



Capturing the Value of Design Thinking in Different Innovation Practices

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Design thinking has become a popular notion in the field of innovation. What is design thinking really and—even more important—what could be its value in applying it in innovation practices? This paper presents four studies that together capture the value of design thinking in different early-stage innovation practices. Study 1 comprised a literature review on design thinking to form the basis of an agreed domain of discourse for design thinking in innovation. In Study 2, this shared domain of discourse was validated. This shared domain of discourse provided the input for Study 3, which investigated how innovators apply design thinking in early-stage innovation practices. It shows that the application of design thinking is dependent on the innovator's aim for the project, his or her vision on innovation, and the main challenge s/he is facing. This combination of characteristics is termed an image of design thinking. The images frame the application design activities in the context of the specific innovation project. Study 4 successfully validated the four images and shows that the combination of the images and the agreed domain of discourse can serve as a common language and a tool that allow capturing the value of design thinking in early-stage innovation.

Keywords – Design Thinking, Design Activity, Design Expertise, Innovation Practices.

Relevance to Design Practice – The four images of design thinking (= the combination of the aim of the innovation project, the vision on innovation and the main challenge) together with the developed card deck (48 cards) serve as a common language and tool that supports capturing the value of design thinking in innovation.

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Introduction

Recently, practitioners and scholars in an array of non-design sectors have become interested in the concept of design thinking, because they want to tap into designers' problem-solving strategies and benefit from design as an agent of change (Stewart, 2011).

Managers and management scholars are particularly attracted to the concept of design thinking, as the recent financial crisis has forced them to look for new strategies to survive within the competitive landscape (e.g., Kimbel, 2009; Liedtka, 2004). While applying design thinking, managers find that this approach empowers them to develop new or alternative solutions to their management problems. Additionally, the management field is interested in adopting design thinking as a powerful way of working that can promote and support innovation (see e.g., Beckman & Barry, 2007; Boland & Collopy, 2004; Lockwood, 2010; Martin, 2009a, 2009b; Meyer & Marion, 2010; Seidel & Fixson, 2013). Innovation refers to the core renewal process in an organisation resulting in new products and services that create value for both the user and the company (Bessant, Lamming, Noke, & Phillips, 2005). Managers more and more often see design thinking as a way to create this value (Hassi & Laakso, 2011; Rae, 2016).

At the same time, the world of (industrial) design is expanding due to social, cultural and technological transformations in the late 20th century (Buchanan, 1992; Stewart, 2011). These transformations radically changed assumptions about value creation

that stem from the industrialisation of societies (Brand & Rocchi, 2011). Global access to the Internet and Web 2.0 has transformed the way value is created. Value production is no longer solely in the hands of large companies as consumers are gaining access to more and more tools for value production.

Design practitioners such as Kelly (2005) and Brown (2009) adeptly anticipated these technological and social developments by broadening the scope of their working field. For instance, in his book *Change by Design*, Brown shows how design thinking could be a major lever for change by using design as a systematic tool for managing the innovation portfolio. The ideas of Kelly and Brown on design and design thinking originated in the design research community, which has a long-standing research tradition in investigating how designers think and act while designing products and buildings (within an industrial economy). This research community coined the approach to designing products as 'design thinking', a term first used by Archer (1979).

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These two inherently different ‘worlds’, the world of design and the world of management, that are interested in design thinking meet each other in early-stage innovation practices. The innovation practices include opportunity identification, opportunity analysis, idea generation, idea selection, and concept and technology development (Koen et al., 2001). This is the phase in which strategy (developed by managers) and product (and service) development (created by designers) are integrated (Koen et al., 2001; Moenaert et al., 1995). Therefore, this study focuses on the innovation practices in the early stage of innovation. Due to their different roles in innovation, designers and managers have different interpretations of what design thinking means within innovation practices. For managers, design thinking means *creating and applying strategies* by taking a designerly approach. For designers, design thinking means the approach designers take *while designing products (and services)*. To harness the business opportunities offered by employing design thinking in the field of innovation it is important to gain a better understanding of the concept of design thinking and its method of application in the early stage of innovation.

Research Design and Paper Structure

This paper presents four interconnected studies, which together capture the value of applying design thinking in innovation practices. To be able to investigate the application of design thinking during these innovation practices, there is a need for an agreed domain of discourse, since design thinking is ambiguous in nature and there is no uniform notion of what design thinking is (see e.g., Hassi & Laakso, 2011; Johansson-Sköldberg, Woodilla

& Çetinkaya, 2013). In Study 1, we address this need, performing a literature study on design thinking in the fields of design and management. Study 1 resulted in a card set consisting of 48 design activities representing design thinking. Study 2 validated this card set as an agreed domain of discourse. Study 3 aimed to capture the value of design thinking in different innovation practices. We used the card set (agreed domain of discourse) to elicit stories from 33 innovators who reflected on their innovation practices and the value of design thinking within those practices. The results of Study 3 show that the application of design thinking is dependent on the innovator’s aim for the project, his or her vision on innovation, and the main challenge s/he is facing. This set of characteristics is termed an *image of design thinking*. The value of the images of design thinking is that they show how and for what purpose innovators use design thinking within innovation. Study 4 validates these images by testing if other innovators could identify with one of the images and the corresponding activities. The results of Study 4 show that this validation is successful. The paper ends with a discussion on the four studies and the value of design thinking in innovation practices.

Study 1: Towards an Agreed Domain of Discourse on Design Thinking

The introduction explains that design thinking is a multifaceted concept that comes in many different shapes and forms. It also shows that the ambiguous nature of design thinking results in different discourses on design thinking (Johansson-Sköldberg et al., 2013). To have a valuable discussion about design thinking in innovation, it is essential to understand the discourses in the two different communities and to develop an agreed domain of discourse.

Within Management literature, the conceptualisations of design thinking vary from high-level definitions such as design thinking as the “transfer of the organisation’s design philosophy into design activities and *outputs*” (Chen & Venkatesh, 2013, p. 1682) to descriptions of design thinking as a set of formal design methods such as the need for finding, brainstorming and prototyping (see e.g., Seidel & Fixson, 2013). In addition to the formal design methods, management scholars also highlight the designer’s mind-set or design attitude; that is, the desire to do something differently (Boland & Colopy, 2004, p. 3) is an important aspect of design thinking. The design research community has used the term design thinking since the 1980s (Archer, 1979; Rowe, 1987) and scholars have organised symposia on design thinking from 1991 onwards (Cross, Dorst, & Roozenburg, 1992; Dorst, 2011). Over time, multiple conceptualisations of design thinking were developed and they still coexist. Cross (2011), for example, defined design thinking as “the core creative process for any designer” (p. 1). He calls this core creative process “design ability”. He stated that the most direct approach to inquiring into design ability is asking designers what they do (Cross, 2011, p. 8). In doing so, he makes a close connection between design thinking and design acting or doing. Dorst (2011) focuses more on the cognitive aspect of design thinking. He builds on the work

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of Roozenburg and Eekels (1995), who state that design thinking consists of multiple cognitive activities comprising inductive, deductive and abductive forms of reasoning. More recently, Blizzard et al. (2015) determined five characteristics of design thinking: (1) collaboration, (2) experimentalism, (3) optimism, (4) feedback-seeking, and (5) integrative thinking. By highlighting the integrative power of a designer, they put the design thinker in a social context in which s/he operates.

While analysing the different conceptualisations of design thinking, we realised that commonalities are found in the abstraction of (parts of) the ways professional designers think and work, which in this paper we frame as design expertise (Adams, Daly, Mann, & Dall'Alba, 2011; Cross, 2011; Kimbell, 2011). Design expertise is the way expert designers execute design processes and the strategies they use to develop solutions for the design task at hand (for an overview see Cross, 2004, 2007; Lawson & Dorst, 2009). Researchers study expert designers to identify 'best practices' for designing (Cross & Cross, 1998). They describe the activities designers engage in while executing their design task. This study uses the literature on design expertise for building an agreed domain of discourse about design thinking in innovation (see: Ball, Ormerod & Morley, 2004; Brown, 2009; Cross, 1986, 2004, 2011; Cross, Dorst, & Christiaans, 1996; Dorst & Cross, 2001; Dorst, 2003; Dorst, 2011; Kruger & Cross, 2006; Lawson, 2004; Petre, 2004). We chose this approach since the extensive body of knowledge on design expertise generates a solid base from which to start. Especially, because this is a field in design research where authors build on each other's work and the different authors have consensus on what the act of designing comprises. We analysed this literature and distilled all design activities present in this literature. To ensure that we did not omit important design activities mentioned in the management literature, we also reviewed contemporary books and articles from management sciences on design thinking and listed the design activities, related to design expertise, that were mentioned (Boland & Collopy, 2004; Hargadon & Sutton, 1997; Martin, 2009a; 2009b; Verganti, 2009).

From the reviewed papers and books, we identified 118 design activities. While analysing this list of activities, we noticed that, although the wording of some activities differed, the meaning was (almost) the same. Consequently, we (as expert

design researchers) grouped the design activities according to their similarity in meaning. Accordingly, we formulated the design activities in such a way that it expressed the meaning of the design activities in each group as saliently as we could. An example of a description of a design activity is 'bridge different languages'. This design activity was elicited from a group with the following design activities: 'is able to read different types of drawings', 'functions as a bridge between disciplines', 'is a knowledge broker' and 'functions as an interpreter'. Some activities although closely related were conceptually different (e.g., 'iterate between design problem and its solution' and 'let the design problem and solution co-evolve'). In such cases, we kept the two design activities. This ensure that we would not merge concepts that could have different interpretations for different people. The grouping and reformulation process resulted in descriptions of 48 design activities (see Appendix A). The descriptions of the 48 design activities are comparable to the formulations in the literature on design expertise on which we drew.

The 48 design activities formed the basis for the design of a card set. Each card within the set consists of a description of one design activity (see Appendix A). To enrich the descriptions of the design activity, we complemented each card with a drawing representing the activity (see Figure 1). A design professional who is an expert in representing complex information in visual form made the drawings. He collaborated with the research team to reach consensus about the fit between the drawing and the design activity on the card. Two iterations were required to reach consensus. The first iteration led to changes in the content of the drawing and the second iteration led to an improvement in details. The card set is the result of Study 1 and its aim is to function as an agreed domain of discourse on design thinking in innovation, which we will test in Study 2.

Study 2: Testing the Agreed Domain of Discourse with Domain Experts and Affected Users

Having created the card set we needed to test it to ascertain if it could function as an agreed domain of discourse for design thinking. Thus, Study 2 was undertaken. For that study, we set up interviews in which we asked the questions shown in Table 1.



Figure 1. The card set.

Table 1. The interview questions used in Study 2.

<i>Interview Questions</i>
1. The interviewer asked for biographical information to see if the respondent matches the criteria set for the study.
2. To get familiarised with the card set and to create a focus, the interviewer asked the respondent to: <ol style="list-style-type: none"> a. Divide the cards in two stacks: activities that are essential for design thinking and activities that are not essential for design thinking. (The interviewer gave the card set in a random order to each respondent.) b. The interviewer asked the respondent to think of additional design activities needed to execute his or her job in a designerly manner. If there were additional activities, the respondent could add these on empty cards to the card set. c. The interviewer asked the respondent to select the ten unique activities for design thinking from the selection of the essential and added cards.
3. The interviewer asked questions about the completeness, accuracy of the card set by evaluating the interview approach, and the card set with the respondent to see if the approach allowed for a discourse on design thinking in innovation.

Data Sampling and Collection

According to Milton (2007), an agreed domain of discourse should involve domain experts and affected users. In this study, we tested the card set with both groups.

Data Sampling Domain Experts

We conducted interviews with 21 scholars from the fields of both design and management who engage in research on design thinking in the context of early-stage innovation. We considered these scholars to be domain experts in the field of early-stage innovation. We selected scholars who study design expertise and the way designers apply their expertise in their design practices. Additionally, we selected management scholars who were interested in design thinking as a different approach to doing business. Appendix B provides a detailed overview of the scholars selected. The scholars originate from different disciplines. Their expertise range from product design, design engineering, architecture, arts, management and business. The scientific discourse of design and management scholars is often found in international scientific conferences, demonstrating the wide variety of geographical locations of these scholars. Each scholar was interviewed individually using the interview method as shown in Table 1.

Data Sampling Affected Users

The affected users in this study are innovators who apply design thinking in their daily innovation practice. Tapping into our rich network, we started the study with innovators from our own network who claim that they use design thinking in their innovation practices. While recruiting the innovators, we purposefully sought people who execute innovation projects within a variety of functional areas and organisational positions within companies and innovation consultancy agencies. We did this to cover different possible views on design thinking in innovation. Then we did ‘snowball sampling’, which provided us with names from our network of innovators that would fit our sample. This strategy resulted in interviews with 33 innovators. Appendix C provides a detailed overview of the innovators. The overview includes their function, country of origin, innovation focus or expertise and sector per the Global Industry Classification Standard. The overview shows a wide variety of application

areas such as the industrials, consumer discretionary and staples, healthcare, information technologies and financials sectors. Many affected users are in the research & consulting services in the industrial sector. These include, for example, consultants who have developed a focus and expertise in innovation with the use of design thinking. A column was added to indicate their innovation focus or expertise. This is the service that they provide or the focus of their work. The focus or expertise of our sample ranges from strategic to practical and from service-oriented to product-oriented. The geographical locations of the sample show a focus on Western Europe (NL, DE, SE, GB, DK with several innovators from the US) with the addition that, although based in a region, their organisation often operates worldwide. The overview shows that the sample of affected users is wide in both its application area and the innovators’ focus and expertise. Innovators were interviewed individually at their workplace using the interview questions shown in Table 1.

Data Analysis

There are two quality indicators for an agreed domain of discourse: completeness and accuracy (Milton, 2007): both are addressed in Study 2. We used completeness as a quality indicator to check that we had not overlooked important design activities. Additionally, we checked whether we had used the concept of design thinking too broadly by describing it with 48 different design activities. To evaluate if all aspects of design thinking are fully articulated by the card set we, first, created an overview that shows what cards the two groups labelled as (non)-essential for design thinking. This allowed us to understand how broadly the respondents see the concept of design thinking. Secondly, we made an overview of which ten cards they found unique for design thinking. We executed this step since a high degree of agreement among respondents, on the unique aspects of design thinking, could be an indicator that the set of 48 design activities could be reduced. Finally, we made an overview of cards that the respondents added to the card set.

We used accuracy as a criterion to check if the design activities, that were formulated and the drawings made by the design professional, captured the intended meanings. Subsequently, accuracy was reached when the meaning manifested in each of the cards is similar to the meaning the scholars assign to the individual cards. To evaluate the accuracy of the card set,

we analysed how the two groups interpreted the statements on the cards, how they would apply the design activity on the card and if this application is in line with the activities that we expected.

Results Study 2

Analysis of the Completeness of the Card Set

Completeness According to the Domain Experts (= The Scholars)

As a group, the scholars found *all* the cards *essential* for design thinking. The average set of *essential* cards selected by a scholar consists of 28 cards (median: 30 cards). (Largest set: 44 cards; smallest set: seven cards.) On average, each card was selected 12.2 times (median: 12 times). The card that was most frequently selected as being essential was picked 19 times (= *'let the design problem and solution co-evolve'*). The scholars selected one card only three times (= *'build on another's ideas'*).

As a group, the scholars found *all* cards except one *unique* for design thinking. On average, each card was selected 3.8 times as being unique for design thinking (median: three times). The scholars selected the most popular unique card 11 times (= *'imagine the non-existent'*). The card that they deselected was: *'continue to be inspired by adding information to the innovation project'*.

Twelve scholars added one or more cards to the card set. These additions fall into four categories:

1. rephrasing of an existing card (n = 3)
2. addition of details to an existing card (n = 7)
3. general statement on design expertise (n = 1)
4. addition not related to the set with the potential to make the set more complete (n = 4). (Appendix D shows the descriptions of all added cards.)

A qualitative analysis of the statements that the scholars made regarding the completeness of the card set confirms this. The scholars complimented the completeness of the card set. For example, one scholar was initially a bit worried, as he thought that design thinking was too complex to cover in an interview. As background information, he brought a huge pile of books about design thinking to the interview. Although he mentioned the many theories described in the books a few times, he never had to fall back on them because the cards allowed him to speak about his subjects of interest in a rich and detailed manner. He also reflected on the cards by saying the following:

...Pff, a lot of these, a lot of what's on these cards is very good, there's nothing actually bad on any of these cards ... So they're all relevant in some aspects.

Completeness According to the Affected Users (= the Innovators)

As a group, the 33 innovators found *all* the cards *essential* for design thinking. The average set of *essential* cards consists of 34.4 cards (median: 35 cards). (Largest set: 48 cards; smallest set: 14 cards.) On average, each card was selected 23.7 times (median: 25 times). No card was deselected. The most frequently

selected cards were picked 31 times (*'make sense of user needs'*, *'deal with uncertainty'*, and *'make ideas tangible with the use of prototypes'*). The least popular cards were selected 14 times (*'find inspiration in the complexity of the innovation project'*, *'use a seemingly unstructured process of experimentation'* and *'create committed team members by challenging them on their personal goals'*). As a group, the innovators selected all cards at least once as being unique for design thinking. On average, each card was selected 6.5 times as being unique for design thinking (median: six times). The innovators selected the most popular unique card 13 times (= *'make sense of user needs'*, *'trust on intuition during decision-making'*, *'create meaningful solutions'*). The least popular cards were only selected once by the innovators (= *'find inspiration in the complexity of the innovation project'*, *'continue to be inspired by adding information to the innovation project'*, and *'divide the tasks according to the team's competences'*).

Twenty innovators did not feel the need to include new cards in the set and complimented the set as a rich conversation tool thanks to its diverse range of statements combined with illustrations. Thirteen innovators would rephrase some of the cards or add new cards to the set. Similar to the scholars, the innovators also added four types of cards to the set:

1. rephrasing of an existing card (n = 2)
2. addition of details to an existing card (n = 5)
3. general statement on design expertise (n = 6)
4. addition not related to the set with the potential to make the set more complete (n = 6). (Appendix D shows the descriptions of all added cards.)

Analysis of the Accuracy of the Card Set

Accuracy According to the Domain Experts (= the Scholars)

We discussed the accuracy of the card set with the scholars. Overall, they were very impressed by its accuracy. On only a few occasions, they expressed their confusion about the formulation of the statements on the cards. This often originated from their professional knowledge of the extensive body of research that exists behind the statements. As one scholar explained:

... All these things that you've chosen are quite complex terms really, that have got a number of different dimensions to them.

We asked him explicitly to express these different dimensions, leading to very rich discussions and insights. In addition, another scholar stated after the interview that the cards really triggered a rich discourse on design thinking.

Secondly, some scholars disagreed with the statements on certain cards. Most often, this was because they disagreed with the research on which the card was based, or because they felt that the terminology used by other scholars was nonsense. One scholar for example disagreed with the statement *'iterate effectively'*, because he stated that it implies that one could also iterate ineffectively. He explained why he thought this was impossible by using examples of designers iterating. This led to a rich discussion that was in the

end in line with the stories that the other scholars told about this card. This also shows that the card set led to accurate discourse on design thinking.

Accuracy According to the Affected Users (= the Innovators)

Most innovators agreed on the wording of the cards. They disagreed only on a few occasions. For example, one innovator, reflecting on the card *mix creativity with analytical reasoning*, said that the statement was poor. He proceeded to explain how will, emotion, empathy and inspiration are all part of creativity and should be included in the mix. Although he initially perceived the statement on the card as poor, it allowed for a rich explanation of how this statement is applied in his daily practice. This example is illustrative of the high-perceived accuracy of the cards according to the innovators.

Conclusion Study 2

In Study 2, we evaluated the card set based on the card selection procedures of the scholars and the innovators. The quantitative analysis of the card selection procedures showed that the selection of cards that are essential and/or unique was quite random. In other words, no subset of cards in the set represents the core of what design thinking is. This shows that the richness of the card set was necessary to capture the extensiveness of the concept of design thinking; the richness was needed for an agreed domain of discourse on design thinking.

Regarding the completeness of the card set, it can also be concluded that both scholars and innovators found the card set to be quite complete. The scholars and innovators made four types of additions to the card set. The first group consisted of cards that reformulate existing cards in order to improve the accuracy of the set. The added cards in the second group included a more specific description of a design activity described on one of the original cards. The third group consisted of added cards with statements that cannot be linked one-to-one to design activities. The fourth group of cards consisted of additions to the original set. In total, ten cards belong to this category (see Appendix D).

The scholars and the innovators also commented on the accuracy of the card set. Although some scholars and innovators mentioned the complexity of the statements on the cards, they understood what these statements meant. We concluded this since the stories that they told us based on the statements were related to the meaning that we gave to the card. None of the cards were criticised and/or reformulated by multiple scholars and/or innovators, which suggests that the scholars and the innovators deem the cards accurate. Future research could test whether simplifying some of the statements could improve the accuracy of the card set.

Based on the analysis above, about the completeness and accuracy of the card set as the main quality indicators for an agreed domain of discourse, it can be concluded that the current cards functioned quite well as an agreed domain of discourse for design thinking.

Study 3: The Practical Application of Design Thinking in Innovation

The card set on design thinking proved to function as an agreed domain of discourse and, as such, could be used to understand its value in different innovation practices. This section reports on a third study that aimed to gain a better understanding of how innovators apply design thinking in their daily innovation practice. This study was executed with the same group of innovators that also participated in Study 2. This third study was executed immediately after Study 2 (with the same card deck). During the interview, the interviewer asked the innovator to reflect on the 10 unique cards that the respondent selected and explain how s/he applied the design activity in his/her daily innovation practices. This resulted in 33 interviews on the application of design thinking in the innovation practices of the innovators. The interviews with the innovators lasted between 35 and 120 min. The interviews were recorded and transcribed ($\pm 193,000$ words).

Data Analysis

A first analysis of the rich stories of the innovators on how they apply design thinking in their innovation practices led to two new insights. First, we discovered that the *application* of the design activities sometimes differed because the innovation practices were different. Second, the application of the design activities was not unique. We found that innovators who face similar challenges within their innovation practices use design thinking for similar purposes during innovation. Based on these insights, we concluded that in order to create an understanding of the application of design thinking in innovation, it was important to make the stories of the innovators themselves the unit of analysis.

The Construction of the Images of Design Thinking

In order to categorise the stories of the innovators sensibly, we adopted a procedure that is similar to family resemblance sorting (Rosch & Mervis, 1975). Categories that are created via family resemblance are fuzzy categories in which members are generally similar to each other, but there is no set of defining properties that would be shared by all members of the category (Medin, Wattenmaker, & Hampson, 1987, p. 243). In relation to this study, there were no examples of innovators all selecting the same design activities; the similarity between them is that they share a vision and innovation challenges. For example, innovator #6 (UX designer in the field of software and services), innovator #16 (senior specialist in NPD processes in the aerospace industry), and innovator #17 (head of design in an IT company) (for more details see Appendix C) all juggle different expressions of value throughout the (new) product development process. Design thinking facilitates dealing with the increasing complexity of their products and the business processes in which they are involved. Design thinking facilitates collaborations between organisational departments and in taking along all stakeholders in the problem context to ensure progress. Due to the similarity of the challenges, and the similar ways they apply design thinking, they belong to one category.

The result of the categorisation procedure is the origination of the images of design thinking. The result of the categorisation procedure is the origination of the images of design thinking. Morgan (1997) introduced the concept of images in his famous book—*Images of Organization*. He defined images as a way of thinking, or a way of seeing the world. He explains that a particular image of a situation leads to a deep understanding of the situation and provide therefore a way to deal with complexity and chaos (p. 4). That is, images are constructed views on the world that enable people to recognize situations and to cope with the complexity of this situation in a positive way (p. 376).

In our study, the images are constructed based on combinations of the innovator’s aim for the project, his/her vision on innovation, the main challenge s/he is facing and the way he/she applies design thinking to overcome the challenge and for what specific activities design thinking is used.

To arrive at the images of design thinking, we applied a five-step method based on the work of Medin et al. (1987). Table 2 shows the five steps and the results of these steps in the study.

To ensure that our interpretation and categorisation of the interviews justifies the content, we asked the innovators to evaluate our interpretations (that we sent to them). Thirty innovators responded that they agreed with the analysis. They found our interpretations recognisable and they made sense to them. We did not receive content-related feedback from three respondents.

Results Study 3: Four Images of Design Thinking

This section describes the four images of design thinking. These images represented the practical application of design thinking in industry and were constructed based on the rich stories of that innovators told while reflecting on their individual selection of the 10 most unique design activities. The images are: (1) *value-driven innovation* (n = 9 innovators), (2) *experience-driven innovation* (n = 7 innovators), (3) *purpose-driven innovation* (n = 11 innovators), and (4) *vision-driven innovation* (n = 6 innovators).

Table 3 shows the four images of design thinking. The first column describes the aim of the innovators within the image. The second column shows the innovators’ vision on innovation. The third column shows the challenge these innovators are facing. The fourth column describes the main purpose of design thinking in the image and the fifth column zooms in on specific innovation activities that are supported by design thinking (For a more extensive explanation of the images, see: Valkenburg, Sluijs, & Kleinsmann, 2016; Kleinsmann, Valkenburg & Sluijs, 2012).

Table 2. Five-step method for the construction of the images of design thinking.

	<i>Aim</i>	<i>Result in this study</i>
Step 1	Identify prototypical exemplars & determine the core message.	Four categories of two to three key personas. Preliminary definition of the innovation challenge.
Step 2	Capture the content of each interview.	Detection of three to four innovation activities (to overcome the challenge) per interview.
Step 3	Categorise all interviews using the key personas as centres of categories.	Four clusters of interviews assembled with the use of family resemblance.
Step 4	Name categories.	Naming of the images.
Step 5	Capture the content of each category in detail.	Clusters of similar activities supported by design thinking found in the interviews corresponding with that image. Final description of an image.

Not all innovators in an image executed all the activities mentioned in the fifth column of Table 3. All innovators executed two to three activities each and all innovation activities were executed by at least two innovators. Appendix E shows the distribution of the innovators along the activities.

Study 4: External Validation of the Images of Design Thinking

A study into understanding how innovators apply design thinking in their daily innovation practice resulted in four images of design thinking. To validate the images, we need to investigate if other innovators recognise themselves in the images and if they apply similar activities. Therefore, we set up a fourth study. We performed Study 4 as part of a seminar on collaborative innovation networks. During the seminar we did a workshop (in 2 sessions) in which we presented and evaluated the images.

Participants of the Workshop

Twenty people took part in the workshop divided into two sessions (Session 1: n = 9; Session 2: n = 11). From their own introduction during the workshop and the analysis of their public profiles, we concluded that 18 people had profiles similar to those of the innovators in the study. Two people had different profiles: one scientist and one person who supports inventors. We excluded both persons from further analysis.

Results Study 4

All 18 participants explicitly identified themselves with one of the four images (see Table 4). They explained that they recognised the challenges and the innovation activities. The respondents assigned themselves to an image in just a few minutes, which also shows that it was not difficult for the respondents to position themselves within one image.

The respondents within the vision-driven group of Session 1, for example, all have very future-oriented tasks and have the task of changing systems with the use of design thinking. This fits the vision-driven image. The respondents recognised the innovation activities from their practice and they started to share experiences on how they create paths to the future, how they take people along those paths and how to have fruitful dialogues with these people along the way. Furthermore, one participant, who chose experience-driven innovation, told the facilitator informally

Table 3. Description of the four images of design thinking.

<i>The innovators' aim</i>	<i>Innovators' vision on innovation</i>	<i>Innovators' challenge in innovation</i>	<i>Design thinking facilitates:</i>	<i>Design thinking is particularly used to:</i>
Innovators in value-driven innovation aim to develop strategies for the long-term survival of the company.	Innovators in this image see a world in which customers in the supply chain become more demanding and business processes become more complex.	Reframing the business model leading to a sustainable value proposition is the main challenge because the traditional operations are no longer sufficient to be competitive in the fast-changing market and expressing competitive advantage in the market is key.	A holistic view on the market, business, stakeholders and added value. Additionally, design thinking facilitates collaboration across organisational departments and taking along all stakeholders in the problem context to ensure progress.	<ul style="list-style-type: none"> • Zoom in and out of the problem in context to create a full understanding of the problem—and its solution space. • Get in contact with the end user to overcome organisational fixation and to create a project goal. • Visualise and conceptualise to create a shared understanding among stakeholders. • Make decisions in spite of ambiguous and incomplete information to progress the project.
Innovators in experience-driven innovation aim to create rich experiences through involving people in the experience as well as in the creation of it.	Innovators in this image see a world in which the user's experience is an inextricable part of service innovation. The value of an experience unfolds in the use.	Innovators see discovering the value for the user and making it explicit to create business as their main challenge.	Co-creation with all stakeholders as a driving force in discovering the value for the end-user.	<ul style="list-style-type: none"> • Engage all stakeholders to get their input during co-creation. • Be sincerely curious about people to make all stakeholders aware of implicit user values. • Create a safe atmosphere of doing and play to let the stakeholders embody the innovation problem and explore the unknown.
Innovators in purpose-driven innovation aim for well-designed products (& services) that deliver maximum value for users.	Innovators in this image see a world in which products become increasingly complex, for instance through the integration of 'smartness' or addition of service platforms.	Innovators see the task of integrating all knowledge from different disciplines and domains as their main challenge.	Creating a shared understanding in the team about what the added value for the user is exactly. User value in turn drives the integration and application of knowledge by all members of the design team.	<ul style="list-style-type: none"> • Cultivate end-user curiosity to create a valuable product. • Align user and business value to make the concept accomplishable. • Synthesise thoughts of experts to create a coherent design. • Visualise and prototype in early stages to facilitate discussions. • Rely on dreaming and intuition to break away from the status quo.
Innovators in vision-driven innovation aim for a positive change in the world.	Innovators in this image see a world in which the far future is uncertain and unknown. Within this future, innovators have a strong belief in how to translate grand (societal) challenges into innovation opportunities.	The challenge is to engage in developments that are future proof. Among all the rapid changes in the world, they develop sensitivity towards what is a meaningful and sustainable direction to take for the business.	Achieving a strong vision for the future, which is enriched by provocative endeavours with different types of stakeholders who support the vision.	<ul style="list-style-type: none"> • Make use of intuition, personal engagement and 'what if' questions, to create provocative statements and/or concepts that show future possibilities. • Confront people with and immerse them in a realistic future vision of what the world could be in order to create a dialogue about future possibilities. • Facilitate and orchestrate the input of as many stakeholders as possible during the process of vision making to support the future vision.

Table 4. Distribution of the participants over the images.

<i>Image</i>	<i>Number of participants</i>
Purpose-driven innovation	3
Vision-driven innovation	6
Experience-driven innovation	4
Value-driven innovation	5

after the workshop that the descriptions of the image he belongs to fit him so well that it felt like 'coming home'. He also stated that the image provided him with many insights that will support him in explaining himself to his clients and others in the near future. Knowing the content of the remaining three images also supported him in understanding differences between him and other types of innovators.

Moreover, the facilitator noticed during Session 1 that the participants within one image used similar language, while the language of participants belonging to different images varied. She

asked if the respondents had noticed this. One of the participants (purpose-driven innovation) answered this question as follows:

Yes, very much. There [pointing towards the experience-driven innovation group] they referred to people many times, there [pointing towards the vision-driven innovation group] they talk about dreaming. And I have lists.

This respondent recognised that the experience-driven innovator is focused on people, the vision-driven innovator is focused on visions and dreams that are further into the future

and the purpose-driven innovator is focused on clear and tangible goals, which can be expressed lists such as program of requirements and to-do lists. This is also an indicator that the images are representative and distinctive.

The participants of the workshops also reflected in groups on the innovation activities that we formulated within the images. These reflections led to vivid discussions. For example, one participant within experience-driven innovation in Session 1 stated:

We added practical examples [to the innovation activities]. Let's start with explaining, "be curious about people.

He continued by explaining how he did this. This is representative of what other participants did. They enriched the activities with examples from their own practice, without adding new innovation activities. This indicates that people who belong to an image actually execute the innovation activities within an image.

Moreover, the person that supported inventors (whom we excluded from further analysis) asked the purpose-driven innovators questions about the innovation activities. He could not believe that somebody would actually engage in such activities. The participants that identified with the image 'defended' the innovation activities with a lively explanation of how they applied them and how the activities supported them in their daily innovation practice.

Discussion and Conclusions

The paper shows that the context in which designers operate is changing. Some people within the design community find this problematic, since they think that an extension of the context in which design thinking is applied will lead to a fad rather than a real opportunity for exploration (Stewart, 2011).

Furthermore, people in industry apply design thinking in a rather uncritical manner, resulting in weak innovation projects (Woudhuysen, 2011). The ambiguity of the concept makes it hard to capture the value of design thinking in innovation practices. This was reinforced by the significant disconnect between the available theoretical knowledge on design thinking, sourced from the literature on design expertise, and its practical implementation. These studies aimed to connect theory and practice in two distinct ways. Firstly, by creating a common language through the creation of a card set that served as a shared domain of discourse. Secondly, the images of design thinking support people in understanding their innovation practice and thus identifying how they apply design thinking in a valuable manner.

To overcome the gap between theoretical knowledge on design thinking and its practical application, we developed a card deck by drawing on the literature on design expertise. We successfully tested if both scholars (theory) and innovators (practice) could accept this card deck as an agreed domain of discourse. Consequently, the card deck functions as a bridge between theoretical knowledge on design thinking and its application. Outside the direct scope of this paper, we tested if the card deck could function as a tool to train people in what design

activities they can use while executing early-stage innovation projects within a particular image. In various settings, we applied the card deck to: (1) explain what design thinking is, and (2) train the participants to improve specific parts of their early-stage innovation practices. On these occasions, the card set provided a playful means of reflecting (collaboratively) on the value of design thinking in the early stage of innovation.

The four images of design thinking presented in Study 3 frame how innovators apply design thinking to support their innovation practices. The images support the designer in reading the situation in which s/he will apply design thinking (Morgan, 1997, p. 4 & 376).

Study 3 explains that the application of design thinking is dependent on the innovator's aim for the project, his or her vision on innovation, and the main challenge s/he is facing. In other words, design activities have a different value within the different images. Take for example prototyping as an important design activity. In *value-driven innovation*, innovators use prototyping mainly for the synthesis of the diverse knowledge bases of the different stakeholders. Prototypes are used to create a shared understanding about the technical complexity of the innovation project and to elicit tacit assumptions about the stakeholders. In *experience-driven innovation*, there is an emphasis on collaborative prototyping with users, mainly during the discovery phase in which it is determined what will create value for the end user. In *purpose-driven innovation*, innovators use prototypes to turn ideas into concepts. These concepts facilitate the creation of a shared understanding in the multidisciplinary team. Prototyping is also a vital element in *vision-driven innovation*. Innovators use prototypes to provoke a dialogue with the stakeholders (including future users) and to test the vision created. This finding is in line with the work of Lawson (2006) and Schön (1983, p. 131) that showed the importance of the context while designing. It is important to mention that Study 3 also showed that design thinking is not solely responsible for success in innovation. The innovation activities clearly display that the innovators used design thinking to deal with important aspects of their entire innovation process. However, the innovators' tasks are more extensive than the innovation activities described in Table 3. Therefore, we want to emphasise that, to be successful in innovation, other innovation activities should also be executed.

Study 3 provides the reflections of 33 innovators on the value of design thinking in their innovation practices. Some of the innovators participating in this study told us (after the interview) that they feel like sole advocates of design thinking within the organisation for which they work. They explained that they find it hard to awaken interest and kindle enthusiasm among their colleagues about their designerly way of working, because it deviates from what their colleagues are used to. This is partly because the innovators also find it difficult to explain what things they do and why. The respondents of Study 4 recognised this problem and suggested that they will use the contents of Table 3 to show their colleagues that there are other best practices available. This indicates that the framework presented in Table 3 could support innovators with explaining their way of working to others

and that using the images of design thinking will lead to greater commitment and belief in the value of applying design thinking in innovation. This confirms our own experiences, in which we acted as design consultants and used the images and the card deck to explain the value of design thinking in innovation practices to other people. The images supported rich discussions about the innovation context and responsibilities of the participants. These discussions provided insights on the value of design thinking in their innovation practices; because the participants could see clearly the advantages of applying design thinking. The card deck functioned within these consultancy settings as a hands-on tool to support decision making on which design activities to exploit.

Concluding, we can say that the combination of the descriptions of the images together with the card deck can serve as a common language and a tool that allows capturing the value of design thinking in early-stage innovation.

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Appendix

Appendix A. Grouping design activities.

#	<i>Design activity card described on card</i>	<i>Design activity as described in literature</i>
1	Dare to take risks to be innovative	<ul style="list-style-type: none"> • Asks for forgiving afterwards rather than permission before
2	Alternate between a diverging and converging approach	<ul style="list-style-type: none"> • Has a 'breath-first' approach • Uses a process of diverging and converging to come to a solution • Uses a process of divergent (create choices) and convergent thinking (make choices)
3	Build on another's ideas	<ul style="list-style-type: none"> • Uses brainstorming to come up with new ideas • Builds on one another's ideas
4,5	Balance desirability, viability and feasibility/ Transfer the innovation brief into consumer value and market opportunity	<ul style="list-style-type: none"> • Balances desirability, viability and feasibility and converts this into customer value and market opportunity
6	Integrate the knowledge bases of different disciplines	<ul style="list-style-type: none"> • Is able to integrate different 'design spaces'
7	Find inspiration in the complexity of the innovation project	<ul style="list-style-type: none"> • Uses the complexity of a design project as a trigger for creativity
8	Use the innovation project as a learning experience	<ul style="list-style-type: none"> • Has a focused and directed approach to gathering problem information and prioritizing criteria • Learns towards a design solution • Uses qualitative research to learn from the lives of others and incorporate this learning into their projects
9	Iterate between design problem and its solution	<ul style="list-style-type: none"> • Is able to move between 'design spaces' that all consist of a part of the design problem/solution • Uses solution conjectures as means for developing their understanding of the problem • Uses proposed solutions as reminder for issues that need to be considered • Creates a matching problem and solution pair • Builds a bridge between problem and solution
10	Let the design problem and solution co-evolve	<ul style="list-style-type: none"> • Is solution focused • Sees the connectedness between problem and solution • Uses drawings for exploration of problem and solution together • Let the design problem and solution co-evolve
11	Engage and empathize with users	<ul style="list-style-type: none"> • Engages and empathizes with users • Are skilled observers
12	Make sense of user needs	<ul style="list-style-type: none"> • Is user-centred • Uses empathic abilities to observe the people they design for • Uses scenario's to keep stakeholders at the center of the idea • Makes sense of user needs
13	Convert (user) needs into added value	<ul style="list-style-type: none"> • Converts needs into demands • Translates observations into insights and insights into products and services
14	Co-create with users	<ul style="list-style-type: none"> • Co-creates with users
15	Deal with changing rules, criteria and/or incomplete information	<ul style="list-style-type: none"> • Sees contradicting requirements as a welcome surprise • Uses contradicting requirements as a tool for creativity • Is used to work with incomplete information • Is able to deal with constantly changing rules and criteria • Provides the criteria on which a design is judged
16	Deal with uncertainty	<ul style="list-style-type: none"> • Is able to deal with uncertainty • Tolerates uncertainty
17	Use sparring with people as sources of inspiration	<ul style="list-style-type: none"> • Is able to use the different perspectives of the stakeholders for making a good design • Consults colleagues for gathering information about the design problem • Sees nonlinear and multidirectional relationships as a source of inspiration
18	Continue to be inspired by adding information to the innovation project	<ul style="list-style-type: none"> • Is constantly generating new tasks and goals • Is constantly adding new information to the project to arrive at a unique solution • Is actively looking for new data points
19	Look at the innovation project from different points of view	<ul style="list-style-type: none"> • Is able to look at the design project from different angles • Uses alternative proposals to test a particular idea
20	Create knowledge through interaction and inquiry	<ul style="list-style-type: none"> • Uses abductive reasoning to orient the context of the design project • Creates new knowledge through interaction and inquiry • Asks the 'why' question to reframe the problem and to redefine constraints

Appendix A. Grouping design activities (continued).

#	<i>Design activity card described on card</i>	<i>Design activity as described in literature</i>
21	Use different types of sketches to create a shared understanding	<ul style="list-style-type: none"> • Is able to use different types of sketches
22	Prototype non-physical experiences	<ul style="list-style-type: none"> • Uses prototypes to test ideas • Use prototypes for exploration and evaluation • Is able to prototype nonphysical experiences (with the use of e.g., scenario's, storyboards and persona's) • Creates experiences
23	Visualize together to create a shared understanding	<ul style="list-style-type: none"> • Uses prototypes for creating a shared understanding in the design team
24	Visualize to communicate ideas and concepts	<ul style="list-style-type: none"> • Uses storytelling to communicate the value of an idea • Use storytelling as a way to implement an idea
25	Clarify thought processes with the use of visualizations	<ul style="list-style-type: none"> • Use sketches to clarify thoughts
26	Have a research attitude to really understand	<ul style="list-style-type: none"> • Is focused on underlying principles instead of surface features • Bridges the 'knowing-doing gap'
27	Iterate effectively	<ul style="list-style-type: none"> • Is used to iterate between design problem and its solution • Redefines task constraints constantly
28	Switch between different levels of abstraction	<ul style="list-style-type: none"> • Communicates a specific design proposal with the use of drawings on different levels of detail (e.g., overview drawings and details) • Is able to see both details and the big picture
29	Imagine the non-existent	<ul style="list-style-type: none"> • Uses abstract conceptualizations to imagine
30	Have a reflective conversation with the imaginary	<ul style="list-style-type: none"> • Thinks about how things ought to be (and not how they are) • Is able to imagine the implication of a drawing • Applies imagination to practical problems • Applies constructive forethought to practical problems • 'Shapes' the situation in accordance with his initial appreciation of it • 'Talks' with the context that he is shaping
31	Divide the tasks according to the team's competences	<ul style="list-style-type: none"> • Is able to see the consequences of a certain way of task division • Sees task dependencies between stakeholders
32	Trust on intuition during decision making	<ul style="list-style-type: none"> • Makes intuitive judgments
33	Create meaningful solutions	<ul style="list-style-type: none"> • Creates meaning
34	Create unexpected solutions with a wow factor	<ul style="list-style-type: none"> • Produces novel and unexpected solutions
35	Use a seemingly unstructured process of experimentation	<ul style="list-style-type: none"> • Uses an experimental approach • Uses a seemingly unstructured process of experimentation
36	Challenge the status quo of the innovation project	<ul style="list-style-type: none"> • Adds value by challenging the status quo
37	Create committed team members by challenging each on their personal goals	<ul style="list-style-type: none"> • Adds personal goals to the design brief to challenge himself • Adds personal goals to the design brief to create involvement
38	Recognize situations and apply experience on it to bring the innovation project further	<ul style="list-style-type: none"> • Is good in recognizing situations and applying his experience on it to bring the design project one step further • Uses chunks of information as ordering principles to understand the design project • Incorporate all personal knowledge and experiences into their work • Frames design problems in terms of relevant solutions by using his experience • Uses analogies to create ideas
39	Apply previously used problem solving strategies to bring the innovation project further	<ul style="list-style-type: none"> • Uses heuristics as input for the design project • Is able to work with large cognitive chunks • Has precedents available to solve the design problem • Has a repertoire of tricks available to solve the design problem • Uses problem structuring activities throughout the entire project • Uses 'guiding themes' for problem solving • Is able to use a blend of thinking styles
40	Create a rich design conversation with different stakeholders	<ul style="list-style-type: none"> • Is Creates a multipolar experience in which all stakeholders have the opportunity to participate in the conversation • Creates a rich design discourse by communicating with different interpreters • Identifies and attracts key interpreters to access their knowledge about possible new meanings • Is a good listener (to all different standpoints)

Appendix A. Grouping design activities (continued).

#	Design activity card described on card	Design activity as described in literature
41	Negotiate with different stakeholders	<ul style="list-style-type: none"> • Is able to collaborate with different stakeholders • Is a skilled negotiator
42	Create belief by imagining the future	<ul style="list-style-type: none"> • Uses storytelling to justify the design proposal • ‘Borrows’ the life of others to inspire new ideas • Infers possible worlds • Prepares the ground for ground-breaking proposals by visualizing the future
43	Evaluate alternative proposals against the initial vision	<ul style="list-style-type: none"> • Is concerned with the evaluation of design proposals • Evaluates tentative solutions before implementing them
44	Bridge different languages	<ul style="list-style-type: none"> • Is able to read different types of drawings • Functions as a bridge between disciplines • Is a knowledge broker • Functions as an interpreter
45	Scope the innovation project by prioritizing criteria	<ul style="list-style-type: none"> • Is able to do adequate problem scoping • Helps the client with problem scoping by creating alternative solutions
46	Challenge boundaries by investigating the ill-defined issues of the innovation project	<ul style="list-style-type: none"> • Sets explicitly boundaries for what features within the problem space they choose to attend and what to exclude • Acts as though there is some ill-definedness in the goals, initial conditions or allowable transformations • Challenges accepted explanations
47	Mix creativity with analytical reasoning	<ul style="list-style-type: none"> • Is able to mix creativity with analytical reasoning
48	Make ideas tangible with the use of prototypes	<ul style="list-style-type: none"> • Uses prototypes to communicate about ideas • Relies fundamentally on non verbal media of thought communication • Make ideas tangible with the use of prototypes as early in the process as possible

Appendix B. Profiles of the scholars.

#	Role / department	Country	Organization	Area of expertise
1	Department of Management, Politics and Philosophy (MPP)	DK	Copenhagen Business School	Management
2	Faculty of Design, Architecture and Building	AU	University of Technology Sydney	Product- & service design
3	Faculty of Engineering and IT	AU	University of Sydney	Design Engineering
4	Key Centre of Design Computing and Cognition	AU	University of Sydney	Design Engineering
5	Faculty of Architecture and Town Planning	IL	Technion - Israel Institute of Technology	Architecture
6	Design Studies	GB	University of the Arts London	Arts & Design
7	Engineering department	GB	Cambridge University	Design Engineering
8	Faculty of Art and Design	GB	Montfort University	Design Management
9	Faculty of Industrial Design Engineering	NL	Delft University of Technology	Product- & service design
10	Department of Management Engineering	DK	Technical University of Denmark	Product Design
11	Faculty of Industrial Design Engineering	NL	Delft University of Technology	Product Design
12	Research department Product Design & Engineering	NL	University of Applied Sciences Utrecht	Product- & service design
13	Centre for Design Research	USA	Stanford University	Product Design
14	Professor of Engineering Design	FR	Grenoble INP Génie-Industriel	Design Engineering
15	Professor	GB	University of Strathclyde	Design Engineering
16	Department of Management, Politics and Philosophy	DK	Copenhagen Business School	Management
17	Vice-president for Research	LU	University of Luxembourg	Design Engineering
18	Design Management	DE	University of Applied Sciences, Muenster	Management
19	Design lab	US	University of California, San Diego	UX Design
20	Faculty of Industrial Design Engineering	NL	Delft University of Technology	Design management
21	Faculty of Industrial Design Engineering	NL, DE (?)	Delft University of Technology	Product design

Appendix C. Profiles of the innovators.

#	Role	Country	Focus	GCIS Sector	More specific
1	Head Of R&D	NL	R&D & NPD	Industrials	Building products
2	Head Of Product & Services Planning	NL	Product & service portfolio	Consumer discretionary	Automobile
3	Senior Director Design Innovation	NL	Business innovation & Strategic partners	Healthcare	Healthcare technology
4	Chief Design Officer	NL	Business innovation	Consumer discretionary	Household durables
5	Design Manager	NL	Brand values	Consumer discretionary	Household durables
6	User Experience Designer	GB	Experiences	Information Technology	Internet software and services
7	Senior Advisor	NL	Business processes	Industrials	Transportation infrastructure
8	Director Business Development	NL	NPD & strategic business development	Industrials	Aerospace
9	Chief Financial Officer	NL	Early-stage innovation	Consumer discretionary	Apparel
10	Expert Engineer & Project Manager Aem	NL	Technical expert	Industrials	Construction and engineering
11	Concept And Design Creation Manager	DK	Strategic business development	Consumer discretionary	Leisure facilities
12	Product Designer And Portfolio Promotions Manager	NL	Marketing & sales tools for new products	Industrials	Commercial services and supplies
13	Social Business Change Manager	NL	Experience	Financials	Banks
14	Senior Specialist Engineering Mechatronics	NL	Business processes	Industrials	Industrial machinery
15	Packaging Manager	NL	Products	Consumer staples	Personal products
16	Senior Specialist In Product Development	SE	Research & method improvements	Industrials	Aerospace
17	Head Of Design	GB	NPD & User Interfaces	Information Technology	Communications equipment
18	Vice President	NL	Strategic development	Consumer discretionary	Household durables
19	User Centered Designer	NL	User research	Industrials	Research & consulting services
20	Service Designer	NL	Service innovation	Industrials	Research & consulting services
21	Creative Facilitator	NL	Creativity expert	Industrials	Research & consulting services
22	Strategic Consultant	NL	Product portfolios	Industrials	Research & consulting services
23	Strategic Consultant	NL	Business innovation	Industrials	Research & consulting services
24	Strategic Consultant	NL	Service innovation	Industrials	Research & consulting services
25	Strategic Consultant	GB	Strategic design	Industrials	Research & consulting services
26	Head Of User Experience	GB	design experiences; building empathy	Financials	
27	Strategic Consultant	NL	Product design	Industrials	Research & consulting services
28	Strategic Consultant	NL	Visualisation expert	Industrials	Research & consulting services
29	Strategic Consultant	NL	Service innovation	Industrials	Research & consulting services
30	Strategic Consultant	NL	Brand design	Industrials	Research & consulting services
31	Creative Researcher And Facilitator	NL	User research	Industrials	Research & consulting services
32	Strategic Consultant	NL	Business development	Industrials	Research & consulting services
33	Customer Experience Director	GB/DE	Service innovation	Industrials	Research & consulting services

Appendix D. Added cards.

	<i>Added cards of the scholars</i>	<i>Added cards of the innovators</i>
1. Rephrasing of an existing card (accuracy)	<ul style="list-style-type: none"> • Find inspiration wherever you can • Continue to add information in the process • Let the problem and solution co-evolve 	<ul style="list-style-type: none"> • Challenge status quo, the boundaries of current business • Knowledge and capitalizing on knowledge and learning effects
2. Addition of details to an existing card (accuracy)	<ul style="list-style-type: none"> • Storytelling through visual experiences • Design innovation is creating value • Questioning the scope of the design problem • Conceptualization: the concept as the answer to need • Take into account the different phases of the product lifecycle • Define a vision and an ambition • Use metaphors as a visualizing device without having to draw 	<ul style="list-style-type: none"> • Clear vision • Create a mini new business case • Pre-sensing • Team spirit: the common goal above all other • Combine experience with various points of view
3. General statement on design expertise (completeness)	<ul style="list-style-type: none"> • Knowing/finding out which expertise to include 	<ul style="list-style-type: none"> • (Time) Constraints • Evaluation after launch • Why do we do what we do? • Leadership climate • Good resources
4. Addition not related to the set with the potential to make the set more complete (completeness)	<ul style="list-style-type: none"> • Create a new frame • The designer's eye/I • To distinguish the idea in from the idea with • Reframing the problem through interaction 	<ul style="list-style-type: none"> • Play • Playfulness and fun • Simplicity • Be aware of emerging technologies • Unlocking creativity through emotion, commitment, involvement, engagement, empathy • Personality

Appendix E. Distribution innovators among design activities.

Value driven:

- Zoom in and out of the problem in context to create a full understanding of the problem—and its solution space (*innovators V1, V3, V4, V6, V7, V9*).
- Get in contact with the end user to overcome organisational fixation and to create a project goal (*innovators V1, V2, V6, V7, V8, V9*).
- Visualise and conceptualise to create a shared understanding among stakeholders (*innovators V1, V3, V5, V6, V7, V8*).
- Make decisions in spite of ambiguous and incomplete information to progress the project (*innovators V2, V3, V4, V5, V7, V8*).

Experience Driven:

- Engage all stakeholders to get their input during co-creation (*innovators E2, E3, E4, E7, E7*).
- Be sincerely curious about people to make all stakeholders aware of implicit user values (*innovators E1, E2, E3, E4, E5, E7*).
- Create a safe atmosphere of doing and play to let the stakeholders embody the innovation problem and explore the unknown (*innovators E1, E2, E4, E5, E6*).

Purpose driven:

- Cultivate end- user curiosity to create a valuable product (*innovators P6, P7, P9, P10*).
- Align user and business value to make the concept accomplishable (*innovators P1, P2, P3, P8, P10*).
- Synthesise thoughts of experts to create a coherent design (*innovators P1, P2, P3, P5, P8, P9, P11*).
- Visualise and prototype in early stages to facilitate discussions (*innovators P4, P5, P6, P7, P10*).
- Rely on dreaming and intuition to break away from the status quo (*innovators P2, P4, P5, P6, P8, P9, P10*).

Vision driven:

- Make use of intuition, personal engagement and ‘what if’ questions, to create provocative statements and/or concepts that show future possibilities (*innovators V2, V3, V4, V5, V6*).
- Confront people with and immerse them in a realistic future vision of what the world could be in order to create a dialogue about future possibilities (*innovators V1, V2, V4, V5, V6*).
- Facilitate and orchestrate the input of as many stakeholders as possible during the process of vision-making to support the future vision (*innovators V1, V2, V3, V4, V5*).