Design thinking teams and team processes: Creativity through discipline

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Research

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Abstract

Design thinking is hailed as a cornerstone for innovation. It has teamwork as a basis, yet we know little of how the design thinking team operates and collaborates. In this study, we investigate both quantitatively and qualitatively 51 design thinking teams as they work on an innovation project. We seek especially how they communicate and collaborate while working with design thinking tools. Teams are divided in three according to performance. Findings suggest that the highest performing groups utilize the design thinking method more disciplined than the other groups. To achieve this, they employ more authority behaviors and less supportive behaviors than the other groups. This disciplined approach to the method as a process and employed tools (such as brainstorming) in turn enable important team processes such as team reflexivity and psychological safety. Based on these findings, we suggest that a disciplined approach at the team level towards design thinking enhance innovative performance.

Introduction

Design thinking and innovation are often mentioned together. Design thinking is hailed as a cornerstone of innovation (Brown, 2009) and, by some, as an effective tool for innovation (Tschimmel, 2012). In its simplest form, design thinking is a reasoning process that results in the creation of a product (Lee, Ostwald, & Gu, 2020). It has strong connotations of user centeredness and the concept of usability (Norman, 1988). Design thinking has been increasingly applied as a problem-solving approach to support product development teams in the early phases (Meinel, Eismann, Baccarella, Fixson, & Voigt, 2020). It can broadly be described as a creative problem-solving approach utilizing a designer's perspective including the respective principles, mindsets, methods and tools (Brown, 2008, 2009).

Although design thinking is somewhat of a buzz word, it may have been more popular in the domain of practice than in science (Meinel et al., 2020). When we add the important modifier of teamwork, research is scarce. Team design thinking is widely used and employed, but rarely researched. Collaborative design thinking has received relatively little attention in past research, and we know little of how collective intelligence operates in design (Lee et al., 2020). The potential linkages between the literature in organizational and team learning and the tools and processes advocated by design thinking's collaborative emphasis represents a fertile area for inquiry (Liedtka, 2018). The aim of this paper is thus to investigate the design thinking team. The overarching research question is therefore this: How does the design thinking team collaborate to achieve innovative performance?

The study begins with a theoretical foundation of the research followed by the re- search methodology section. After the data analysis, the findings are presented followed by the discussion section and conclusion.

Literature Review

Design Thinking – Methods For Team Communication

Design thinking may be thought of as a set of methods and specific elements that facilitate dialogue through a shared focus on users, turn-taking during conversations, and the use of visualization (Liedtka, 2017). Pezeshki (2014) has suggested that design thinking enables better conversations through a shaping and directing, allowing new possibilities to emerge, and embedding the dialogic approach. This builds engagement and trust (Liedtka, 2018). Methods are diverse and used differently, but often involve a quite structured process by which team members think individually (problem-solving) before they engage in a team debate. Often ideas should be visualized, for instance by the use of Post-It notes attached to a wall.

The process begins with the formation of heterogeneous teams that seek deep user understanding. They feed into a dialogue-based process in which insights, design criteria, and ideas are created. These ideas then move into testing and the results determine the kind of feedback response necessary (prototyping). Underlying the entire process is an infrastructure of support and facilitation (Liedtka, 2018). The structure aids and contributes to reducing feelings of insecurity and increasing comfort (Liedtka, 2017). Through an initial phase, the result is then user testing. In other words, attention is given to the end user and his/her needs and how the specific solution meets, or fails to meet, these needs. This should involve several iterations, in which problem and solution are jointly transformed. Such a process enhances the usability (Heldal, Sacramento, & Wennes, 2017; Norman, 1988).

Based on a review of design thinking practices, Liedtka (2015) proposes that design thinking generally consists of three stages: data gathering about user needs, idea generation, and testing. This is in close correspondence to what Seidel and Fixson (2013, p. 19) term "*needfinding, brainstorming, and prototyping*". Needfinding involves real user participation, through some sort of data gathering, where the aim is to understand who the end user is; what task you are designing a solution for, and how they currently accomplish it. Brainstorming is a group process that applies techniques that promote the search for new solutions that might not be possible through individual ideation. Prototyping is the process by which novel ideas are developed into a preliminary model, enabling evaluation of a given approach as well as the potential for further ideation (ibid).

In traditional design environments, visual representations, such as a sketch or drawing, can enhance idea-generation, structuring thinking and augmenting problem-solving abilities (Bresciani 2019). Visual elements (both textual and graphic) immediately organize information in preparation for communication or to provide clarity. In this context, designers continuously draw on their imagination and cognitive skills to develop new visualizations that are often based on previous representations during the conceptual design stage.

Knowledge visualization systems facilitate team communication and reasoning processes. Such systems are used to shape knowledge, to abstract, diverge, converge, structure, elaborate, and evaluate, as part of the process of building a team mental model (TMM) (Briggs et al. 2001). The TMM is part of the construct of a team's shared mental model, and represents the team's shared perception of reality (Heldal, Sjøvold, & Stålsett, 2020). Shared TMMs are structures held by members of a team that enable

them to form accurate explanations and expectations for their shared reality, which in general requires joint dialogue and shared communication.

The Design Thinking Team and Team Processes

Dialogue is central to innovation. Tsoukas (2008) argued that knowledge is created through direct social interaction. Design thinking's emphasis on collaborative tools for sense making and ideation would appear to be well-suited to facilitating such interaction. Teamwork is important for the concept. Seidel and Fixson (2013) define this collaboration as *"...the application of design methods by multidisciplinary teams to a broad range of innovation challenges..."* (p 19). (Liedtka, 2018) argues that, while significant scholarly work has appeared in design-focused academic journals such as *Design Issues*, the attention accorded to "design thinking" as a problem-solving approach within top-tier academic management publications has been scant. Though anecdotal reports are plentiful, systematic assessment of design thinking and its utility as a problem-solving approach is limited (Cooper, Junginger, & Lockwood, 2009; Johansson-Sköldberg, Woodilla, & Çetinkaya, 2013).

We know little of how newly formed teams work together in employing important design methods such as brainstorming and prototyping (Seidel & Fixson, 2013). The potential linkages between the literature in organizational and team learning and the tools and processes advocated by design thinking's collaborative emphasis represent a fertile area for inquiry (Liedtka, 2017). This is what we will pursue next. Central to innovation and team processes (Heldal et al., 2017) are the concepts of explore and exploit as well as the ability to be both creative and task-oriented. We will pursue next how design thinking methods relate to team processes of explore and exploit and relate to creativity/divergent thinking and task-orientation/convergent thinking.

Explore And Exploit, Divergent And Convergent Thinking

Explore activities involve searching, discovering, and inventing (Heldal & Sjøvold, 2021), activities that are often equated with creativity. Creativity is at the core of the design thinking process, in fact one of the important values derived from design thinking is improvement in the creativity of solutions (Liedtka, 2017). Design thinking has been described as the best way to be creative and innovate (Johansson-Sköldberg et al., 2013). Design thinking is often equated to creativity. Sometimes the popular version of design thinking is presented as a way to make managers think more creatively (Johansson-Sköldberg et al., 2013). The relationship between an individual's cognitive operations and that of a team of which they are a member, is a rich one, which has been linked to creativity (Fischer et al. 2005). The emergence and sharing of creative activities and cognitions in a social environment is also known as "co-creation" (Giaccardi, 2004; 2005). Csikszentmihalyi (1997), in his studies of creative individuals, noted that the ability to accommodate contrasting beliefs lay at the core of what differentiated these individuals. They were both playful and disciplined, both divergent and convergent in their thinking. These same tensions would later be used to describe the process of design thinking (Owen, 2007), and echo the iterative process described earlier. The process is problem- as well as solution-focused, hypothesis-driven, and interested in the particular and the concrete. It relies on abduction and expects to cycle through multiple

experiments that test a variety of solutions in an iterative way that actively works a variety of tensions between possibilities and constraints, and is best suited to decision contexts in which uncertainty and ambiguity are high (Liedtka, 2018).

Team members are also likely to engage in variance-reducing activities in an effort to exploit their current knowledge and expertise and, thereby, improve their performance. These may be thought of as exploit activities and involve task-oriented and result-oriented behaviors. In many team-based projects, there is motivation to implement exploitation practices to minimize ambiguity and manage multiple task requirements (Gilson et al., 2005; Groysberg & Lee, 2009). There is also evidence that teams need a focus to coordinate efforts. Persistent team vigor, dedication, and absorption are crucial characteristics if teams are to stay focused on their efforts (Cheung, Gong, Wang, Zhou, & Shi, 2016). A similar concept could be that of task engagement. Researchers seem to agree that task engagement is important for performance (Rodríguez-Sánchez, Devloo, Rico, Salanova, & Anseel, 2017), due to a common perspective on *motivation* around the task. Team literature cites a strong connection between cohesion and task engagement. The concept of task engagement in teams is relatively new; initial results support the argument that social resources, such as group cohesion, are instrumental in attaining a shared positive motivational state (Costa et al., 2014; Salanova et al., 2003). In design thinking, a divergent approach is one that widens the scope or breadth of consideration of an issue, encompassing more factors, possibilities and responses. In contrast, a convergent approach is one that narrows the scope or breadth of possibilities being considered, focusing on potential solutions (Lee et al., 2020). Explore may, in its essence, be similar to divergent thinking, while exploit is similar to convergent thinking. With regards to team processes and innovation, iterating between these two and/or even performing them together is important (Heldal & Sjøvold, 2021).

Iterating

Iteration is important to the design thinking team, on several levels. Teams need to be internally focused as well as externally focused (user-oriented), and employ divergent as well as convergent thinking. As explained above, creativity is being both playful and disciplined (Csikszentmihalyi, 1997), and innovation involves the ability to both exploit and explore (Heldal et al., 2017). As Csikszentmihalyi (1997) and Heldal et al. (2017) note, this create tensions and ambiguity. This translates into team processes (Heldal & Sjøvold, 2021). To overcome complexity and ambiguity, both contextually and within the team (design thinking teams are inherently multidisciplinary (Liedtka, 2017)), dialogue is of the essence. Tsoukas (2009) asserts that, given the difficulty that individuals creating their own disconfirming data, dialogue among people is key to accomplishing successful experimentation. “Thinking together,” as Pyrko, Dörfler, and Eden (2016) describe it, requires mutual engagement around a shared problem in a conversation that is shaped but not controlled, in which the willingness to share tacit knowledge is critical. Vuillemot, Rivière, Beignon, and Tabard (2021) find that visualizations and prototypes act as “boundary objects” in these conversations. Boundary objects are important cross-boundary collaboration facilitators (Heldal, 2008). Both practitioners and researchers emphasize the importance of iterations. Cross and Cross (1995) in reviewing a wide range of studies of design processes in action, noted, “*It becomes clear from*

these studies that architects, engineers, and other designers adopt a problem-solving strategy based on generating and testing potential solutions." Cross emphasized design's intense focus on problem exploration before solution finding.

These iterations of divergent/convergent thinking are difficult and even paradoxical at the team level, in that they translate into very different behaviors (Heldal & Sjøvold, 2021). As such, it is a contention that may be a basis for disagreements and even conflicts (Sjøvold & Hegstad, 2008). Seidel and Fixson (2013) finds that the better performing design thinking teams experience a higher levels of debate, suggesting that behaviors related to task conflict enhance a kind of reflexivity needed to balance creativity and task orientation. Task conflict is indeed positively related to group outcomes such as cohesion, through the exercise of voice in team decision making. An important caveat to this relationship is that the effects of relationship conflict must be minimized, as task conflict may spill over into relationship conflict (e.g., Amason, 1996; Amason, Thompson, Hochwarter, & Harrison, 1995; Edmondson & Smith, 2006; Jehn, 1995, 1997; Jehn & Mannix, 2001). The exercise of voice, or voicing up, is in turn an important factor in psychologically safe groups and has been argued to enhance both creativity and efficiency in design thinking groups (A. C. Edmondson, Bohmer, & Pisano, 2001; Stålsett, 2017). Their approach is supported by academic research that suggests that people are more open to selecting creative solutions when they are offered multiple alternatives, rather than a single one (Mueller, Melwani & Goncalo, 2012).

Aims Of This Study

Based on the previous, we argue that there is limited knowledge as to how the design thinking team actually operates as a team. Firstly, the methods suggest a disciplined and task-oriented structure related to exploit behaviors and convergent thinking. Team members are therefore likely to engage in variance-reducing activities in an effort to exploit their current knowledge and expertise and thereby improve their performance. In many team-based projects, there is motivation to implement exploitation practices to minimize ambiguity and manage multiple task requirements (Gilson et al., 2005; Groysberg & Lee, 2009). There is also evidence that teams need a focus to coordinate efforts. Persistent team vigor, dedication, and absorption are crucial characteristics if teams are to stay focused on their efforts (Cheung et al., 2016). On the other hand, it is also suggested that design thinking teams be creative, employing explore behaviors and divergent thinking. Although team creativity is intuitively dependent on creative individuals, team processes (e.g., internal communication, team cohesion and vision) have been shown to be more important (Hülshager, Anderson, & Salgado, 2009). Rodríguez-Sánchez et al. (2017) emphasize the importance of social integration processes (such as team cohesion) in this regard. The psychological safety notion of A. Edmondson (1999) builds on this argument in the same way; that group relations need to be trustful and supportive so as to avoid fear of condemning behaviors (Pescosolido, 2003).

Yet, the tension between creativity and structure is well-known and seen by some as quite a paradox (Heldal et al., 2017). At the team level, discipline-oriented and task-oriented behaviors do not normally go together well with creative-oriented and supportive-oriented behaviors (Heldal et al., 2020; Sjøvold & Park, 2007). And the risk of falling into a pitfall of imbalance is all too present. Too much structure, and

creativity is killed (Grøtan, 2014). Too much supportive behavior and you risk group think (Janis, 1982). Design thinking as a process and method may very well be suited to enable the desired team dynamics, with its emphasis on both structure and creativity. Yet, another way to look at it is that design thinking, with its attention to iterations, visualizations, and user-centeredness, involving both task orientation and creativity at once places huge demands to how teams collaborate. The overarching research question is therefore this: How does the design thinking team collaborate to achieve innovative performance?

Method

We employed a mixed methods approach in the study, both qualitative and quantitative. We will first describe the teams and the setup.

The Teams

The investigation was performed on a sample of management students with different engineering backgrounds, similar to an MBA programme. These students were randomly assigned to teams, consisting of groups of 3–5 students. They did not know each other beforehand and were randomly distributed with regard to gender, age, and engineering background. We performed a check on the students' overall ratings during the programme, with no significant differences appearing among the groups. We thus have reason to believe that students were evenly dispersed within the teams, in order that we may attribute differences in performance to team processes. All teams were explicitly performance-oriented, aiming for a top grade.

Ethical statement

Participants were asked for consent to use the results in our research and informed on which data were gathered and how they were used, that participation is voluntary, and that they could withdraw from the study without any consequences and have the collected data deleted at any point. No names were given in the reflection notes.

Table 1: Overview of respondents

The Setup

The teams' task was to: 1) come up with an innovative business idea and; 2) develop a business plan for this idea. The ideas were developed according to the framework of Osterwalder and Pigneur (2010). This is labelled a business plan canvas, and consists of a visualization tool with nine steps of business plan modelling that are to be performed iteratively. The canvas was simplified into four steps: 1) product idea; 2) customer; 3) partners; and 4) economic profile. The teams followed a core framework of design thinking as follows:

- Needfinding – teams were asked to think of an idea individually that would resolve an everyday problem for a specific user. Come up with as many ideas as possible.

- In idea generating phases, ideas were noted individually on sticky notes that were attached to the Osterwalder Canvas at the wall. Discussion and reflection together could then follow, employing a brainstorming process.
- The whole process had several idea generating phases (following the steps in Osterwalder mentioned above)
- After each idea generating phase, participants were encouraged to single out one idea to pursue (for instance choosing one customer group)
- The four steps mentioned above should be iterated as many times as necessary (as judged by the teams themselves).
- All teams were encouraged to involve end users as much as possible (and other relevant actors that could offer information) through prototyping and/or other involvements (observations, interviews). All user interactions were logged, all teams had extensive activities externally.
- The Osterwalder Canvas (explained above) was used as a visualization tool. All teams worked with the canvas in an A3 format either hanging on the wall or laid out on a table
- All teams employed story-boarding as part of the process (sketching up the process through either a drama, video, or cartoon). The user-story was “performed” in a 8 minute long pitch, by which the business idea was to be presented to the business developer.

All teams were encouraged to work iteratively with potential customers and clients, as the core idea of design thinking (Head & Alford, 2013). The business plans were assessed by one or two professional business developers according to the following criteria, in line with the framework of Sørheim and Botelho (2016): is the business idea sufficiently new and innovative? Is there a market/customer need for the idea? Do we possess the right resources in our team? Is the financial plan thoroughly worked through? Each of these were rated on a scale, with the options being: A (excellent); B (good with some flaws); and C (mediocre). Plans were, as a whole, subsequently rated as follows: (A): the business idea and corresponding business plan are good enough to be further continued/developed; (B): the business idea and corresponding plan have some merit, but need some work or changes; and (C): Do not invest in this plan. The level of the A's approached levels of “real” business ideas and some later turned into business ventures. Quantitative findings are based on the SPGR instruments, while qualitative assessments are based on observations, notes from the coaching sessions, and analyses of the reflection notes.

Quantitative Measurements

The Systematizing Person-Group Relations Instrument (SPGR) was used for data gathering and investigation (Hare, 2003; Sjøvold, 2007). The teams were all measured with the SPGR instrument (as described below) one week after the start of the study and one week before the presentation of the plan. According to Seidel and Fixson (2013), some teams may do well in the conception phase but fail to maintain performance in a later phase. We wanted therefore to employ measurements in more phases. The survey was distributed electronically. The time span of the process was 8 weeks. After the first test,

teams were informed of the results and asked to reflect on possible measures. In the second session, the groups were encouraged to reflect on the effect of their chosen actions and resulting dynamics. Teams were also required to hand in reflection notes at the end of the process.

The SPGR process is based on the semantic differential scaling technique established by Osgood, Suci, and Tannenbaum (1957). Earlier studies (Koenigs, 2000; Sjøvold, 2007) have described the validity and reliability of the SPGR tool, and the instrument has been used in different settings (Andre & Sjøvold, 2017; Heldal, Sjøvold, & Heldal, 2004; Schultz Joseph, 2017). The subsequent detailed appearance of the SPGR tool is presented similarly to the methodological descriptions in an earlier study (Snider & Osgood, 1969). The SPGR scale consists of 24 items describing team interactions/team behaviours. Each item is rated on a scale of the interaction, described as occurring never or seldom (1), sometimes (2), or often (3), where each group member rates each person within the group accordingly. This results in a profile of each group member's interactions within the group. The 24 items are, for analytical purposes, synthesized into 12 functions. These are described in Table 2, with links to previously presented theories. The Cronbach's alpha for the questionnaire in this study varies from 0.78 to 0.92, dependent on the subject in question.

Table 2: Overview of SPGR functions and theoretical connections

Qualitative Assessment

All groups were observed by the author twice, following the team tests. Groups were asked to explain team results and reflect on own performances. During these observations, notes were taken in situ, observing actions rather than interpretations (Tjora, 2006). The aim here was to understand the dynamics of the groups and how they reflected on what was important for them. Important factors that were attended to using the framework of Sjøvold (1995) were communication in terms of: who speaks and when; do they address each other; are they forward-leaning; are they attentive to tasks at hand; are they easy-going or serious. Groups were also asked: 1) How do you judge own performance; 2) How do you attend to the proposed plan (design thinking) and 3) If anything – what would you improve? We wanted to investigate levels of inclination towards task orientation/structure vs. well-being/feeling of content/creativity and how they related to the design thinking methods. In the reflection notes, we sought reflections related to the factors mentioned above.

All notes were material for textual analysis. The texts were analyzed according to Tjora (2017), using four steps. First we developed what Tjora (2017) calls empirically close codes; small snippets of text representing elements in the texts. We then extracted from these five themes: 1) focus of loci; 2) attention to learning; 3) group climate; 4) measures taken; and 5) own perception of performance. From these, we developed what Tjora (2017) calls a concept, a metaphor close to the final conclusion. The reason behind this is to reach a more generic and abstract understanding of the data (Tjora, 2017, p. 72). We developed a concept for each of the groups: *A-groups – the impatient, systematic and challenging groups*; *B-groups – the wanderers*; and *C-groups: The happy go lucky*. The overarching concept was: *the disciplined design thinking team*. Concepts are possibly understood as legitimate results (Glaser, 1992), as well as a basis

for theory development. Here we use them also as illustrating metaphors for what we later will present in the findings section. The fourth and last step, termed theory development, involved the understanding of the concepts and the themes in light of previous research.

Results

We will first present findings from the qualitative assessments of the groups and then the findings from the quantitative analysis.

Qualitative Description Of The Groups

Although the groups worked in similar fashions with regard to the design thinking methods, there were visible differences between the groups related to being either a C-group (poor performers), B-group (mediocre performers), or an A-group (top performers). Our general perception of the groups was that the A-groups were impatient and disciplined; the B-groups were motivated but drifting; and the C-groups were self-content and happy.

C-Groups: The Happy-Go Lucky

Albeit aiming for performance, these groups started their projects with an attention to team-members' well-being and enjoyment. When asked, they indicated that this was intentional. Their aim was to build a safe and cohesive group, within which it was safe to be creative. Within the initial task of coming up with ideas through needfinding, they also managed to build upon each other's' ideas through brainstorming. However, all ideas were supported, with the underlying intention of keeping the sense of well-being in the group. This apparently created a problem for these groups, in that they could not manage to disregard poorer ideas and continue with fewer, or even a single idea to develop further. This led to significant losses of the initially high energy levels within the groups, because they became resigned and fell into a kind of stalemate. They managed to develop their projects and deliver, but as time went on they were mostly characterized by passivity. Despite apparent energy losses, these groups openly expressed their happiness with the group and regarded themselves as top performers.

With regard to design thinking, these groups started not with an attention to the process and task at hand, but rather with the intention of building cohesion. The intention was to build a basis of knowing each other, upon which they could later collaborate. One group expressed this as follows:

"...Early in the semester, during the "forming phase", the group emphasized getting to know each other and being liked. In the beginning, there was not as much focus on working hard on the tasks, but instead learning about each other. Furthermore, in the development of the group, we may have been a little too caring and it has not been the norm in the group to express dissatisfaction or to have strong opinions about how tasks should be solved. If we had had a more task-oriented leadership role, the efficiency of the work would probably have increased..." (Reflection note C-group 1)

The concept of "flat structure" was important for these groups, meaning that they did not want an authoritarian leader. This was thought to be of essence for the groups' wellbeing, and the ability for all of

them to join decision-making and participate in co-creating the idea. As time went on however, as C-group 1 expressed in the quote above, this developed into low efficiency. One of the other groups stated:

"...The group started working early with well-being among the members and focused on creating trust in each other. This was extra important as the group wanted a flat structure, and everyone had to be able to take the leadership role without being met with unnecessary skepticism..." (Reflection note C-group 5)

A large part of what these groups thought to be a success, was their attention to the social. That meant that one of the things these groups actively paid attention to was nurturing of the group members (literally), often appointing this as a dedicated responsibility. This was not only at the start, but continued on as the project developed. Even if some may have had the intention of being more task oriented, they seemed to enjoy this mode of working and also crediting their performance to this emphasis. One of the groups reflected:

"...The social responsible's... ..responsibility of bringing cake to the meeting at the end of each week has been a success. This creates a climax at the end of each week, which the group members look forward to and work towards. In our group, it has been experienced that the group members build each other up due to the cake responsibility. Complements are given for the work the social responsible has done, and this also spreads to professional work with the task at other times of the week..." (Reflection note C-group 2)

A-groups: The impatient, systematic and challenging groups

The most salient characteristic of the top-performers, was their dynamic in approaching teamwork, combined with a disciplined structure towards the process. One group had to split up because one of the members was ill and had to work from his home (the whole period). Another group consisting of three members, decided after two weeks that they could not work together. They split up, with two of the members working together while the third member worked alone - coming together only to decide on deliverables and future tasks. The other groups would co-work along the whole spectrum from splitting up to being together most of the time. Characteristically these groups worked in a systematic and disciplined manner with task-orientation but also with team relationships. For instance, many of these groups fixed team roles early (only two of the groups did not) and employed more formal roles than the other groups.

With regard to design thinking, these groups were the ones most attentive to performing the process "by the book." For instance, the brain storming processes were always concluded with the selection of one idea. All ideas were visualized (leaders were attentive to everyone using the sticky notes and adhering them to the wall). Iterations were performed methodically. However, with regard to team processes, it could look very different, as explained above. When asked, these groups would typically answer that this was how they could best manage the design thinking process, solving the problem for the customer. (In contrast, the C-groups would put the teams' wellbeing in front). Only one of these groups had an espoused emphasis on social well-being within the group.

The A-groups would employ a leader (as did some of the others), but also a secretary and some even a devil's advocate role. A clear structure appeared in how they rotated on these roles. Leaders were firm and authoritative. In contrast to the C-groups, these groups were quick to decide on the business idea to be developed. This necessarily involved firmness and the discarding of some ideas. They worked on challenging each other, both with tasks (e.g. deliverances) and team relations (e.g. performing the role) from the very start. Approximately half of the groups were, by coincidence, subjected to adversity they had to overcome. Common for these, was that they dialogued and communicated through the adversity, employing honest feedbacks. The other half did not experience adversity, but still in much the same manner communicated and dialogued with honest feedback.

Observing and conversing with these groups would take the form of an almost eager impatience and a reported list of things (from the groups themselves) that could be done better (how can we be satisfied when we have so much to improve?). The A-groups were never completely satisfied with their work and group, and always showed an eagerness to improve. And this improvement and discipline was, in essence, connected to using the design thinking process and the best adapted team dynamics. The latter could, as described above, differ among the groups. These groups apparently also spent a lot of time in discussing and reflecting on the best way to move ahead. In contrast, this was not perceived as necessary for the C-groups.

"...The group gathered to discuss how the rotation of leadership role should be carried out, as well as what requirements should be set for the leadership role. Through this process, one person was very clear on what he expected from the others. Great demands were made on what had to be met by them, and if those expectations were not met, this person expressed that he had to intervene to take over the leadership role..." (Reflection note A-group 7)

This kind of toughness and directness characterized the dynamics in these groups, without turning into conflicts. They were accustomed to this way of communicating and agreeing on challenging each other.

"...At present, we as a group have raised more sensitive and uncomfortable topics to challenge each other..." (Reflection note A-group 13)

B-Groups - The Wanderers

Compared to the C-groups, the B-groups did not openly express an attention towards well-being and being top performers. They were more similar to the A-groups' impatience and eagerness to develop, and were, as such, pro-active and forward-leaning. In developing ideas, they managed to both come up with a lot of ideas and choose one to go forward with. However, they seemed less firm and structured (than the A-groups) in doing this, and some groups experienced retaking discussions on ideas that were disregarded. They could also seem more task-oriented than the C-groups, more attentive to the work that had to be done, but at the same time also experienced misunderstandings with their intentions. As a whole, these groups displayed many of the same characteristics as the A-groups, but did not seem to employ them in a systematic and structured fashion. For instance, one of the things that distinguished the A-groups was

their ability to challenge each other and each others' views; an attention to psychological safety that the B-groups would try to emulate. However, not whole-heartedly and not systematically. Many of these groups would, for instance, use a "devil's advocate," a role that should challenge the group's ideas. In contrast to the A-groups though, the B-groups would try this as an idea (maybe doing it once or twice) and then disregard it. Some of these groups were satisfied with their performances; others were more indifferent.

With regard to design thinking, these groups were attentive to the process and the task at hand. However, their mindsets seemed more drifting as they would not manage to maintain the discipline necessary to stay with their tasks. This could be seen, for instance, in how they related to iterations. Many of these groups followed a more linear path in their product development, which resulted in few improvements and developments from the original idea. The A-groups, in contrast, would often end up with solutions very different from what they started out with. Where the C-groups were content and not seeking any improvements, the B-groups on the other hand could acknowledge that they needed improvements and suggest actions to be taken. However, as opposed to the A-groups, they would often not stick to the program:

"...The group members believe that the group discussions could have been more effective if they had a person who led the discussions and resolved the group's derailments. The group members also lacked a person who would have followed up the execution of the tasks and would have set clear expectations and goals for each group member..." (Reflection note B-group 20)

This tendency to drift was by most attributed to not only the lack of a clear structure having a leader or a person that could finalize decisions, but as reflected by some a fear of performing this role too authoritarian:

"...Even though the group decided to have a leader, the division of roles in the group in practice has had a flat structure. We believe that this was because the group members were not well enough acquainted with each other at the beginning of the collaboration and because of that they were careful to take on the leadership role. The group did not have a clear picture of, or a standard for, how a group leader should be and what functions he or she should perform. The group members who had the leadership role were therefore afraid of appearing too totalitarian and demanding. Often there was uncertainty about who was actually the leader at the moment. This led to the leadership role becoming quite weak..." (Reflection note B-group 4)

This acknowledged lack of structure was common for these groups. Another important characteristic was that they, in hindsight, could reflect on improvements. The A-groups in contrast had on-going reflections; while the C-groups did not acknowledge any improvement factors. The above-mentioned lack of structure and discipline in performing the leadership role, reverberated also in weak performance of other roles, for instance the Devil's Advocate. As reflected above, some reason was attributed to being insecure of each other, while others attributed this to a lack of task orientation:

"...In the start, it would have been advantageous to structure the working days better and specify smaller sub-goals... ...We assume that with better planning and structure, the time pressure towards the submission deadlines would be easier. We see in retrospect that it would have been positive if we had had a more task-oriented focus earlier in the project, and used the role of the devil's advocate more actively..." (Reflection note B-group 11)

Quantitative Findings

In this section we will present the results from the SPGR questionnaire. These measurements were performed in the first week of the project, where the main task was to conceive of a possible business idea; and in the second to last week of the project when the main task was to finalize the project and rehearse a pitch.

Table 3: Measures of team behaviors

First week (1 of 8)

First, there is only a weak statistical difference between the groups with regards to the N2 vector - creativity. The A-groups are however, by this measure, the most creative, although observations suggested similar usages of initial phases of brain storming (coming up with ideas). Findings suggest further that C groups work significantly more than A and B groups in this phase towards group conformity. This shows in their significantly higher scoring in the D2 vector, which denotes interactions oriented towards acceptance of the group and conformity. A similar but opposite tendency is shown in the O2 vector, which denotes interactions that promote the individual self/self-promotion. Although the significant difference is not as strong here, A together with B groups are significantly higher on this vector. This attests to the higher levels of confrontations already from the start with the top-performers. A-groups differ significantly from the other groups with regards to higher levels of C1 (Control) and Task-orientation (C2). This suggests that A-groups have worked more methodically and were more disciplined (C1) with attention to the achievement of a result (C2) already from the start, while the C-groups emphasized getting to know each other and building a positive climate. These findings correspond with observations of the brain storming process. The convergence of many ideas to one require a discipline and confrontation when needed, as exemplified by the top performers.

Last week (7 of 8).

In this phase, there are no statistical differences in D1 (task conformity). All groups work similarly with regard to task orientation. However, C-groups continue to show significantly more conformity behaviors (D2) than the A-groups, with the difference that B-groups here show more similarity with the C-groups (B/C groups are together lower than A-groups at the 0,1 level). A and B groups continue to be significantly higher in self-promoting behaviors (O2) than C-groups, and critical and opposing behaviors (O1). Taken together with the conformity behaviors, it suggests that A-groups demand more of each other and that voicing up behaviors is not a problem with regard to unification around a common task. Some reason

may be the accompanied discipline exerted by the A-groups. A-groups differ from the C and B groups, with a continued significantly higher level of authority and discipline-oriented behaviors (C1). Even if the graphical figure shows large differences in task-orientation (C2), there are no significant differences. Taken together with the other findings, it suggests all the same that A-groups show a unity in performing, through a coordinated (disciplined) approach. Individual contributions are still promoted, and they demand more from each other than the other groups. This corroborates the qualitative findings, in that temperatures were quite high within all groups approaching deadline. Contrary to B and C groups however, the rough behaviors of the A-groups translated into constructive discussions; while for others could lead them into a state of quarrel or dispute (as happened with one of the C-groups). But more often than not would especially the C-groups refrain from these kinds of behaviors, either not acknowledging them or perceiving them.

Discussion

How does the design thinking team collaborate to achieve innovative performance? Our investigation seeks to answer these questions through two important tenets of design thinking, visualization tools and iterations between divergent and convergent thinking.

A general conception of design thinking teams is that they are driven by creative processes, or at least employ methods that elicit creativity necessary for innovation purposes (Stålsett, 2017). Our results suggest that these teams actually spent little time doing this, compared to other things. Creative behaviors were significantly lower than other team behaviors. We will argue that a reason may be found in *how* they worked with creativity. Qualitative data suggests that, for instance, brain storming was used by all groups; the difference was how they used it. Findings suggest that coming up with ideas and playing with them, and generating ideas was unproblematic for the groups. What all groups struggled with, however, was turning several ideas into one, or in other words, going from divergent thinking to convergent thinking (Lee et al., 2020). All groups visualized notes attached to the business canvas, making all ideas visible for the whole team. Visual thinking techniques potentially support both divergent and convergent collaborative tasks (Eppler & Kernbach 2016). That is, design thinking in teams relies on visual representations for idea generation *as well as collaborative analysis and decision-making*. And innovative teams, while relying steadily on being creative, also need attention to structure and task orientation (Heldal & Sjøvold, 2021). What we find here, is that the visual representation indeed enabled idea generation (easy for the teams), but that the shift to analysis and decision-making required discipline and task-orientation (more difficult). The top-performers (A-groups) were significantly higher on these behaviors than the rest, suggesting a value in following the design thinking method structurally and disciplined. There is probably little room for the kind of spontaneous, free venturing into unknown spaces, and creativity is firmly posited within preplanned frames. Dialogue is, in this fashion, shaped, but not controlled (Pyrko et al., 2016).

It is important also to understand how the teams worked to achieve cohesion or team feeling. Anderson, De Dreu, and Nijstad (2004) argued that strong cooperative norms through discussing and building on

each other's ideas contribute to creative success (instead of pursuing individual goals). Hülshager, Anderson, and Salgado (2009) advocated the importance of cooperative behaviors and a supportive atmosphere for creative and innovative activities. Results indicate that these behaviors were clearly accentuated, although indicating an inclination towards the task-orientation and discipline of the top performers. A possible interpretation of the quite low attention to creative behaviors in combination with high cohesive behaviors, is that design thinking teams need to follow a quite structured process based on tools and achieve a form of task cohesion. We reason that the A-groups' ability to achieve cohesion was through their systematic and disciplined approach to the task, in a kind of structured cohesion around the task. The poorer performing C-groups, on the other hand, built cohesion around the notion of well-being and fun. Rodríguez-Sánchez et al. (2017) clearly supports this thesis with regard to team performance in general, and argues that the collective engagement around a task enhances the intrinsic motivation. The design thinking teams in our study, in general, focused much of their attention on being task-oriented and employing the methods at hand. Here, the best teams also showed significantly higher attention to the need of discipline and structure for the resolving of task, getting more structured and disciplined further on in the project.

Some results even indicate that the C-groups' attention to wellbeing impeded a transition to being more task-oriented when needed, and that this is a question of discipline and authority. Hackman (1992) notes the potential positive effect for cohesion, highlighting however the importance of compliance to an accepted authority in the group. This ability to work disciplined with the methods, both creative and task-oriented, resonates with effective team processes that are quite advanced. Exploring (creativity) and exploiting (task orientation) behaviors are best performed together, which is difficult or even paradoxical (Heldal & Sjøvold, 2021). The difference between the groups of our study, was that the poorer performing C-groups showed fewer authority behaviors at the team level, while the high-performing A-groups showed more. It is possible that they employed authority with a basis in their task cohesion, and that this helped them in sticking with the design thinking method even when processes were not so pleasant. Arguably, some reason may be attributed to the employed tools of visualization. The use of visual thinking is important in design thinking, and aids in structuring ideas and representations (Lee et al., 2020). The word structuring is important here, as it points to the importance of convergent thinking. Only the best achievers managed the transition to convergent thinking, choosing ideas to discard. This necessarily presupposes some kind of discipline and authority in the team processes, without ruining the collaborative climate. As such, especially the convergent thinking part seems to require elements of psychological safety, the ability to voice concerns and be critical (A. C. Edmondson et al., 2001). Further, previous research has shown that visualizations serve as "boundary objects" (Vuillemot et al., 2021), which in turn facilitate cross-boundary collaboration (Heldal, 2010). It is possible that the A-groups' task orientation, which involved disciplined attention to visualization, actually contributed to them achieving higher levels of cohesion without a conscious attention to it. The C-groups on the other hand were less disciplined in employing this method, with more attention to cohesion building behaviors. The latter is a well-known trigger for lapses in team performance, through, for instance, phenomena such as group think (Janis, 1982).

We will next discuss how the teams managed to work iteratively in relation to the end user; important tenets of the design thinking method (Norman, 1986). The important factor here is how the teams collaborated to achieve psychological safety. This argument is interpreted and seen with the observations of conflict behavior in the groups. In fact, collaborating and being direct, without fear of condemning, is an important factor of being creative together (Pescosolido, 2003). The best performing groups employed more of these behaviors than the others. Seidel and Fixson (2013) suggested that high levels of debate were associated with high levels of reflexivity, which in turn enabled high performance. Although none of the groups spent much time on conflict behaviors, the best performers showed more of these and also gave greater attention to being disciplined and task oriented from the start. As such, it is possible that they soon adopted a norm of being psychologically safe (A. C. Edmondson & Lei, 2014), an ability to openly express one's opinions. This attribute is essential for the design team to be creative, because it mitigates group conformity (Stålsett, 2017). It is possible that the visualisation of individual ideas has mitigated the effect of group conformity, but this in turn hinged upon the teams' ability or motivation to do this in a structured way. We interpret this also as a clear sign of the importance of being reflexive for team performance, as also found by Seidel and Fixson (2013). The top performers maintained a continuous reflective dialogue on the best way to move ahead, and importantly did this in an honest and direct way. Arguably, they experienced levels of task conflict (Dreu & Weingart, 2003), but employed this in a constructive way by being task-oriented and disciplined. As such, they worked continuously with developing shared mental models, both at team and task level, which is important for team performance in complex team tasks (Heldal et al., 2020). It is possible further that the top-performers' more conscious use of visualization of ideas on the post-it notes contributed to constructing the team mental model, as this contributes to the sharing of tacit knowledge (Pyrko et al., 2016). These internal honest feedback loops are, at the same time, characteristics of teams' ability to communicate also externally and establish external relationships (Ancona & Bresman, 2007; Sjøvold & Park, 2007). This is, at the same time, a basis for the user-orientation of design thinking. All groups oriented towards their end users, but arguably the top performers managed to incorporate user opinions more constructively. The phenomenon is suggested to be a matter of trust (Sjøvold & Park, 2007), as in-group relationships has strong connections with also out-group relationships.

We conclude our discussion, based on the above, with the following argument: Design thinking is thought of as a structured process to achieve creative and user-oriented solutions. We find that this corresponds and mutually enhance internal team processes, although with an emphasis on task orientation, discipline, and structure. We argue that design thinking may be thought of as a disciplined and task-oriented process, that elicits creativity (and not the other way around). Previous research has hailed the creativity part of design thinking; we advocate here a more nuanced approach to the task-orientation and discipline of design thinking. Design thinking is further thought of as a highly iterative process, alternating between coming up with ideas and testing them out. This also corresponds to internal team processes, showing an iterative process between divergent and convergent team thinking behaviors. The ability to combine these paradoxical behaviors, is enabled through on-going reflective internal discussions, the ability to be honestly reflexive with other team members. This in turn enables important iterations necessary for high

performing of team design thinking, having the psychologically safe base to be externally oriented and user centered. It may be suggested that this also goes the other way around – they mutually enhance each other. Sjøvold (2007) in fact argue that teams that are externally oriented, enhance internal trust relationships.

Conclusion

The design thinking team is a problem-solving and task-oriented group, employing specific methods and discipline to achieve a common goal. There is space for creativity, but the idea of wild and joint brain storming does not seem to fit with the design thinking team. The design thinking team that performs is rather disciplined, structured and authoritative, also in their approach towards creativity. The important keyword here is the design thinking concept of iterations, which translates well into flexible team processes. It is probable that methods of visualization contribute to balancing creativity as an iterative process, aiming at the end goal of solving a problem for an end user as well as coming up with new solutions. All in all, we find that the design thinking method not only combines well with well-known team performance factors related to innovation, they may enhance each other. Important however are elements of authority and discipline to stick with the process, and honest team reflexivity as an open dialogue.

Abbreviations

SPGR: Strengthen the Person Group Relationship

Declarations

- Availability of data and material

Quantitative data is available upon request.

- Competing interests

There are no competing interest

- Funding

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- Authors' contributions

Only one author

- Acknowledgements

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Tables

Table 1: Overview of respondents

	Number of persons	Number of groups	Number of ratings
A-groups	79	19	350
B-groups	96	23	415
C-groups	39	9	171
Total	211	51	936

Table 2: Overview of SPGR functions and theoretical connections

SPGR function name	Team behaviors
C1 – Task-orientation	Analytic, structured, logical, task-oriented, time-oriented, neutral, punctual
D1 - Loyalty	Willingly working, following norms, trustworthy, precise
S1 - Engagement	Inspiring, motivated, lively, involving other opinions, solution-oriented, positive
S2 - Empathy	Open, involving others, smiling/laughing, actively listening, encouraging others, interested in others
D2 - Accept	Accepting group norms, listening, recognizing others, giving into others, grateful, asks for help
N1 - Nurture	Openly attentive to other's needs, supporting others, offering help, offering trust, offering a snack
N2 - Creativity	Intuitive, dramatic, spontaneous, looking for absurdity, experimenting, breaking norms
O1 - Critique	Openly disagreeing, doubtful, attentive to aberrations, challenging norms, questioning authority
W1 - Resignation	Non-talkative, not participating, non-responsive, passive, low confidence
W2 – Self-pity	Sad, complaining, expresses sorrow and disbelief, self-pitying
O2 – Self-promotion	Demanding attention, rough, rigid, aggressive, tough, individualistic, blunt, brusque, stepping on others
C1 - Control	Steering, controlling, authoritarian, rule managing, agenda setting, time-limit-oriented

Table 3: Measures of team behaviors

Team behaviors			A-groups (M)	B-groups (M)	C-groups (M)	Significant differences
Accept	D2_1	Round 1	3,30	3,36	3,65	C1>B1 (*); C1>A1(*); C2/B2>A2 (**); C1>C2(*)
	D2_2	Round 2	3,34	3,42	3,49	
Nurture	N1_1	Round 1	3,23	3,08	3,38	B1<C1 (*); A1<C1 (*)
	N1_2	Round 2	3,23	3,19	3,31	
Creativity	N2_1	Round 1	0,43	0,40	0,25	A1/B1>C1 (!); B2>B1 (**); C2>C1 (*)
	N2_2	Round 2	0,51	0,71	0,45	
Critique	O1_1	Round 1	0,70	0,56	0,36	A1>B1 (*); A1>C1 (*); B1>C1 (**); B2/A2>C2(*); A1<A2 (**); B1<B2 (**); C1<C2 (**)
	O1_2	Round 2	0,84	1,04	0,62	
Selfpromotion	O2_1	Round 1	1,21	1,10	1,00	A1/B1>C1 (*); A2>C2 (*); B2>C2 (*); B2>B1 (**)
	O2_2	Round 2	1,21	1,45	0,96	
Control	C1_1	Round 1	1,61	1,45	1,26	A1>B1 (!); A1>C1 (*); B1>C1 (*); A2/B2>C2 (*); A2>C2 (**); A1<A2 (**); B1<B2 (**); C1<C2 (**)
	C1_2	Round 2	1,84	1,75	1,47	
Task orientation	C2_1	Round 1	2,80	2,77	2,58	A1/B1>C1 (*); A1>C1 (*)
	C2_2	Round 2	2,81	2,86	2,62	
Loyalty	D1_1	Round 1	3,22	3,11	3,34	C1>C2 (**)
	D1_2	Round 2	3,15	3,11	3,15	

** Significance at the 0.01 level; * Significance at the 0.05 level; ! Significance at the 0.1 level

A1=A round 1 (n (ratings)=350); A2 = A round 2 (n=343); B1 = B round 1 (n=415); B2 = B round 2 (n=415); C1 = C round 1 (n=151); C2 = C round 2 (n=151)

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