Design Thinking

Characteristics and Promises

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DESIGN THINKING: CHARACTERISTICS AND PROMISES

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ABSTRACT

This paper analyses a variety of Design Thinking methods to identify a governable pattern that is required to roll out Design Thinking as mindset in a multi-national company. A comparative analysis is essential to unveil focal points that lead to this organizational mindset transformation. Hence, a thorough understanding of the method and its core values may avoid uncoordinated innovation capabilities. Ultimately innovation will not be an R&D topic in an organization anymore but become part for every employee's job, irrespective of his or her position.

Keywords: Design thinking methods and characteristics, Review

1. INTRODUCTION

A number of new innovation methods have emerged during the past two decades with an increasing interdisciplinary collaboration between the engineering, economic and social sciences. In spite of this, it is still a challenge to develop and introduce new innovations. One approach that increasingly makes its way to businesses of all sizes is called Design Thinking. This approach seems to be more promising to operationalize the innovation capabilities of a company (Brenner and Witte, 2011).

Design Thinking is a human-centered problem solving method that mostly leads to radical innovative solution in terms of the feasibility, desirability and viability of products or services (Brown, 2008, 2009).

In many languages the term design is used in the context of craftsmanship and the arts, such as design of clothes, buildings and other objects. Although Design Thinking is rooted in industrial production and engineering, the term design is meant in the sense of intentional development of products, services or solutions (Lindberg *et al*., 2009).

Among the big promoters of Design Thinking have been SAP and Apple, which collaborate closely with IDEO, an innovation consultancy company. SAP's co-founder Hasso Plattner invested in two university campuses, one at Stanford, the other in Potsdam, which teach and research around Design Thinking and Design Thinking led innovations. Popularity in industry is increasing as the pressure on innovativeness and new product introductions increases with an equally increasing competitive pressure (Brown, 2009). Design Thinking as a method is in line with, or even complements, other approaches such as open and user-driven innovation. While innovation theory is one lens, Design Thinking is also interesting from an organization theory perspective, considering the "thinking" aspect (Rylander, 2009). Most people are trained in analytical thinking, where problems are broken down in smaller pieces to be solved, and

from there attempts are developed to predict the future based on data from the past. According to Brown (2009), this limits the possibilities to envision or even change the future. Organizations are used to define, and find solutions for problems. The limitation however of classic problem solving is in quantifying the value, or the behavioral aspects of the solution (Shamiyeh, 2010). From a behavioral perspective, the reason why Design Thinking can and does make its way to organizations is, because it is not limited to designers, but should be part of a managerial task and hence can be done by all type of people (Badke-Schaub *et al*., 2009). Design Thinking could be lived to an extent to which it is part of the business strategy of a company (Badke-Schaub *et al*., 2009).

2. EVALUATION OF DESIGN THINKING METHODS

Identifying the governable elements of Design Thinking requires a comparison of different approaches taught by schools of Design Thinking or deployed by leading innovation consultancies or companies with desirable products that developed their own version. Each school of thought will be analyzed in terms of characteristics related to corporate strategy, the method and its processes, the human dimension and the governance that ensures the interwoven integrity of all parts. Earlier defined Design Thinking approaches are rather circular approaches whereas later ones are sequential.

2.1 CIRCULAR APPROACHES

Initial Design Thinking approaches were of circular nature. Those have also impacted sequential approaches, as this analysis will reflect later.

2.1.1 BROWN'S DESIGN THINKING APPROACH

Tim Brown, together with the IDEO innovation consultancy company founder David Kelley, is among the originators and formalizers of Design Thinking.

Brown's method comprises three core steps: Inspiration, Ideation and Implementation. Interestingly, in contrast to other Design Thinking approaches, the inspiration step is not only related to the problem that must be solved, but also considers market opportunities, or the combination of both: problem and opportunity (Brown, 2008). Compared to the other phases, the inspiration phase requires rather smaller teams that establish the overall framework. Ideation is the process of generating, developing and testing ideas. The implementation phase focuses on the realization of the idea by making the product, service or solution ready for marketability. The innovation is refined by iterating through these three phases. This does not necessarily have to be linear: the process can go from any phase to any phase, as required (Brown, 2009). Constraints to the product, service or solution are categorized in terms of the feasibility, viability and desirability.

Design thinker's characteristics (Brown, 2008)

- Balances feasibility, viability and desirability
- Empathic
- Experimentalistic
- Optimistic
- Collaborative and teamwork

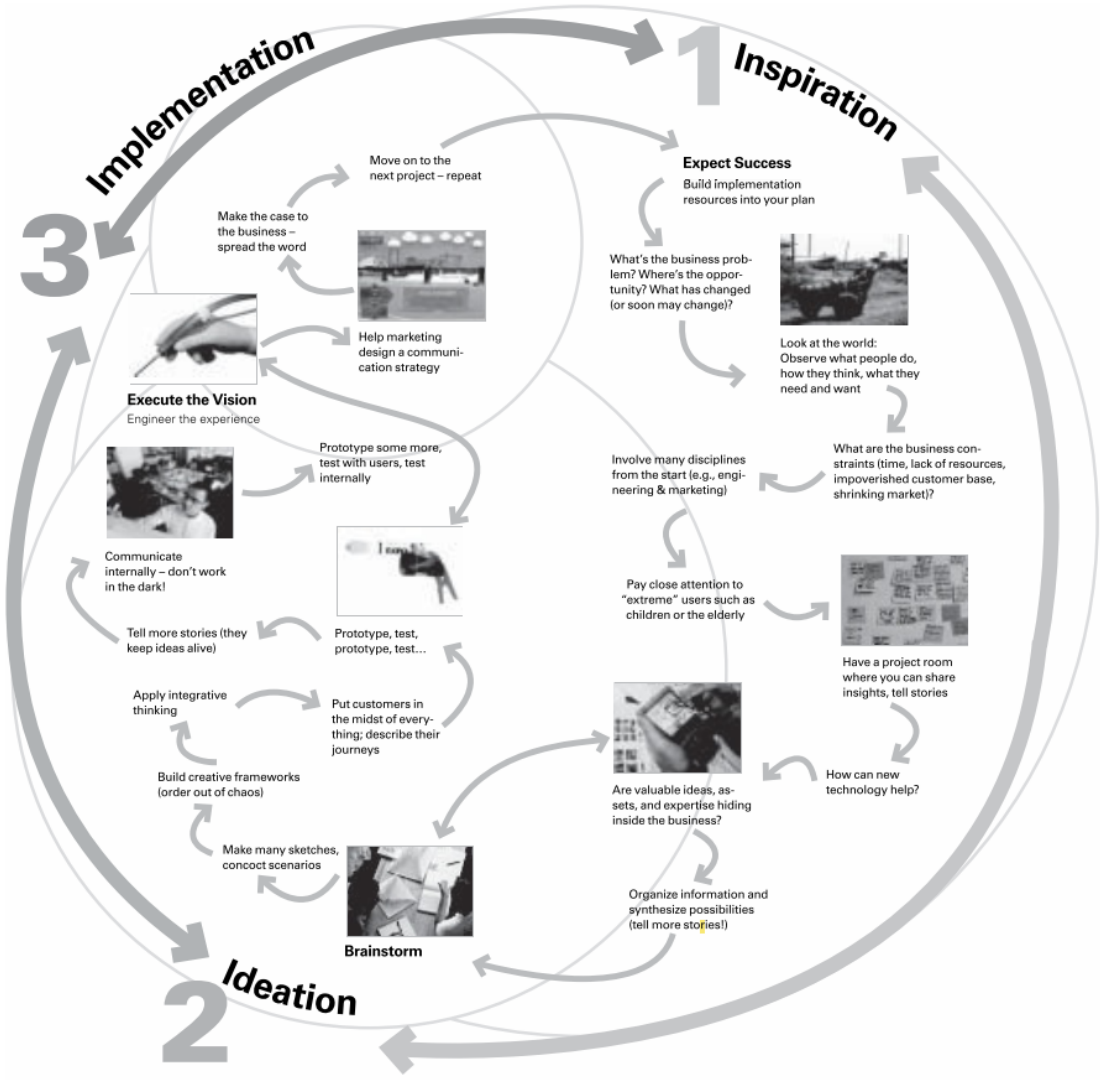

Figure 1. Tim Brown's three-step Design Thinking approach (Brown, 2009)

Design thinking success factors (Brown, 2008)

- "Fail earlier to succeed sooner" requires simple prototypes to receive early feedback
- Focus on human needs, behavior and empathy
- Go beyond status quo
- Collective ownership of ideas
- Team learning
- Heterogeneity of team members
- Complementing specialization and subject matter expertise of team members
- Notice what users do and say, and even more importantly what users don't do and don't say
- Divergent and convergent thinking
- Optimism through confidence and trust
- Trying by building physical prototypes; the paradox of prototypes is that they slow down the project in order to speed it up

2.1.2 Dunne and Martin's Design Thinking Approach

Design Thinking is seen as the mental process to solve "wicked problems". It is applied to projects with an expected deadline. The phases consist of inductive, deductive and abductive elements. While induction and deduction are comparable to the divergence and convergence of the thinking process, abductive logic generates truly new ideas. Ideas are then tested in practice (Dunne and Martin, 2006).

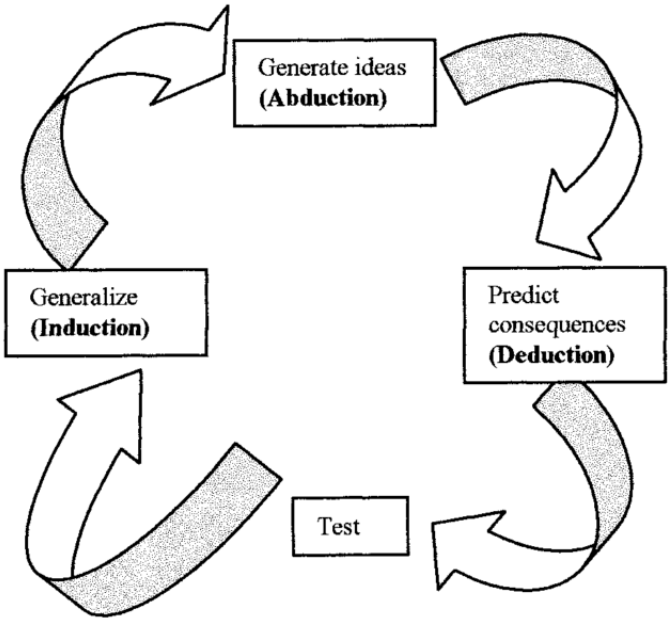

Figure 2. The cycle of Design Thinking (Dunne and Martin, 2006)

Design thinker's characteristics (Dunne and Martin, 2006)

- Collaboration and teamwork
- Observational and empathic
- Human-centric

Design thinking success factors (Dunne and Martin, 2006)

- Integrative and systems thinking (Senge, 1994)
- Design relates to "wicked" problems, not necessarily to conventional problems, which only require decision making
- Project-based with deadline (not ongoing)
- Constraints are inspirational rather than a limitation

2.2 Sequential Approaches

Recently emerging Design Thinking approaches prefer sequential approaches for didactical reasons. The commonality of sequential and circular approaches is in the iterability.

2.2.1 The Stanford d.school Approach

A sequential approach with multiple phases is foreseen in the Stanford d.school definition of Design Thinking. Simply stated, this approach categorizes the phases into a problem and a solution space. The problem space comprises the phases: understand,

observe and point of view. The solution space comprises the ideate, prototype and test phases. Newell *et al*. (1967) mentioned the problem space back in 1967, and asked for a comprehensive understanding of the problem, believing that a solution can be derived directly from within the inner structure of the problem. Forty years later, Cross and Dorst (2007) defined the "co-evolution of problem and solution", i.e. the exploration of both the problem and the solution space in parallel (Cross, 2007). The Stanford d.school method allows iterating between phases that are either linked directly or indirectly.

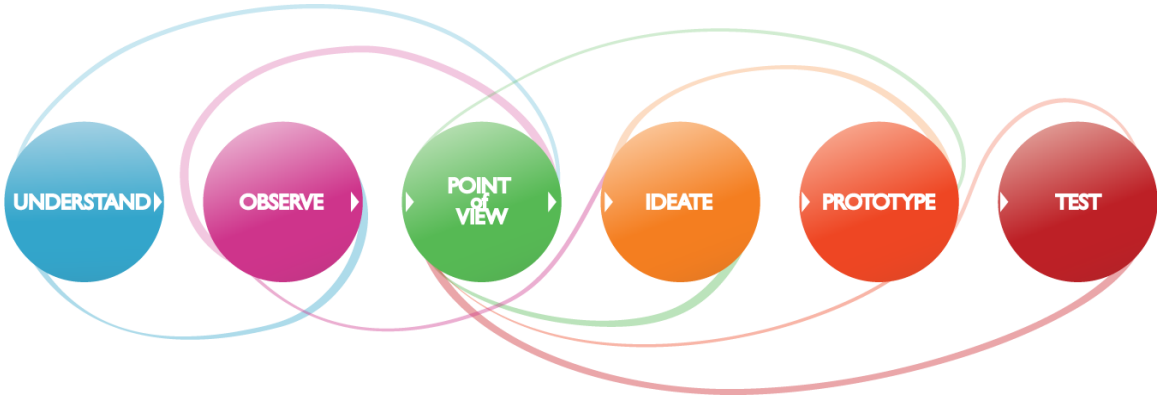

Figure 3. The Stanford's Design Thinking process (Plattner *et al*., 2009)

The understand phase is used to build a common understanding and an agreement on the design challenge that kicks off a Design Thinking project (Cross and Clayburn Cross, 1995). Especially terminological and semantic foundations are tried to be settled. Once the challenge and its meaning are partially clear (no full clarity is required at this stage) some observation is required to better understand the problem. This can take the form of field or academic research leading to more detailed insights. In the point of view phase, the problem is specified in detail and focus is turned to that of a single-user. Often, a so-called "how might we" question is developed, which questions the user's needs and creates insight that will be further elaborated in the solution space. The solution space starts with the ideation phase. Ideating is a diverging process that should generate as many as possible ideas, no matter how realistic they are or aren't. During prototyping, an idea is made physically tangible, which promotes the idea and serves as basis to test and improve it in early stages (Plattner *et al*., 2009; Ratcliffe, 2009).

Design thinker's characteristics (Meinel *et al*., 2011)

- Open and radical culture of collaboration
- Intellectual and emotional
- Empathic

Design thinking success factors (d.school, 2010)

- Wicked problems
- Interactive and incremental
- Heterogeneous teams with different experiences
- Divergence and convergence
- Extensive understanding of problem space
- Iteration between problem space and solution space (Lindberg *et al.*, 2010)
- Quantity of ideas, wild and even impossible ideas
- Fail early and often during prototyping

2.2.2 *The SAP Design Thinking Approach*

With Hasso Plattner supporting the development of the design thinking approach at d.school in the Stanford and Potsdam campuses, it is logical that SAP's approach to Design Thinking is highly compatible with the d.school approach. The main differences are the labels used to describe the phases and an extension with one phase. The problem space of SAP Design Thinking comprises scoping, research and synthesis. The solution space consists of ideation, prototyping, validation and implementation. The additional phase of implementation is particularly important because there is a danger of discontinuation of ideas prior to realization. SAP has understood that the tough part is producing products that can be launched in the market place. The transition from validation to implementation can be seen as a kind of implicit business case. While Design Thinking was initially used to develop new software solutions, SAP has discovered the problem-solving capabilities of this approach. Participants highly identify themselves with the solutions generated and are knowledgeable through all the background information they collect by doing thorough research. End user business software is particularly suitable for Design Thinking because it has the aspect of human interacted usage and user experience. Prototypes can be easily created with paper mock-ups and validated before they are turned into high fidelity product-proximate solutions.

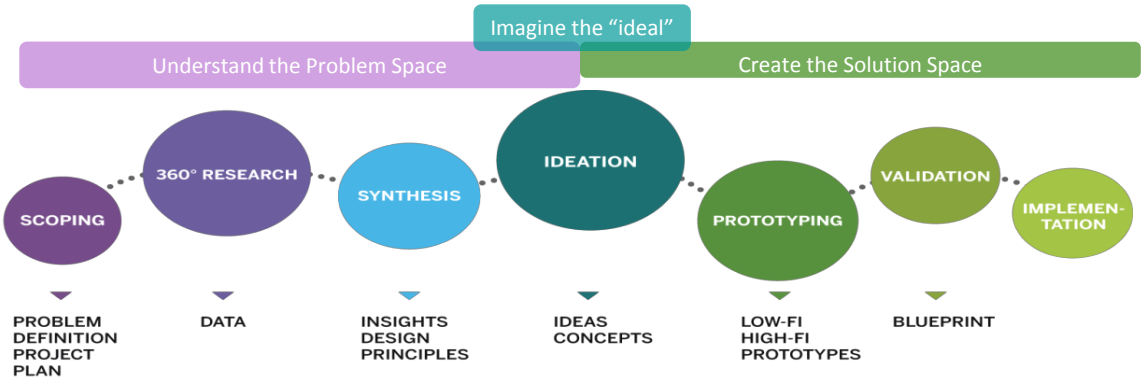

Figure 4. Imagine, Create & Innovate - Design Thinking with SAP (Serie, 2012)

Design thinker's characteristics (Waloszek, 2012; Cigaina, 2013)

- T-shaped expertise comprising subject matter, management expertise or intense customer contact
- Empathic
- Culture of trust
- Detour-friendly thinking
- Integrative thinking

Design thinking success factors (Waloszek, 2012)

- Any type of challenges
- Creative environment and working spaces
- Multi-disciplinary teams
- Time boxing
- Listening and air time for everyone
- Respect different perspective – no need to agree
- Time commitment

- Create big pool of ideas (quantity)
- Persona-focused problem formulation

2.2.3 Further Design Thinking Interpretations

St. Gallen's Design Thinking process

The University of St. Gallen has developed an own circular design thinking interpretation based on Stanford's d.school approach. While the St. Gallen approach does not mention any problem and solution spaces there is a pattern noticeable. Its label suggests that only the first phase "(re)define the problem" belongs to the problem space but this cannot be true. The problem space also includes need finding, while the remainder belongs to the solution space (Vetterli *et al.*, 2011).

Design thinker's characteristics (Vetterli *et al.*, 2011)
- Behavioral analysis
- Skilled observation capabilities

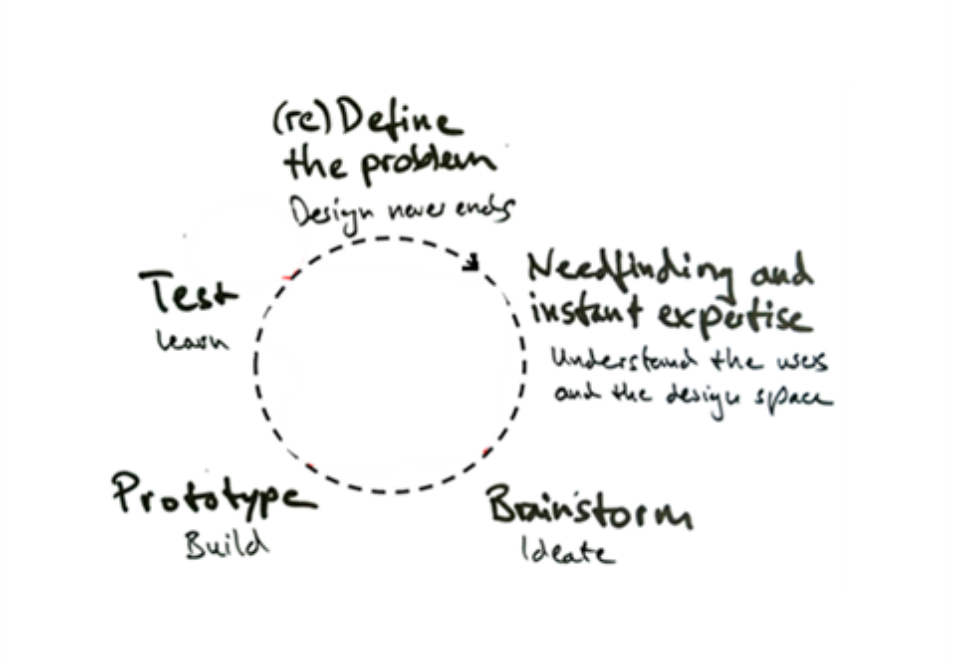

Figure 5. St. Gallen Design Thinking process (Vetterli *et al.*, 2011; St. Gallen, 2013)

Design thinking success factors (Vetterli *et al.*, 2011)
- Behavioral analysis
- Iterative
- The user decides productization
- Human-centric
- Diverging and converging phases
- Project and milestone-oriented
- Tangibility of prototypes
- Early involvement of end-users

Joint method of IDEO and Riverdale School – Design Thinking for educators

IDEO and Riverdale School have co-developed a sequential approach of design thinking as opposed to IDEO's cyclical approach. This sequential approach is similar to

d.school approach. The phases discovery and interpretation dominate the problem space. The solution space comprises the ideation, experimentation and evolution phases. Divergence and convergence are at the heart of this approach (IDEO & Riverdale, 2012).

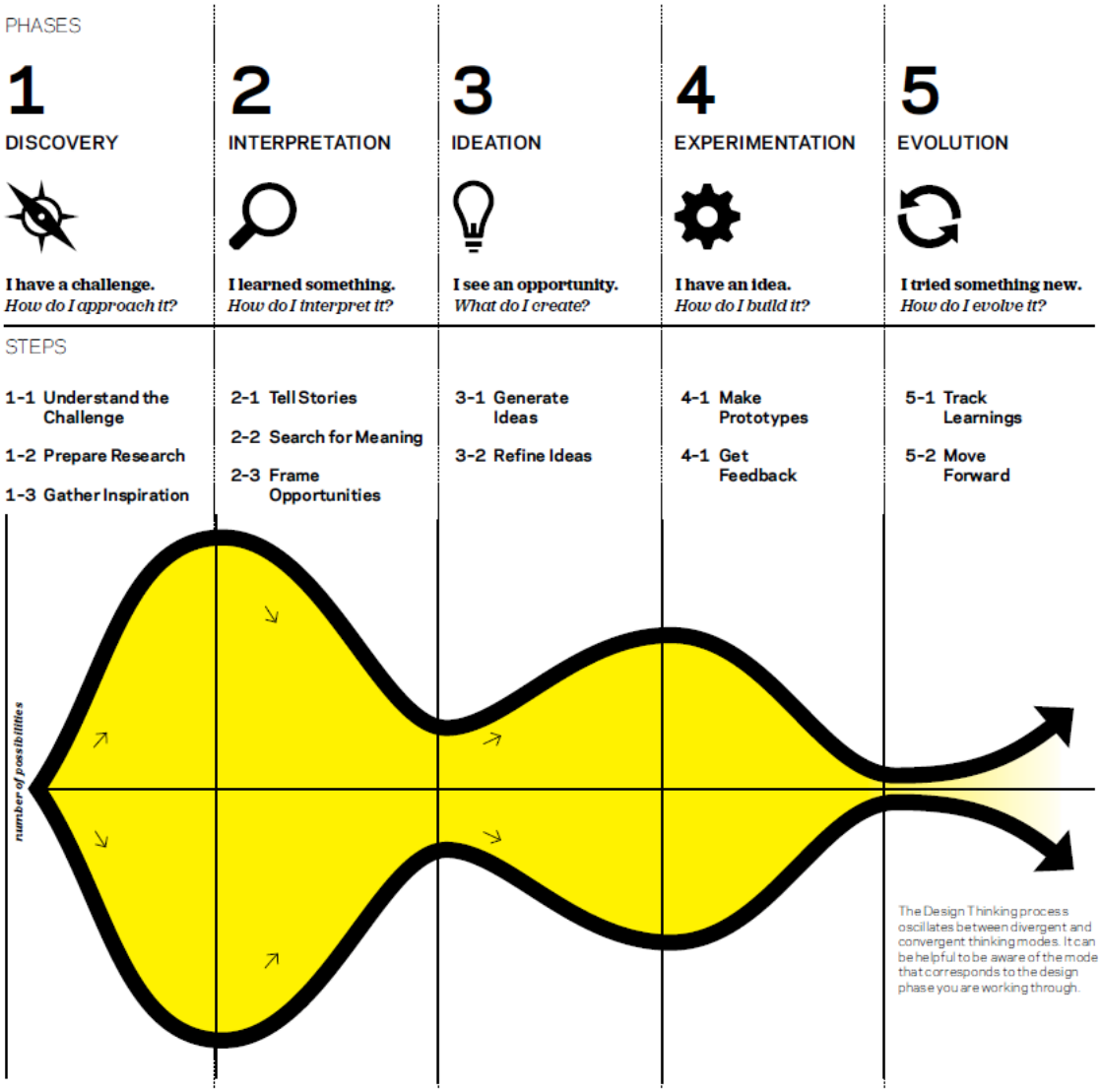

Figure 6. Design Thinking process for educators (IDEO & Riverdale, 2012)

3. CHARACTERISTICS OF DESIGN THINKING

The different design thinking methods have various characteristics in common. The characteristics can be grouped into procedural and people perspectives. The procedural perspective refers to the rules, structure and framework, whereas the human perspective refers to personal characteristics, attitudes and contributions. The categorization is necessary to establish a governance framework needed for a company to deal with Design Thinking as a means and mindset and, hence, to manage innovation both operationally and strategically.

3.1 FOUNDATIONAL ELEMENTS OF THE DESIGN THINKING PROCESS

There are a few elements that significantly characterize the Design Thinking process. All Design Thinking methods allow for divergence and convergence in all the phases, and distinguish between a problem and a solution space.

3.1.1 Problem & Solution Space

Problem space

The term problem space can be traced back to 1967 (Newell *et al*., 1967) as mentioned earlier. The problem space was defined by Newell was rather defined as an analytical array in which the problem lied. This analytical array was tried to be solved. This Newellian theory focuses on the problem's states and operators with which the problem can be solved. According to this theory the solution space is inherent to the problem space, which is different from the Design Thinking approach. Newell (1979) argues for a combined, parallel exploration of the problem and solution spaces. Dorst and Cross (2001) argue for a separation of the problem and solution spaces. Yet, in Design Thinking the problem space deals with a high-level to deep-level understanding of the challenge at hand. Design Thinking distinguishes with its problem-driven approach because the optimal solution is validated against the problem (Simon, 1981; Visser, 2010). More importantly, the design process in the solution space does not start until the problem has been thoroughly analyzed and understood (Cross, 1982). In general, the observation of the problem and empathy of affected humans requires thorough analysis (Brown, 2009; Plattner *et al*., 2009). Identification of the goal, then analyzing the problem and defining it within the problem space is proposed (Hong and Choi, 2011). Problems can be "wicked", i.e. complex, ill defined and imprecise. The rephrasing of a problem can lead to a different solution (Lindberg *et al*., 2010; Owen 2007; Rowe, 1987; Cross 2004). According to Bauer and Eagan (2008), wicked problems suit best for Design Thinking because the complexity of these problems cannot be solved with purely rational and analytical approaches.

The lead author of this article experienced that as a rule of thumb it is recommendable to spend more than half of the time to understanding the problem. The problem space in the author's terms is an interrogation-like space to uncover the truth and minimize missing any details. Another analogy is determining a patient's disease. Most of the time is invested in exploring the symptoms before a diagnosis is defined. Once the diagnosis is clear and the problem curable, healing can be simple with medication or operation.

Solution Space

It is obvious that the solution can only be as good as the problem is understood. The solution is determined by creating ideas, mental models and prototypes that tangibly solve the problem. Iteration allows cycling within a phase and between phases. As a consequence, there is always a way to move back and forth between the problem and solution space (Lindberg *et al*., 2010). This iteration makes most sense assuming that tangible prototypes raise new questions for the problem space, i.e. when presenting the prototype to stakeholders, or if new user needs emerge. With each iteration, the design thinker's knowledge will increase in both the problem and the solution space, until an acceptable state of solution has been found (Cross, 2007).

3.1.2 Divergence and Convergence

Classic business thinkers, especially managers with high-level responsibilities, mainly think convergently. They have a decision attitude to solve problems based on analytical decision tools and to choose from a variety of options without necessarily understanding the roots of the options. The risk of wrong decisions could be minimized if the time were taken to deal with the subject in a divergent and convergent mode (Dunne and

Martin, 2006). Divergent and convergent thinking are elementary cognitive factors to solve problems (Guilford, 1967).

Divergence

Divergence or more specifically divergent thinking is the ability to find many possible answers or options to a particular problem. This thinking causes a changed point of view and generation of ideas that ultimately lead to creativity (Guilford, 1950). Divergent thinking does not equal creative thinking but is an important part of the creative process (Runco, 1991). Runco and Acar (2012) showed that divergent thinking may lead to increased creativity. Divergence in design thinking does not only refer to individually generated ideas but also to the collection of already existing data, such as research data, news, interviews and statistical and numerical information that help to better understand the overall challenge (Brown, 2009). Per definition one might think that divergence is correlated with the solution space in which participants are asked for their creativity to generate ideas that lead to solutions.

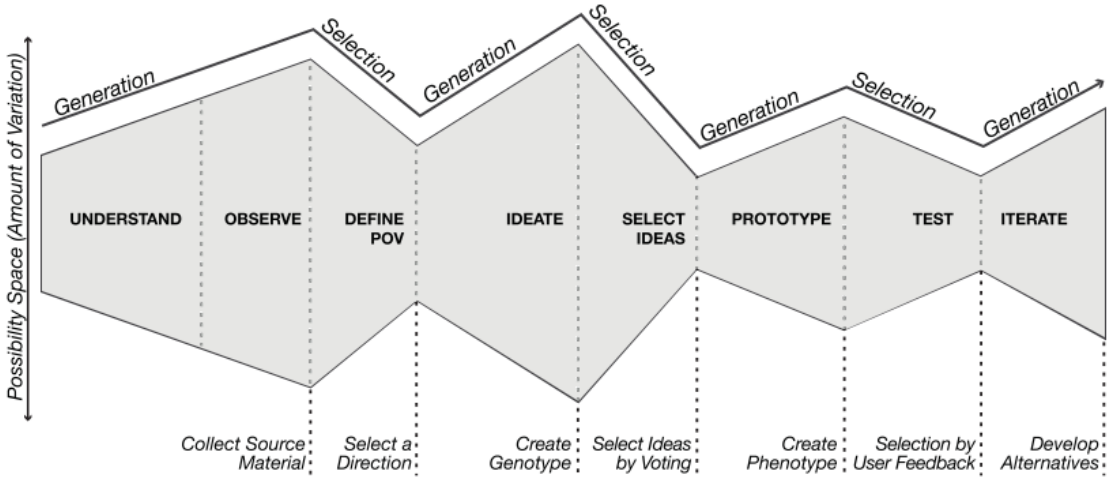

Figure 7. Alternation of generating and selecting in the design thinking process (Thoring and Müller, 2011)

Convergence

Convergent thinking utilizes elements and outputs of divergent thinking, bringing them together in a meaningful way, using methods, clusters, patterns, concepts or frameworks. (Lindberg *et al*., 2010). Dym *et al*. (2005) point out the importance and success of the symbiosis of divergence-convergence, especially for project-based learning with a focus on a certain problem. The lead author observed a natural behavior of individuals automatically starting to converge data into patterns once a critical mass of divergent data has been collected and the brain recognizes patterns and dependencies.

3.2 Characteristics of the Design Thinking Method

While many characteristics may apply for Design Thinking, only the most important ones are discussed. The importance results from a comparison of Design Thinking methods. The order of characteristics is by their importance.

Human-Centricity

Having understood that from a Design Thinking perspective the problem space is the most important part, the method can be narrowed down to the problem of the individual

or the end-user. At the end of the problem space a very detailed end-user specific problem formulation is defined, in the form of so called "how might we" questions, where a fictive persona is in focus. While the problem could be a statement, it is recommended to phrase it as a question. Psychologically, the formulation of a question triggers the brain to think. It becomes clear that empathy must be at the core. Any solution adds direct value to the individual for whom the problem is tried to be solved (Brown, 2009; Plattner *et al*., 2009; Dunne and Martin, 2006). The human centricity of Design Thinking is not much different from the core idea of (lead) user-driven innovation (von Hippel, 1988, 2005).

Collaboration & Teamwork

Projects are set up for a purpose. In the context of Design Thinking the project is related to a design challenge or problem statement. Projects are typically set up and staffed with project members for a certain period of time. Staffing a new project does not automatically imply well-functioning teamwork and collaboration. Collaboration is about sharing and jointly developing knowledge, and supporting other team members. Among the most important positive influential factors of teamwork is the likelihood of increased motivation (Parlett and King, 1970). The results of teamwork can be synergistically higher than the sum of individual performances (Peacock, 1989). Closely linked with collaboration is the setup of teams as discussed next.

Interdisciplinary Teams

Ideally, the skillsets and perspectives of the team members complement each other. Realistically, however, a team cannot always consist of a heterogeneous group of people, and totally mutually exclusive or complementing skillsets, but a balanced setup is desired as much as possible. The weakness of homogenous teams is that they lack differences in, and, in effect, tend to agree on, perspectives of peers due to similarities of mindsets (Perry and Euler, 1988). Heterogeneous teams have the potential to question, critique and discuss anything, which may promote the emergence of innovative ideas (Hackman, 1983). Bradshaw (1989) observed highly intellectual homogenous and heterogeneous teams and concluded that heterogeneous teams performed better. Abstraction and simplification of hypotheses among members of such teams are required to ensure that points of view are understood. Naturally, opinions and ideas need to be discussed, clarified and evaluated ad hoc, along with a collaborative learning process (Gokhale, 1995). According to Buchanan (1989), there are also positive effects for the individuals like growing self-confidence and increased tolerance.

Ideation & Experimentation

Ideas are the basis for tangible solution attempts such as prototypes. One does not have to be a product designer or engineer to come up with bright ideas. There is also no correlation between high intelligence and creativity. Ideas can be the result of a wealth of options as well as the result of scarcity. Design Thinking assumes that anyone can be creative. There are multiple methods to foster the creativity and idea generation of people such as building on ideas of others or reverse brainstorming. Design Thinking welcomes wild and even unrealistic ideas, but the most valuable one are the simplest ones that solve the problem. Similarly valuable are ideas that are out-of-the-box, meaning going beyond standard ideas or ideas that anyone would respond to immediately, because true innovation starts with ideas that are beyond average and qualitatively meaningful (Brown, 2008).

From various Design Thinking workshops conducted by the lead author, in which the participants are given 2 x 1 minute sketching and ideation games, he observed an

impressive result. To demonstrate the formulation of a design challenge, the first assignment the participants get is: “paint a chair”; the second assignment is: “design something comfortable to sit on”. Among Westerners, the pattern emerging from the second assignment is that they start designing fancy chairs or objects coming close to Scandinavian or Italian designer chairs. In a workshop with Middle-Eastern participants this exercise tended to result in drawing a big cushion. From what they have been given as a mini design challenge, the result is extraordinarily good, because the solution fits the problem and is cheap to realize.

Physical experimentation (especially early, low-fidelity prototyping) is key for Design Thinking. Many advocates of Design Thinking would even claim that this is the most important part. Prototyping according to Design Thinking can involve anything from simple Lego models, paper mockups, play-doh objects, to role-play; anything, that helps making the solution to the problem more tangible (Brown, 2008, Plattner *et al*., 2009; Brown and Wyatt 2010; Dunne and Martin, 2006; Koria *et al*., 2011).

Timeboxing

Experience shows that just like the usage of post-its, time framing a certain task is crucial. Participants tend to forget the time and forget to focus on the next task agreed upon. While in project management time is allocated to all tasks, in order to generate a project network path, the context in Design Thinking is somewhat different. Time boxing refers to the time allocation of the current task in the phase (Thoring and Müller, 2011). Time boxing has broad acceptance in agile project management (Oesterreich and Weiss, 2007) and also in agile software development (Jalote *et al*., 2004). Experience shows that time awareness avoids or minimizes lasting discussions. One way of managing time is putting the discussion into reserves like parking lots. Discussion of the topic can be picked up and continued if it is not resolved over time or more time is available. The marginal utility of additional time is low because the additional value-adding to results generated during that time is negligible.

3.3 Characteristics of the Design Thinker

Empathic

Empathic people observe and are sensitive to events in their environment, find it easy to put themselves into the position of persons affected (Owen, 2006), but are also sensitive to things that have not been said or done, or unusual habits and behaviors. They are questioning things for the way they are done and things that are not done. This character allows them to utilize every detail of the observation and turn it into an innovation (Brown, 2008). Empathic people carry multi-epistemic attributes such as thinking, feeling, sensing and intuiting (Jung, 1921; Bauer and Eagen, 2008; Brown, 2008).

Observational and Curious

Observational people do not only passively watch and monitor what people in their environment do but are also actively participating in the observation. They engage and interact by conducting interviews and discussions while interpreting the behavior. Active observation means being part of it and immersing with the proband. They try to experience what the affected people experience (d.school, 2010). Curiosity, a phenomenon that has been carried from childhood, results from not knowing and questioning (Owen, 2006). Curious people tend to reject traditional market research techniques, such as focus groups that risk thinking alike and producing similar, me-too products (Beverland and Farelly, 2007).

Knowledgeable
T-shaped skillsets seem suit Design Thinking quite well. A T-shaped skillset has strengths in two dimensions. The vertical axis represents subject matter expertise while the horizontal axis reflects broad knowledge in other domains. This combined skillset enables the design thinker to communicate across domains with other project members. (Brown, 2008; Owen, 2007; Brown and Wyatt, 2010). Recent literature introduces the concept of the "drippy T", where expertise in at least one subject matter exists along other areas (Guldbrandsen and van Dijk, 2011). T-shaped skillsets are realistic in for example IT departments, where knowledge from other domains (e.g. business management) has been developed by collaborating with those domains (Brenner and Witte, 2011).

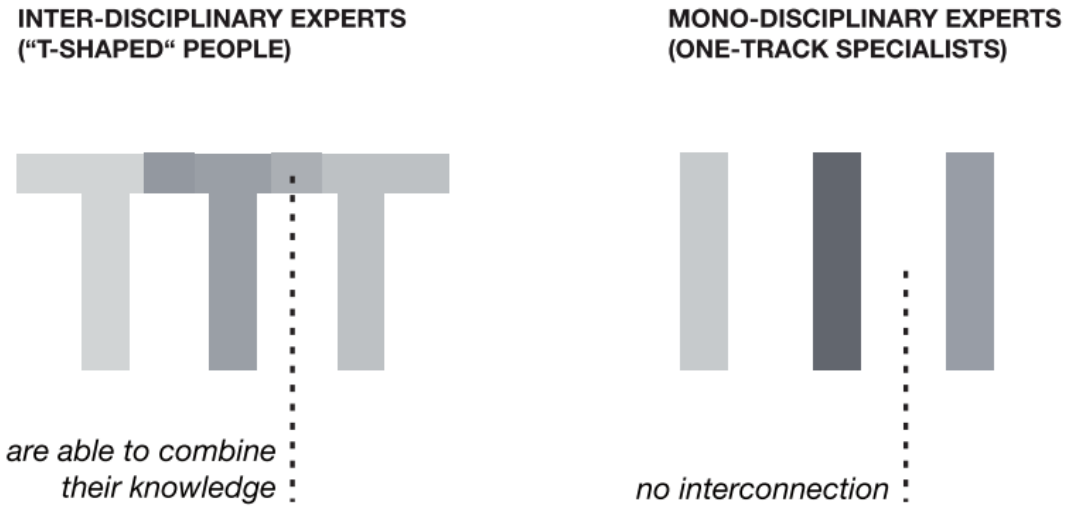

Figure 8. T-Shaped People vs. One-Track Experts (Thoring and Müller, 2011)

Holistic and Integrative Thinking
Focusing on the root of problems is important, while on the other hand the context must be understood as well. Hence, holistic thinking is required with a 360 degrees view on the issue. Systematic dependencies must be recognized (Holloway, 2009). Systematic thinking not only requires recognizing structural dependencies but also socio-economic patterns, relationships and other dependencies (Sato, 2009). Once the holistic and systematic dependencies are understood, the design thinker usually tries to generate solutions that are not mutually exclusive but balancing if there are potentially conflicting ideas. (Brown, 2008; Fraser, 2009; Martin, 2009). Especially products and related services should not be considered separately. The interplay between a product, service and their context is important (Bauer and Eagen, 2008; Owen 2007). Efeoglu (2012) refers to the right balancing of product and service as solution.

Tolerant (Deferring Judgment)
One of the rules of Design Thinking is to defer judgment. Since Design Thinking participants are not typically from the same domain, all opinions should be respected. Especially ideas that are wild and seemingly unrealistic may carry great potential once adequately interpreted, and further brainstormed (Kelley and Littman, 2005).

Pragmatic and Experimentalistic
The design thinker iterates between the problem and the solution. The experimentalistic nature allows the design thinker to recognize a move into the right direction. If the

direction is misleading, the problem is questioned or the solution is adapted with a new prototype or change (Cross, 2004). By experimenting, new possibilities are explored. Experimentalistic humans are not scared of failing (Fraser, 2007; Holloway, 2009).

Optimistic

The design thinker believes right from the start that solutions for the problem, which are better than existing ones, can be found (Brown, 2008). Knowing that frustrating times may come, optimistic people know to balance moods and stay professionally optimistic for the purpose of the job. They proactively find a way to work towards this possibility (Owen, 2007). Optimists consider constraints rather as inspiring and challenging (Dunne and Martin, 2006).

4. CONCLUSION

Design thinking is a means and a strategy. As a means it helps developing new products and services with multi-disciplinary teams. As a strategy it opens up the fixed mindset that the day-to-day operation of jobs creates in people's functioning. Design Thinking truly changes the myopia of employees and integrative (systematic) dependencies across teams when the design thinker is open for diversity in terms of unknown knowledge, lively discussion and thorough research. Design thinkers are intrinsically motivated and are not scared of moving away from the comfort zone to re-invent and develop their personality and management style. The more design thinkers collaborate with non-alikes and learn from others' expertise, the faster they develop themselves and, especially, an attitude of questioning, challenging and trusting.

Design Thinking requires a mentality for change in top-level management, which is recognized as a source for inspiring employees. The transformation to a Design Thinking oriented company can happen if the board recognizes invested funds as a kind of venture or risk capital, not necessarily focused on the sole competitiveness of the product that is the result of the innovation process.

Awareness of Design Thinking's core characteristics is required as a basis for the development of an Innovation Management Framework that covers, handles and further promotes these characteristics across a company. In a subsequent article such an Innovation Management Framework will be proposed, which governs the Design Thinking rollout for multi-national companies.

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