy of Lubart for computational support tools of creativity (Lubart, 2005)

One clear finding is that for many of our interviewees, design remains independent work. There might be more demand for structured, formal creativity techniques in assignments demanding extensive group collaboration and in converging knowledge from relevant stakeholders in projects involving a large number of people. But as long as there are individual responsibilities in design, there does not seem to be a great demand for formal measures among the professionals.

Formal creativity techniques, such as Brainstorming, did not surface often in the interviews. Their role seems thus be rather subdued. However, the professionals we interviewed did indicate benefits of using brainstorming, such as the function of gathering information from clients. This suggests that

even though the formal methods have been used in professional design, the purpose of their use might have been different from what has commonly been assumed.

We also found that the studied organizations did not have a structured or a formal approach to knowledge acquisition. This is somewhat in contrast with the results of Petre (2004) whose field research in engineering consultancies documented active programs of knowledge acquisition including patent searches, technical literature reviews, and analysis of legislative requirements and regulatory standards. Interestingly, we did not observe notable differences between designers working on different regions in the three dimensions we observed.

5.1. Conclusions and future directions

Many studies of creative design have adopted a specific perspective of drilling into creative techniques (e.g. Jansson & Smith, 1991; Shah, Vargas Hernandez & Smith, 2003). This has left the overall picture of design creativity somewhat fuzzy and produced findings contradictory to design practice. For instance, research has repeatedly found brainstorming to be less efficient in producing ideas than if the individuals were working separately (e.g. Mullen, Johnson & Salas, 1991). However, by ignoring the complicated social context surrounding brainstorming in professional design, these approaches disregard some apparent benefits related to it. For instance, Sutton and Hargadon (1997) found a different reality in work place ethnographic research. They studied brainstorming as a part of the larger scale operation in the design agency IDEO. Their approach provided insights in to the factors that make brainstorming popular among practitioners that the traditional studies of brainstorming have disregarded. They found that designers were highly motivated in team work; teams allowed effective utilization of knowledge and dissemination of ideas, and working in teams supported social bonding. (ibid.) This can be taken to indicate that design companies may benefit from systematic "creativity" techniques once they are adequately modified to match the organizational requirements and adopted into everyday "routines".

The initial findings from our study of research practices show that the established methods of design (skills of design thinking in the modern vernacular) prevail. On the other hand, designers do opt in new techniques and methods as well as the general public. For instance, knowledge acquisition methods have been quit transformed since the internet sources have become available. Product designers also highly value new prototyping tools such as 3D printers.

One could ask whether formal techniques redundant in professional design? The answer is yes, sometimes. The character of design work requirements changes. Previously people have needed help to collaborate within large design teams and to work with external stakeholders. One could ask is the current information overflow presented by the internet soon overtaking individual work? Maybe some specific tools to facilitate this will emerge. Lindemann argued that creativity supporting methods and procedures should be generic (2010, p. 28). Based on the reports from our informants, it seems that there is likely demand for both specific creativity-support tools and techniques (e.g. 3D printing equivalent for electric prototyping) and generic tools such as easily utilizable electronic brainstorming tools (see Liikkanen, Kuikkaniemi, Lievonen & Ojala 2011). There would seem to be plenty of possibilities to study the utilization of different creativity-support tools, such as electronic magazines and blogs that designers utilize to update their expertise. It would be interesting to find out how the transition from printed sources and trade fairs to constant stream of digital information influences the creative output of designers.

Our findings encourage further explorations among real designers. It would seem that the studies of particular design methods, for instance ideation techniques, conducted in isolation from their real-life application context provide a biased sight on design creativity. We prefer a future orientation to creative design research in which rests on the association of research with practice. An example study in this vein is Hargadon & Bechky (2006); a study which revealed interactions between people that precipitate the moments of collective creativity. We hope to see research development in empirical and theoretical directions which can help us to advance the state-of-the-art in that line of research. Since this initial report is on the major commonalities in design, in future we hope to find and show key differences between designers and their organizations using the data we have already gathered and are currently gathering, maybe shedding light on why some design are more creative than others.

References

Akin, Ö. (1986). *Psychology of architectural design*. London: Pion.

Brown, T. (2009) *Change by Design*. New York, NY: HarperCollins.

Gero, J. S. (2010). Future directions for design creativity research. Paper presented at the *International Conference on Design Creativity* (ICDC2010), Kobe, Japan. DOI:10.1007/978-0-85729-224-7_3

Hargadon, A.B. & Bechky, B.A. (2006) When collections of creatives become creative collectives: a field study of problem solving at work. *Organization Science*, Vol. 17, No. 4, 484-525.

Jansson, D. G., & Smith, S. M. (1991). Design fixation. *Design Studies*, 12(1), 3-11.

Jung, M., Sonalkar, N., Mabogunje, A., Banerjee, B., Lande, M., Han, C., Leifer, L. (2010) Designing Perception-Action Theories: Theory-Building for Design Practice. In: K. Dorst, S. Stewart, I. Staudinger, B. Paton & A. Dong (Eds.), Proceedings of the *8th Design Thinking Research Symposium* (DTRS8), 233-242.

Kelley, T. & Littman, J. (2001) *The Art of Innovation: Lessons in creativity from IDEO, America's leading design firm*. New York: Doubleday.

Liikkanen, L. A., Kuikkaniemi, K., Lievonen, P., & Ojala, P. (2011, May 7-12). Next step in electronic brainstorming: Collaborative creativity with the web. Paper presented at the Extended Abstracts of *Human Factors in Computing Systems conference ACM SIGCHI* (CHI EA '11), Vancouver, BC.

Liikkanen, L. A., Laakso, M., & Björklund, T. (2011, October 19-21). Foundations for studying creative design practices. Paper presented at the Procedings of the *Second Conference on Creativity and Innovation in Design* (DESIRE'12), Eindhoven, Netherlands. DOI:10.1145/2079216.2079260

Lindemann, U. (2010). Systematic procedures supporting creativity - a contradiction? Paper presented at the *International Conference on Design Creativity* (ICDC2010), Kobe, Japan. DOI:10.1007/978-0-85729-224-7_4

Lubart, T. I. (2005). How can computers be partners in the creative process: Classification and commentary on the special issue. *International Journal of Human-Computer Studies*, 63(4), 365-369.

Mullen, B., Johnson, C., & Salas, E. (1991). Productivity loss in brainstorming groups: A meta-analytic integration. *Basic and Applied Social Psychology*, 12(1), 3-23.

Schön, D. (1983) *The Reflective Practitioner*. How Professionals Think In Action. New york: Basic Books.

Shah, J. J., Vargas Hernandez, N., & Smith, S. M. (2003). Metrics for measuring ideation effectiveness. *Design Studies*, 24(2), 111-134.

Shneiderman, B. (2007). Creativity support tools. *Communications of the ACM*, 50(12), 20-32.

Smith, G. F. (1998). Idea-generation techniques: A formulary of active ingredients. *Journal of Creative Behavior*, 32(2), 107-133.

Sutton, R. I., & Hargadon, A. (1996). Brainstorming groups in context: Effectiveness in a product design firm. *Administrative Science Quarterly*, 41(4), 685-718.

Ward, T. B., Smith, S. M., & Finke, R. A. (1999). Creative cognition. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 189-212). Cambridge, UK: Cambridge University PRess.

Weisberg, R. W. (2006). *Creativity: Understanding innovation in problem solving, science, invention, and the arts*. Hoboken, New Jersey: John Wiley & Sons.