



DESIGN THINKING - A PARADIGM

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Abstract

Design thinking has received an increasing amount of attention in both practice and academia. Previous research has successfully pointed out design thinking is vaguely and diversely defined, presenting eight different discourses. Although design thinking has been viewed from different perspectives with diverse results, much current research use the terms of design thinking without clarification of the relation to one another; this creates confusion. With this paper we clarify design thinking. Through a review of key literature and a conceptual synthesis, we show design thinking is not merely a process or either of eight suggested discourses – but all of them. Thinking like a designer is a paradigm, which may materialize in various forms. It is a way of seeing and interacting with the world. It is a world-view. By categorising central themes from key literature, we add to the current discussion with a coherent conceptual framework of design thinking. A taxonomy of the design thinking paradigm, which provide clarity of levels, since there in current literature are no clear distinction between the fundamental paradigm, methods and practical tools and techniques of design thinking.

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1 INTRODUCTION

The concept of design thinking has received an increasing amount of attention in both practice and academia, particularly outside the design field itself. Evidence of the growing attention can be seen in the rise and popularity of d.schools (Korn and Silverman 2012), the broad application in business practice (Martin 2009) and the growing number of studies in adjacent fields, such as Carlgren (2013) studies on how design thinking can be used to build innovation capabilities. However, what also emerges from the body of evidence on design thinking is that the concept has not yet been clearly and consistently defined. Recent research has identified a total of eight different discourses (Johansson-Sköldberg et al. 2013):

- The creation of artifacts (Simon 1969)
- A reflexive practice (Schön 1983)
- A problem-solving activity (Buchanan 1992, Rittel and Webber 1973)
- A way of reasoning and sense making (Lawson 2006, Cross 2006, 2011)
- The creation of meaning (Krippendorff 2006)
- A way of working (Kelley 2001, 2005, Brown 2008, 2009)
- An approach and skill for managers (Dunne & Martin 2006; Martin 2009)
- A management theory (Boland & Collopy, 2004)

Since different researchers have different understandings of design thinking, heterogeneous semantics occur. When people read different meanings into the concept, it creates ineffective communication and becomes a barrier in research and operationalization of the concept. According to Parsons and Shils (1962), the theoretical foundation of a field can often be placed within a hierarchy ranging from: Ad hoc classification systems (labels that categorise and summarise empirical observations), taxonomies (describe relationship between categories), conceptual taxonomies (offer explanation or predictions) and theoretical systems (laws or formal theories). As much of the current research still merely summarises empirical observations, the theoretical explicitness of design thinking is still ill-defined (Dorst 2010). Design thinking is overused and vaguely defined outside the design field, and taken for granted within the design field itself (Johansson-Sköldberg et al., 2013). To enhance the usage of the term, a precise and clear taxonomy of design thinking is needed.

2 RESEARCH OBJECTIVE

The aim of this paper is to bring clarity to the concept of design thinking. By identifying and categorising core themes from key design thinking literature, a clear taxonomy is proposed.

When conducting research, a better understanding of the different levels of design thinking will allow us to specify and clarify which aspect of design thinking is actually being studied, and to be able to conclude, compare and synthesize findings from different studies. With this research objective in mind, the following research question is stated: **What are the core themes of design thinking and how may they be organized in taxonomy?**

3 RESEARCH DESIGN

The research process was divided in two basic steps. Firstly, key contributions of the design thinking field were identified, and secondly, a taxonomy that explains the relation of central themes were developed.

In order to identify key contributions of the design thinking field, a literature search was conducted. Searches were made in Web of Science and EBSCO Host (Academic Search Premier and Business Source Complete) for the literature published before 15th of March 2014 with the words ‘design thinking’ OR ‘designerly thinking’ in the title. This resulted in a vast number papers of which the majority concerned experimenting or implementing design thinking in other contexts. Since the objective was not to review all literature to collect every little detail of the designing thinking field and understand how it is utilized in other fields, this search did not contribute with any conceptual elements to the design thinking field. It did, on the other hand, identify the central themes in the core literature that are commonly used as key stances for argumentation and explanation of the design thinking concept.

The focus of the literature review was to collect definitions used in the papers and to identify key references that are commonly used as key stances for argumentation and explanation of the design thinking concept. A final list of 15 core works that contribute to defining the design thinking concept were selected. The final selection of key literary works was made upon evaluation of their role in current design thinking studies, i.e. studies that are highly referenced when defining design thinking. The 15 selected works can be seen below:

1. Boland, R., and Collopy, F. (2004). *Managing as Designing* (book, cites 314)
2. Buchanan, R. (1992) *Wicked Problems in Design Thinking* (peer-reviewed Journal, cites 803)
3. Brown, T. (2008) *Design thinking* (peer-reviewed Journal, cites 729)
4. Cross, N. (1982) *Designing ways of knowing* (peer-reviewed Journal, cites 382)
5. Dorst, K. (2011) The core of 'design thinking' and its application (peer-reviewed Journal, cites 43)
6. Dunne, D. and Martin, R. (2006) *Design Thinking and How It Will Change Management Education* (peer-review article, cites 213)
7. Kelley, T. (2001). *The Art of Innovation* (book, cites 870)
8. Krippendorff, K. (2006). *The Semantic Turn* (book, cites 591)
9. Lawson, B. (2006) *How Designers Think* (book, cites 2373)
10. Martin, R. (2003) *The Design of Business* (book, cites 138)
11. Rittel, H. and Webber, M. (1973). *Dilemmas in a General Theory of Planning* (peer-review article, cites 5527)
12. Rowe, P. (1987) *Design Thinking* (book, cites 685)
13. Schön, D. (1983) *The Reflective Practitioner* (book, cites 499)
14. Simon, H. A. (1969) *The Science of the Artificial* (book, cites 669)
15. Verganti, R. (2009) *Design Driven Innovation* (peer-reviewed journal cites 112)

A categorization of the type of literature (book/peer-reviewed journal) and the evidence of impact through the number of citations (the 15th of March 2014) is listed. Due to the diversity of literature, the number of citations were gathered through Google scholar. We were well aware of the fact that Google scholar might be citing to non-academic work, however since part of the key references can be considered non-academic, a citation search in for example Web of Science will leave out more than half of the key literature.

The key literature was subsequently thoroughly read, noting down key topics and contributions of design thinking. These were subsequently analysed by categorization, thus seeking a pattern to synthesize the contributions into a taxonomy for design thinking. A participatory research setup focuses on a process of sequential feedback, reflection and development, where the aim is to identify issues of lack of clarity, evaluate and develop the taxonomy upon. Thus, in order to provide further input for the developed levels, the taxonomy was presented and further developed in a workshop. The target group at the workshop was experts, i.e. researchers and practitioners within the design thinking field. The subsequent section will present the final developed taxonomy.

4 TOWARDS A TAXONOMY ON DESIGN THINKING

Through the research process it has become apparent that design thinking is a concept that contains multiple aspects on different levels of abstraction. Examples of this diversity are Lawson's (2006) 'design thinking as a way of reasoning' that focuses on the logic of abductive reasoning, Schön's (1983) 'a reflexive practice' where design is viewed as practice based reflective reframing, or Buchanan's (1992) 'problem-solving activity' which concentrates on how design thinking solves wicked problems. Much of the business oriented literature gives even more diverse descriptions of the concept e.g. Brown (2008) moves it to a personal level 'a design thinker's profile'. Past literature reviews have concluded that various meanings of the term exist, and have defined the diverse discourses proposing their inability to meet in a taxonomy (Johansson-Sköldberg et al. 2013).

However, when looking at previous literature there are two primary reasons for the design thinking term being coined: the search for a theoretical base for the design discipline (Simon 1973) i.e. a 'cognitive perspective' to be used in design educations (Cross 1982), and the acknowledgement of design from adjacent disciplines searching to understand 'the thinking in designing' (Dunne and Martin). Looking back at these reasons, it becomes apparent that they both search to understand the same 'object'; they

search to understand the ‘thinking’ behind what designers are doing. As the core idea of introducing the term was to help outsiders (originally designers-to-be, recently also other fields such as information systems, management, innovation) to grasp design, the point of clarifying the term in this paper is to establish the basic assumptions, the perception of the world, that are tacit knowledge inside the field. Through the literature review it has become apparent that there is a lack of clarification of the fundamental assumptions within design thinking, and the relationship between these assumptions. The key conclusion is that there in the current literature are no clear distinction between fundamental thoughts, principle methods and practical tools and techniques.

4.1 Paradigm, Methods and Tools

The design field was originally a field of practice, where the task of designing was to develop a new product. The research around design has evolved from studying the practical methods, tools and techniques towards studying a way of thinking. In this paper design thinking is defined as a development philosophy, i.e. a way of thinking that directs and enhances development activities towards certain values, equal to production philosophies such as lean, which directs and enhances production activities towards certain values. The philosophy of design thinking is described in three levels, the paradigm, the methods and the tools and techniques, see Figure 1.

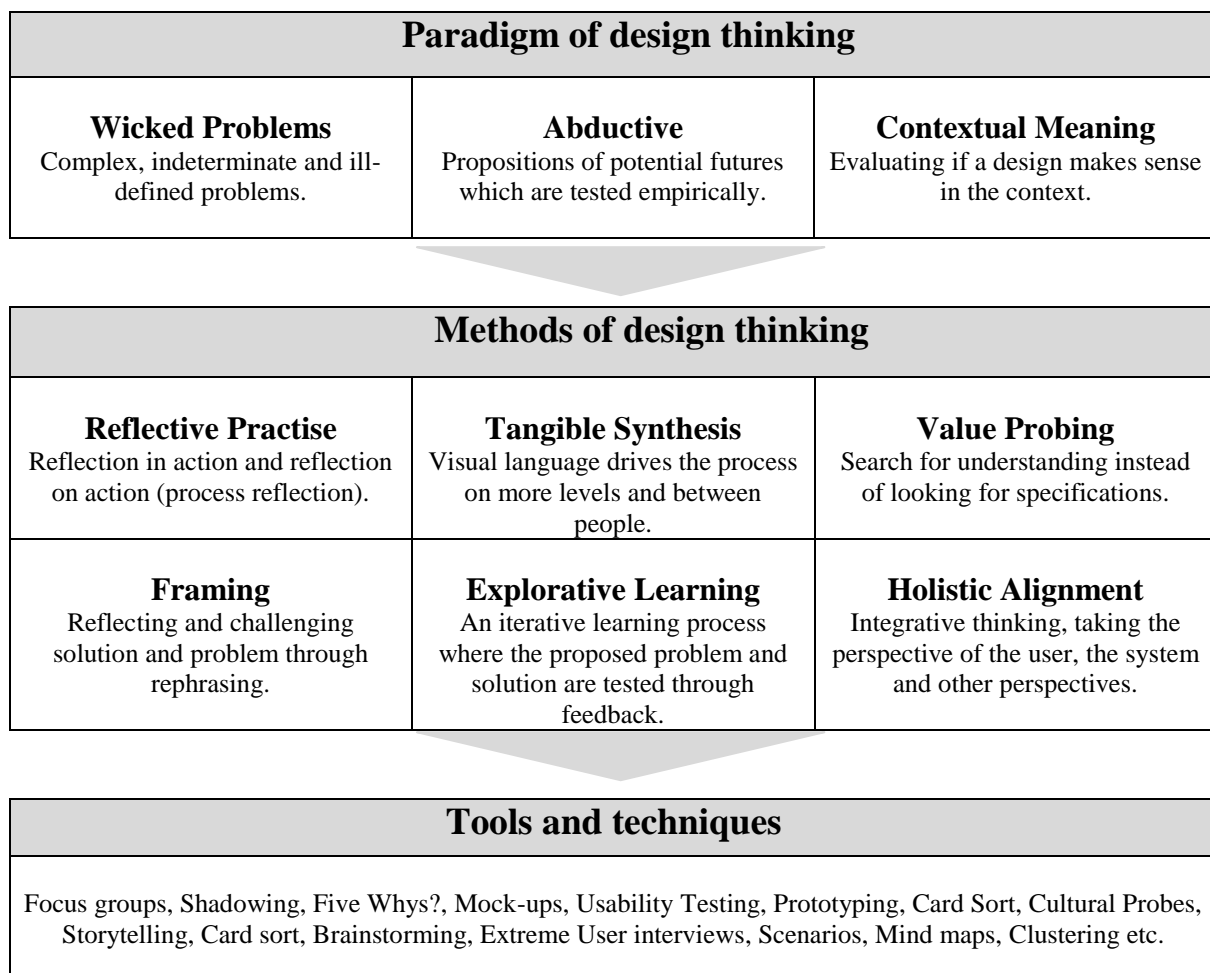


Figure 1. Three levels of design thinking: the paradigm, the methods, and the tools and techniques

The paradigm level deals with the fundamental assumptions made in design thinking, i.e. it indicates the implicit values and the given assumptions, for example the logic used. The use of the notion ‘paradigm’ originates from Kuhn’s theory of paradigm shifts, originally used to describe scientific paradigms. However, Kuhn’s definition can also be transferred to other contexts as well. An example of this is Koskela (1992), where Kuhn’s notion of paradigm is used to describe the thinking behind production

philosophies. According to Smith et al. (1991), when using a paradigm to describe manufacturing philosophies, the paradigm is an indication of: given assumptions, the way problems are posed and solved, as well as values and examples of the thinking.

The second level (the method level) directs the development activities with principal approaches to development, e.g. the characteristic method of collecting and processing input as well as creation of solutions. In design practice, these principles are the underlying guidelines for the action, which enables the practitioners to navigate. By studying practice, scholars have recognized these methods as patterns that are common in design thinking.

The tools and technique level exemplifies practical design techniques such as: prototyping, mock-ups, storytelling, cultural probes etc. These are the concrete manifestations of the methods level, which take different forms depending on the context. The following will present the taxonomy (Figure 1) and the following section will elaborate upon the content of the three levels, giving examples of central themes within each level.

5 THE PARADIGM OF DESIGN THINKING

The paradigm level deals with the fundamental assumption behind design thinking. It will be described within three dimensions: 1) the world view, 2) the way of reasoning and 3) the truth criteria.

5.1 The World View: Wicked Problems

Wicked problems or ill-defined problems are a significant topic for the problem solving discourse in design thinking (Johansson-Sköldberg et al. 2013) primarily presented in the works of Buchanan (1992) and Rittel and Webber (1973), but can also be seen in later works such as Lawson (2006), Cross (2006), Boland and Collopy (2004), Kelley (2001), Brown (2008) and Martin (2009). Rittel and Webber (1973) first described the wicked problems in the context of social planning, contrasting a wicked problem with a tame problem (math, puzzle). Tame problems are clearly defined and can be fully resolved, whereas the solution for a wicked problem can only be better or worse, not right or wrong (Rittel and Webber 1973). According to Buchanan (1992), wicked problems are complex, indeterminate and ill-defined problems in the sense that they are characterized by incomplete, changing, contradicting and interdependent information, which is difficult to gather. Buchanan proposes that design problems are wicked for the following reason:

"Design problems are "indeterminate" and "wicked" because design has no special subject matter of its own apart from what a designer conceives it to be. The subject matter of design is potentially universal in scope, because design thinking may be applied to any area of human experience. But in the process of application the designer must discover or invent a particular subject out of the problems and issues of specific circumstances." (Buchanan 1992, p 16)

Wicked problems exist as fundamental assumptions within the reality of design thinking, to the extent that no matter if designers deal with wicked problems or not, they tackle them as if they were wicked problems, as shown in studies (Cross 2006).

5.2 The Reasoning: Abductive

The reasoning of design thinking is broadly accepted to be abductive (Laws 2006, Cross 2006, Dorst 2010), leading back to the works of Pierce (1955) who described it as propositions or qualified 'guesses' to be empirically test, subsequently. Compared to deduction (the logic of necessity) and induction (the logic of probability) abduction is described as the logic of possibilities (Boland and Collopy 2004). Martin (2010) describes deduction as going from the general to the specific and induction as going from the specific to the general, whereas abduction offers reasoning between the data-driven analytical thinking and the knowing-without-reason intuitive thinking through propositions. The use of abductive reasoning is traced back to the character of the problems:

"This is presumably because design problems are inherently ill-defined, and trying to define or comprehensively to understand the problem (the scientists approach) is quite likely to be fruitless in terms of generating an appropriate solution within a limited timescale." (Cross 2006, p 37)

Design employs an iterative process of suggesting (visualizations, mock-ups, prototypes) and evaluating proposals; through this process a greater understanding of the problem and solution emerges together (Cross 2006).

5.3 The Truth Criteria: Contextual Meaning Making

The primary aim and evaluation criteria of design thinking is to realize meaningful solutions. According to Krippendorf (2006), design is a meaning making activity, where the primary goal is to create new artefacts that make sense in the context for which they were intended. Krippendorff explains the significance of creating meanings within design: "*Humans do not see and act on the physical qualities of things, but on what they mean to them.*" (pp 48). Support of Krippendorf's (2006) position on design thinking as a contextual, i.e. human centred activity can be seen in the attention the 'users' is given in design literature. The use of words like empathy, human centred, co-creation, participatory design in the literature exemplifies this. Design is in the end measured upon its value for the context (e.g. human, situation) for which it was intended. The succeeding section will describe the methods level of design thinking.

6 METHODS OF DESIGN THINKING

Beneath the paradigm level is the methods level. The second level contains principal methods to realize contextual meaning making. These methods are the underlying guidelines for actions in design thinking. They direct the design activities towards development using methodological approaches. Where the paradigm level explains the worldview, the methods level explains the underlying guidelines for actions. The following will elaborate on the methods as a way to:

1. Tackle wicked problems (1a. reflective practice and 1b. framing)
2. Carry out the abductive reasoning (2a. tangible synthesis and 2b. explorative learning)
3. Achieve the truth criteria (3a. input probing and 3b. holistic alignment)

6.1 Method to Tackle Wicked Problems: Reflective Practice

Schön (1983) first described design as a reflective activity or a reflective practice, a reflection in action (while doing) and a reflection on action (process reflection). This has been broadly accepted in later works, e.g. Lawson (2006), Cross (2006) and Buchanan (1992). He argued that competent practitioners have more knowledge than they can express verbally. They demonstrate knowing-in-practice, which is tacit. Thus when abductive reasoning is used, the tacit knowledge is utilized in practice. He describes this as *a reflective conversation with the situation* through reflecting while doing it and by evaluating the proposals. During the practice a designer when confronted with unexpected challenges use tacit knowledge and reflection that are based on previous experience. For the practitioner, the reflection in action serves three functions at the same time: as exploration, move testing and hypothesis testing of the experiments (Schön 1983). In a study of architects, he explains the reflective practice:

"In a good process of design, this conversation with the situation is reflective. In answer to the situation's back-talk, the designer reflects in action on the construction of the problem, the strategies of action, or the model of the phenomena, which have been implicit in his moves." (Schön 1983, pp79)

Thus, the reflective practice is connected with the character of wicked problems, where problem and solution merges.

6.2 Method to Tackle Wicked Problems: Framing

In a process of reflection, the practitioner reframes the object of reflection. Reframing is defined as challenging the solution and the problem through rephrasing, to go beyond the obvious, to discover if the problem is a symptom of another problem, and to identify the core problem. This is often done by reframing the problem to a higher level, making it more general (Rittel and Webber 1973). According to Schön (1983):

"Problem setting is the process in which, interactively, we name the things to which we will attend and frame the context in which we will attend them.... In order to formulate a design problem to be solved, the designer must frame a problematic design situation: set its boundaries, select particular things and relations for attention, and impose on the situation a coherence that guides subsequent moves." (1983, p 102)

Buchanan introduced placements (i.e. reframing) as a conceptual repositioning, a means to shape the problem, situation and procedure. He exemplifies reframing as an opposition to categories: *"Categories have fixed meanings that are accepted within the taxonomies of a theory or a philosophy, serve as the basis for analyzing what already exists. Placements have boundaries to shape and constrain meaning, but are not rigidly fixed and determinate."* (Buchanan 1992, p 13). The reframing serves as a working hypothesis for the direction, showing whether this was the right way to do it. He also describes it as a source for new ideas and opportunities (Buchanan 1992). Martin (2003) supports this by arguing that design thinking handles constraints differently as compared with conventional management thinking, where constraints are seen as an undesirable barrier. In design thinking constraints are embraced as the incentive to create solutions, through reframing.

Verganti's (2009) design driven innovation focuses on a specific part of reframing, reframing within semantics, in which they argue that changing the meaning of objects is a designer's task. Verganti's example comes from the Italian design industry that work with traditional product categories as chairs, bookshelf, cups etc., and shows that Italian design firms have success in reframing in meaning, for example the bookshelf that becomes a bookworm through semantic reshaping.

6.3 Method to Carry out Abductive Reasoning: Tangible Synthesis

In the search for a solution through abductive reasoning, ideation and experimentation are key principles for transforming understanding into models and proposal for solutions. It is an approach of generating synthesis based on intuition, capturing tacit knowledge in ideation or experimentation, or as Schön (1983) would describe it, revealing that *'intuitive knowing in the midst of action'*. The outcome of the ideation and experimentation process can be sketches, mock-ups, prototypes, i.e. models that synthesize insights (Star & Griesemer 1989). Modelling is the visual and physical language of design thinking that drives a development process. Schön (1983) describes it as a means to progression. A visual or a model is used for reflect-in-action as well as reflection-upon-creation. Modelling is used as a method to process information on more levels from diverse perspectives (Schön 1983), e.g. from the detail, to how it fits with the whole product architecture, over whether the technical components inside fit, to considerations of the costs, and finally to the usability.

Equally important, models in design serve as boundary objects; objects that create a shared context or common ground in different problem solving contexts. Star & Griesemer (1989). The same object allows different professions to read different meanings into the object. They establish a shared language to represent knowledge, facilitating a process for jointly transform of knowledge and providing a means to learning about differences. (Carlile 2002).

6.4 Method to Carry Out Abductive Reasoning: Explorative Learning

Previous research broadly recognizes iterative learning as the principle process in design thinking used to obtain knowledge to develop a solution (Brown 2008, Kelley 2001). Because design thinking deals with wicked problems, the knowledge needed to develop a solution is not defined at the beginning and never complete, which makes design a learning process, where the designer learns to understand the problem, and the solution that could create value. Many variations of the iterative learning process exist, but they all go through three cyclic stages of inspiration, ideation and implementation. (Brown 2009).

6.5 Method to Achieve Truth Criteria: Value Probing

One of the major contributions of design thinking is the way of collecting and processing input, for example the company IDEO has become famous for their methods for observation and empathizing with user (Brown 2008, Kelley 2001). Krippendorff (2006) explains the principle as *'Searching the present for available paths to desirable futures is the method of inquiry of design'* (pp 29). As the problems posed in design thinking are wicked problems, i.e. requirements are unclear, ill-defined, changing and never complete, the value aspired is contextual meaning making. Input collecting and processing is

characterized by searching for understanding ‘what has value’, instead of looking for specifications. By probing for value, design thinking searches for deeper information of the values and priorities within the complexity, to be able to generate suggestion on the behalf of multiple perspectives. Krippendorff describes it as: *‘Designers search the present for variables, things they are able to vary, move, influence, alter, combine, take apart, reassemble or change. These variables define a space of possible actions, a design space.’* (Krippendorff 2006, p 29). This identification of design spaces is used to subsequently model possible futures.

6.6 Method to Achieve Truth Criteria: Holistic Alignment

Design thinking deals with wicked problems, which are inherently complex and thus need to be handled within multiple perspectives and systems integration (Buchanan 1992). For example, when developing a new information system, integration of multiple perspectives (costs, technology, business strategy, organization, supply chain, users etc.) is critical for the designer to be able to realize a valuable solution. Also understanding that no matter which solution is created, it becomes part of a whole system, e.g. a user experience, a product portfolio, a business system etc. Krippendorff (2006) explains it as the ecology of artefacts: *“The meaning of an artefact consists of its possible interaction with other artefacts”*, i.e. in order to create artefacts that make sense to humans, the context they are a part of must be considered. Thus, design thinking uses integrative system thinking, taking the user’s perspective and multiple perspectives as strategic approaches to developing holistic solutions. This thinking is embedded in many of the methods design thinking have become famous for.

7 TOOLS AND TECHNIQUES

Underneath the methods lie the actual design tools and techniques. Due to the design field’s origin from the crafts, a significant amount of attention has been paid to practical tools and techniques, to mention a few well known:

- **Brainstorming** define a scope in a group and come up with multiple ideas. This technique widens the spectrum of ideas.
- **Usability test** studies people’s use of a prototype through observations. Insights of the use and usability of the products is gained
- **Guided tour:** People are accompanied on a guided tour in spaces and activities that are relevant for the project. Explorations in situ help people recall and explain values and intentions.
- **Personas:** Character profiles that represent values, behaviour and life styles are developed. The method is used to bring archetypes to life and communicate the concept broadly.
- **Draw the experience** asks people to visualize experiences through drawing, in order to understand how people conceive and order their activities.
- **Quick and dirty prototyping:** quickly assemble possible forms or interactions for evaluations. These serve as common ground for communication in a team.
- **Scenarios** draw up possible future scenarios and invite people to share their reactions. Useful for evaluating proposals and communicating the value to stakeholders.
- **Extreme user interviews** identify extreme users and ask them to evaluate the experience of using a product. The extreme cases are often able to provide insight by highlighting key problems.
- **Shadowing:** People are followed and observed in order to understand their actions and natural context. This method aims at developing understanding of the context and behaviour for which the solution is intended. It inspires and reveals opportunities for improvement.

The following are examples of the numerous diverse design tools that exist today. The paradigm of design thinking is present in the specific design of the tools, e.g. many of them are focused on discovering, showing or testing contextual meaning making of a solution. The methods of design thinking is an intrinsic part of the tools. For example, ‘draw the experience’ probes for understanding value, and has a holistic focus on the whole experience.

Some of these design tools have been widely adopted outside the design field. However, when the tools are taken out of their original context, they might lose their effect if they are not understood properly, if, for instance, the paradigm and methods are not clear. To take a specific technique as example,

prototyping is a technique where early modelling of possible solutions is created. Prototyping, as a technique, inherently includes the following methods:

- **Modelling of possible futures** makes the designer reflect-in-action and reflect-upon-creation (Schön 1983)
- **Holistic alignment** enhances the dialogue by serving as a boundary object (Carlile 2002)
- **Explorative learning** is about underlying assumptions, since proto means first out of more models. They serve as the basis for learning
- **Probing for understanding value** by making the user reflect on the prototype.

This means that prototypes in design thinking are not merely perceived as fast models to test functionality or choose between proposals. Prototypes are used as a technique to capture the value in the paradigm, i.e. to create contextual meaning-making. However, when prototyping as a technique is taken out of its context and used in other fields, there is a risk of loss of the effect, due to a changed context, or different understanding (paradigm).

When another field adopts prototyping, the new context should be taken in consideration, if the technique is to have its full effect (assuming this is the intention). What principle action do we want to achieve with the technique? If what we want is probing, to understand ‘the flow of an experience’, a working prototype in context might be useful. Whereas holistic alignment through dialogue and several print out versions might serve as a stable common ground to base the development of multiple perspective dialogue on. If the prototype is to serve as modelling activity, where tacit knowledge is utilized through reflection-in-action, picking the right people to make the prototypes is essential. However, given the fact that the people in adjacent fields are differently schooled, clarity and explicitness of paradigm and the methods on which design thinking tools are built provide deeper understanding of tools and techniques.

8 CONCLUDING REMARKS

According to Sköldbberg-Johannson et al. (2013), the vague definition of design thinking stems from the concept being taken for granted within the design field and its weak theoretical anchoring in adjacent fields. A major part of design literature is focused on ‘what to do and how’. However, it is commonly recognized, in the attempt to bring design into adjacent fields, that the process and tools alone do not bring the full effect. The research behind design thinking seeks to bridge this ‘shortfall’. However, the lack of explicitness of the underlying assumptions still exists. This creates challenges in the adoption of tools and techniques, making the process superficial. If design thinking is to have its full effect in adjacent field, a deeper understanding of the paradigm and methods is critical in order to choose, adapt and study the tools and techniques.

To address the lack of clarity of the underlying assumption, this paper has reviewed key contributing literature in existing research and organised central themes within taxonomy. By articulating how previous works of research relate to each other and together construct the theory development of design thinking, this paper contributes with a precise and clear taxonomy for design thinking. By making the underlying assumptions explicit, this paper results in a main taxonomy defining the three levels of design thinking: the paradigm, the methods, and the tools and techniques.

We argue that by making the paradigm and methods explicit, the taxonomy provides a deeper understanding of how to study, utilize and adapt tools and techniques to fit other fields. The taxonomy aims to clarify the different levels of abstraction in order to provide insights into *why* tools and techniques are shaped the way they are. The taxonomy contributes to a strong foundation for studying design thinking, by clarifying underlying assumptions, i.e. the paradigm of thinking, the methods that direct actions, the specific tools and techniques and the relation between the levels.

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