# IT TAKES TWO TO TANGO

Investigating the antecedents
and consequences of effective
collaboration between designers
and managers in innovation projects

Kasia Tabeau

# IT TAKES TWO TO TANGO

Investigating the antecedents and consequences of effective collaboration
between designers and managers in innovation projects

PROEFSCHRIFT

ter verkrijging van de graad van doctor
aan de Technische Universiteit Delft,
op gezag van de Rector Magnificus prof.ir. K.C.A.M. Luyben;
voorzitter van het College voor Promoties,
in het openbaar te verdedigen op
dinsdag 28 juni 2016 om 10.00 uur

DOOR

Katarzyna Ewa (Kasia) TABEAU,
Ingenieur Industrieel Ontwerpen,
Technische Universiteit Delft,
geboren te Warschau, Polen

THIS DISSERTATION HAS BEEN APPROVED BY:

| | |
|---|---|
| Prof. dr. H.J. Hultink | promotor |
| Prof. dr. G. Gemser | promotor |
| Prof. dr. N.M. Wijnberg | promotor |

COMPOSITION OF THE DOCTORAL COMMITTEE:

| | |
|---|---|
| Rector Magnificus | Chairman |
| Prof. dr. H.J. Hultink | Delft University of Technology |
| Prof. dr. G. Gemser | RMIT University |
| Prof. dr. N.M. Wijnberg | University of Amsterdam |

INDEPENDENT MEMBERS:

| | |
|---|---|
| Prof. dr. Jan Schoormans | Delft University of Technology |
| Prof. dr. Fred Langerak | Eindhoven University of Technology |
| Prof. dr. Hans Berends | VU Amsterdam |
| Prof. dr. Gloria Barczak | Northeastern University |
| Prof. Ir. Deborah Nas | Delft University of Technology, reserve member |

This research was funded by the Dutch Ministry of Education, Culture, and Science as part of the Creative Industry Scientific Program (CRISP).

Kasia Tabeau, *kasia.tabeau@gmail.com*

DESIGN BY:
Sarah van Berkom, *sarahvanberkom.nl*

PRINTED BY:
CPI – Koninklijke Wöhrmann – Zutphen, *cpithesis.nl*



# Table of Contents

# 1
# Introduction

Prior research has shown that design may have a positive influence on organizational and project performance (see e.g., Chiva and Alegre, 2009; Czarnitzki and Thorwarth, 2012; Gemser and Leenders, 2001; Hertenstein et al., 2005). An indicator that organizations increasingly recognize the role that design can play in competitiveness is that the number of organizations investing in design has increased considerably (Cameron et al., 2015; Gemser and Leenders, 2001; Trueman and Jobber, 1998). Not only is the amount of resources devoted to design on the rise, but the role of design and those who practise it (designers) is also moving from an operational to a strategic one (see e.g., Kang et al., 2015; Perks et al., 2005; Ravasi and Lojacono, 2005; Valencia et al., 2013). A strategic role implies that designers are involved in shaping and executing the innovation objectives of organizations (Fitzsimmons et al., 1991; Hertenstein and Platt, 1997; Ravasi and Lojacono, 2005).

One example of an organization in which the role of designers is becoming more strategic is the health and wellbeing company Philips (Gillespie, 2014). For example, Philips' designers are involved in shaping the objectives of innovation projects by determining user needs, and they are involved in executing the objectives of these projects by assuring that the developed solutions meet the determined needs (Gillespie, 2014). Such a strategic role may require designers to become managers of these innovation projects (Kang et al., 2015; Perks et al., 2005; Peters, 2012; Valencia et al., 2013). For example, Perks et al. (2005) found (based on case study research with U.K. manufacturing organizations) that designers can act as process leaders in innovation projects, which requires them to drive the development of the design throughout the process, and to support all functions in doing so. Similarly, Valencia et al. (2013) showed (based on an in-depth case study of a multinational high-tech company) that designers can have process-related roles in innovation projects, which require them to manage the interactions between functional areas: that is, these roles require them to communicate information that is external to the organization, facilitate communication across functional areas, balance stakeholder demands in the process, and translate the marketing message into product attributes.

If designers are to play a more strategic role in innovation projects, without becoming the actual managers of the project, they need to effectively collaborate with the managers of these projects (Goffin and Micheli, 2010; Liedtka, 2010, 2015; Micheli et al., 2012; Ravasi and Lojacono, 2005). In this thesis, designers and managers are considered to have fixed functional roles (see e.g., Perks et al., 2005; Micheli et al., 2012; Liedtka, 2010, 2015). Effective collaboration between designers and managers then refers to their joint behaviour in working towards some goal of common interest (cf. Pinto and Pinto, 1990). Prior research has studied how designers and managers can collaborate effectively (Goffin and Micheli, 2010; Liedtka, 2010, 2015; Micheli et al., 2012; Ravasi and Lojacono, 2005). For example, Goffin and Micheli (2010) showed how designers and managers can collaborate through the process of innovation projects by addressing the tensions they come across throughout this process, and Ravasi and Lojacono (2005) illustrated how they can collaborate in innovation projects that aim to renew the organization. The main objective of the present thesis is to obtain a better understanding of the antecedents and consequences of effective collaboration between designers and managers in innovation projects. Extant research has not explicitly paid attention to these antecedents and consequences. Rather, prior research has investigated the antecedents and consequences of collaboration with designers in innovation projects in more general terms. For example, prior research has investigated the antecedents of the collaboration between designers and other functions in innovation projects without specifying whether these other functions have a managerial role or not (Abecassis-Moedas and Benghozi, 2012; Beverland and Farrelly, 2011; Perks et al., 2005). Furthermore, although prior studies have examined the consequences of involving designers in innovation projects, they have not investigated whether these designers should collaborate with managers in such projects (Gemser et al., 2011; Hise et al., 1989; Roy and Potter, 1993; Roy and Riedel, 1997). The following chapter will discuss the antecedents and consequences of effective collaboration between designers and managers in more detail. To obtain a better understanding of the antecedents and consequences of effective collaboration between designers and managers, this thesis builds on the design and

innovation management literatures, which are complementary to each other. Studies in the design literature tend to investigate the antecedents and consequences of effective collaboration between designers and managers predominantly from the perspective of designers, while studies in innovation management literature tend to do this predominantly from the perspective of managers. The present thesis builds on and simultaneously extends insights from both streams (design and innovation management) to obtain a more complete overview of these antecedents and consequences.

The remainder of this chapter is structured as follows. First, the main theoretical themes of this thesis are discussed, including a description of the antecedents and consequences of effective collaboration between designers and managers. The academic and practical relevance of the thesis are then discussed. The present chapter ends with a discussion of the methodology of the thesis and its structure.

## 1 .1
## MAIN THEORETICAL THEMES OF THE THESIS

### 1 .1 .1
### ANTECEDENTS OF EFFECTIVE COLLABORATION BETWEEN DESIGNERS AND MANAGERS

The design and innovation management literatures have not paid explicit attention to the antecedents of effective collaboration between designers and managers. However, based on a review of the literature, important aspects influencing effective collaboration are: differences in ways of working and cognitive styles of designers and managers, and the management of these differences. Also, the way in which managers employ designers (for example in terms of designers' influence in decision making) is relevant for effective collaboration. In the sections below, these topics will be discussed in more detail.

There is relatively much recent research, particularly in the context of design thinking, on whether and how designers and managers differ in their ways of working (see e.g., Berends et al. , 2011; Beverland and Farrelly, 2011; Liedtka, 2010, 2015; Seidel and Fixson, 2013). For example, Liedtka (2010) discussed differences in the ways of working of designers and managers (whom she calls business strategists) by focusing on the methods they use and processes they follow, which she derived from her experiences as an academic and business consultant. According to Liedtka (2010), the methods and processes of designers focus on experimentation and doing, while the methods and processes of managers focus on analysis and planning. In a similar vein, based on interviews and archival research, Beverland and Farrelly (2011) proposed that designers are focused on predicting the future in their way of working, while managers are focused on analysing the past. Prior research has described the way of working of designers as subjective and experiential, and the way of working of managers as objective and rational (Beverland and Farrelly, 2011; Chang et al., 2013; Fixson and Read, 2012; Liedtka, 2010). Indeed, prior literature has suggested that designers use their emotions in their work, view reality as socially constructed and use iterations in their process, while managers use logic, consider reality as fixed and quantifiable, and work towards one best solution (Beverland and Farrelly, 2011; Chang et al., 2013; Fixson and Read, 2012; Liedtka, 2010).

To assure effective collaboration between designers and managers, both types of individuals should acknowledge that there may be differences in their way of working (Goffin and Micheli, 2010; Micheli et al., 2012). An important 'strategy' for designers to help managers understand their way of working is to create 'process understanding'; that is, explaining the sequence of (design) activities that will be performed to bring about outcomes (Duck, 2012; Hakatie and Ryynänen, 2007; Hertenstein and Platt, 1997; Maciver, 2012; Roozenburg and Eekels, 1995). For example, Hakatie and Ryynänen (2007) indicated (based on ethnographic research of one innovation project) that designers and managers should share the same understanding of the design process to ensure smooth interaction between them, while Maciver (2012) proposed (using research with four design consultancies in the U.K. and U.S.) that tutoring about the design process is important to establish positive working relationships as this reaps rewards such as trust, knowledge transfer and shared goals. While prior research has focused on the effects of process understanding, there is a lack of understanding on how to actually create process understanding.

Another related theme, as discussed in the design and innovation management literatures, is the degree to which designers and managers differ in their cognitive styles. A cognitive style is an individual's stable and preferred way of acquiring, processing and using information, reflecting the process of problem solving rather than the content of this activity (Hayes and Allinson, 1994; Kirton, 1976; Miron-Spektor et al., 2011). Designers have been described as intuitive, innovative and focused on radical change, while managers have been described as analytical, adaptive and focused on incremental change (Beverland and Farrelly, 2011; Beverland et al., 2016; Chang et al., 2013; Collins, 2013; Fixson and Read, 2012; Liedtka, 2010; Lockwood, 2010; Lorenz, 1994; Von Stamm, 2004). It has been suggested that designers and managers may complement each other due to their different cognitive styles (Beverland and Farrelly, 2011; Liedtka, 2010; Von Stamm, 2004). Von Stamm (2004) stated, for example, that 'to move from idea to profits, both skills sets, adaptive and innovative, are required, all the time' (p.14), and Liedtka (2010) suggested that managers 'desperately need design – precisely because of all the differences' (p.9). However, while from a conceptual point of view it seems valid to propose that designers and managers differ in cognitive style and may complement each other, there is a lack of empirical evidence to actually demonstrate this.

As suggested by prior literature, effective collaboration between designers and managers also requires design management from the perspective of managers; that is, it requires them to use structures and practices set up to deploy design and designers (cf. Candi and Gemser, 2010). For example, where to source these designers, internally or externally to the organization, is a design management decision (Abecassis-Moedas and Benghozi, 2012; Bruce and Docherty, 1993; Bruce and Morris, 1994; Perks et al., 2005). Prior literature has suggested that the differences between external designers and managers may be more pronounced than the differences between internal designers and managers (Bruce and Docherty, 1993; Bruce and Morris, 1994; Perks et al., 2005). Bruce and Docherty (1993), for example, suggested that the different ways of working of external designers and their clients may deter the establishment of

long- term relationships between them, while Perks et al. (2005) showed that external designers may specifically be hired in order to bring in new skills. External designers may also have a more positive influence on the innovativeness of the developed outcomes than internal designers. For example, Abecassis-Moedas and Benghozi (2012) found that hiring external designers is important for product innovativeness (in terms of newness as compared to organizations' other products), and Perks et al. (2005) showed that organizations use external designers when creativity is needed in innovation projects. In some situations, external designers may also be more efficient than internal designers. For example, external designers may be more cost-efficient than internal designers when they are viewed as variable resources that can be 'switched off' (Bruce and Docherty, 1993; Bruce and Morris, 1994). Moreover, external designers may also be efficient in terms of development time duration when they are hired for their specialist expertise, which enables them to develop outcomes quicker than internal designers (Bruce and Docherty, 1993; Bruce and Morris, 1994). However, design management of external designers may be more complicated than design management of internal designers (Bruce and Docherty, 1993; Bruce and Morris, 1994). For example, developing outcomes that are appropriate for the innovating organizations seems to be more challenging for external designers as they are less familiar with the organization than internal designers, and there is also a greater risk of imitation of outcomes when external designers are hired as these designers work for multiple clients (Bruce and Docherty, 1993; Bruce and Morris, 1994).

Another important decision in design management concerns the degree of freedom that designers receive in innovation projects (Beverland, 2005, 2010; Cillo and Verona, 2008; Gemser et al., 2011; Ravasi and Lojacono, 2005; Verganti, 2003). This freedom may involve, amongst others, giving designers the freedom to make decisions on their own, instead of having to do this together with managers (Black and Baker, 1987; Micheli et al., 2012; Ravasi and Lojacono, 2005; Turner, 2000). Prior research has suggested that the extent to which managers should grant free hands to designers may depend on the desired outcome of the innovation project. For example, Micheli et al. (2012) suggested that designers should make decisions together with managers to ensure that commercial aspects of innovation projects are considered, while Ravasi and Lojacono (2005) argued that designers should have the autonomy to make decisions on their own during the development of ideas to ensure that these ideas innovate organizations' current design philosophy. However, no empirical research to date has investigated how the level of decision freedom that designers receive influences various innovation outcomes.

In summary, prior research has not explicitly investigated the antecedents of effective collaboration between designers and managers in innovation projects, but rather investigated the collaboration between designers and other functions without specifying whether these other functions have a managerial role or not. However, based on a review of the design and innovation management literatures, the three main antecedents of effective collaboration seem to be differences in the ways of working and cognitive styles of designers and managers, and the management of these differences in terms of, for example, the freedom that is granted to designers to make decisions on their own.

### 1.1.2 CONSEQUENCES OF EFFECTIVE COLLABORATION BETWEEN DESIGNERS AND MANAGERS

The design and innovation management literatures have not explicitly investigated the consequences of effective collaboration between designers and managers. Rather, prior studies have focused on the consequences of integrating design or designers in innovation, and have suggested that the consequences are to be found in terms of influencing market, financial and process performance, either at an organizational and/or project level (see e.g., Dell'Era and Verganti, 2009, 2010; Gemser and Leenders, 2001; Hertenstein et al., 2005; Hise et al., 1989; Person et al., 2008; Swan et al., 2005).

Research on the influence of integrating design or designers in innovation tends to find positive effects on market and financial performance both at the organizational level (for financial performance, see e.g., Candi (2010); Gemser and Leenders (2001); Hertenstein et al. (2005); for market performance, see e.g., Black and Baker (1987); Candi (2010); Swan et al. (2005)) and the project level (for financial performance, see e.g., Gemser et al. (2011); Hise et al. (1989); Roy and Potter (1993); Roy and Riedel (1997); for market performance, see e.g., Czarnitzki and Thorwarth (2012)). As regards the organization level, Hertenstein et al. (2005) for example, found that effective design (i.e., design that is of high quality, excellence and importance as reflected in awards, products and investments made in design) enhances organizations' returns relative to their assets, and Candi (2010) showed that aesthetic design (i.e., design that focuses on the visceral and experiential qualities of products) enhances the sales that organizations reap in new markets. As regards the project level, Gemser et al. (2011) for example found that functional and experiential design (i.e., design that focuses on functional and ergonomic design, and design that focuses on sensorial and symbolic design) enhances products' financial performance, and Czarnitzki and Thorwarth (2012) found that internal design activities enhance sales of both market novelties and imitations.

Concerning the effect of integrating design or designers in innovation on process performance, results are less positive when examining development time (Marion and Meyer, 2011; Swan et al., 2005). Swan et al. (2005) found that functional design capabilities (i.e., capabilities that reflect the amount of time and resources spent on designing the product to be stretched into a family of products) have a negative influence on speed-to-market when environmental uncertainty is low. Marion and Meyer (2011) showed that intense design activity in new product development (i.e., the intensity with which industrial or graphic design is used in developing products) is associated with longer project development times.

According to extant literature, another process performance measure influenced by the involvement of designers is the degree of innovativeness at an organizational and/or project level (Cillo and Verona, 2008; Dell'Era and Verganti, 2009, 2010; Gemser et al., 2011; Person et al., 2008; Ravasi and Lojacono, 2005; Verganti, 2003). Prior research has distinguished between innovativeness in terms of technology and in terms of design (Gemser and Leenders, 2001; Norman and Verganti, 2014; Verganti, 2008b). Product innovativeness in terms of technology, also termed technological innovation, refers to products' newness in terms of features, functionality and technology (Danneels and Kleinschmidt, 2001; Garcia and Calantone, 2002). Product innovativeness in terms of design, also termed design innovation, refers to newness in products' appearance, the emotions that products evoke, and the way they enable customers to express their identity (Candi et al., 2011). Although designers can play a role in both technological and design innovation (Norman and Verganti, 2014), prior research has suggested that involving designers in innovation projects generally enhances design innovation (Cillo and Verona, 2008; Dell'Era and Verganti, 2009, 2010; Gemser et al., 2011; Gemser and Leenders, 2001; Person et al., 2008; Verganti, 2003). Indeed, prior studies have suggested that involving designers in innovation projects may enhance organizational-level design innovativeness (Cillo and Verona, 2008; Dell'Era and Verganti, 2009, 2010; Ravasi and Lojacono, 2005) and project-level design innovativeness (Cillo and Verona, 2008; Gemser et al., 2011; Person et al., 2008; Ravasi and Lojacono, 2005). For example, Dell'Era and Verganti (2009) found that involving (multiple) designers enhances organizational innovativeness in terms of the amount of design awards these organizations receive, and Person et al. (2008) showed that involving individuals with an education in design enhances innovativeness in product styling as compared to competing products. Gemser and Leenders (2001) showed that design innovativeness has a positive effect on organizational financial performance (regardless of whether design is a common strategic tool in an industry or not).

In summary, prior research has not studied the outcomes of effective collaboration between designers and managers in specific, but rather has investigated the consequences of integrating design or designers on innovation in general. This research has suggested that integrating design or designers in innovation has positive outcomes in terms of financial or market performance, either at the organizational and/or project level. Two important process performance outcomes that have been studied in prior research (also at the organizational and/or project level) are development time and degree of product innovativeness. Process performance outcomes in terms of development time seem to be less positive when integrating design or designers in innovation. However, process performance in terms of product innovativeness is positively affected, especially when it concerns innovativeness in terms of design.

## 1.2
## ACADEMIC AND PRACTICAL RELEVANCE

The present thesis consists of three studies on the antecedents and consequences of effective collaboration between designers and managers. The first study addresses designers' role in creating process understanding. Prior research has suggested that process understanding is important for effective collaboration between designers and managers (Duck, 2012; Goffin and Micheli, 2010; Hakatie and Ryynänen, 2007; Hertenstein and Platt, 1997; Maciver, 2012; Micheli et al., 2012), but has not provided suggestions on how this understanding should be created. It is this gap that Chapter 2 seeks to fill. To do so, this study investigates how designers create process understanding by using specific design practices and abilities. Design practices are routinized actions of ways of working (Reckwitz, 2002), and design abilities are needed for the effective and efficient realization of these practices. This first study identifies the design practices and abilities that are needed to create process understanding, specifies how they are used in radical and incremental innovation projects, and distinguishes how they are used in the strategy, design and realization phases of these radical and incremental innovation projects.

The second study investigates whether designers and managers complement each other in their cognitive styles. It describes the cognitive styles of designers and managers in terms of creativity, conformity and attention to details (Miron et al., 2004). Creativity refers to individuals' ability to identify problems and generate many ideas; conformity refers to their ability to create consensus and generate ideas that will likely be accepted by their group; and attention to details refers to their ability to work in an efficient, reliable, systematic and precise way (Miron et al., 2004). This second study examines whether designers and managers complement each other in their cognitive styles (in terms of their creativity, conformity and attention to details) and how this affects project financial performance. This study contributes

to prior research on the antecedents and consequences of effective collaboration between designers and managers in the following ways. First, it empirically tests whether designers and managers indeed complement each other in their cognitive styles, which is important as prior research has *suggested* that this is the case (Beverland and Farrelly, 2011; Liedtka, 2010; Von Stamm, 2004). Secondly, this study investigates the influence of designers' and managers' cognitive styles on project-level financial performance, while prior research has investigated the influence of integrating design or designers in innovation on this specific outcome (Gemser et al., 2011; Hise et al., 1989; Roy and Potter, 1993; Roy and Riedel, 1997).

The third study investigates the role of exploration and exploitation activities in achieving design innovation. This is important as until present, research focussed on investigating exploration and exploitation activities in technological rather than design innovation, as this study does (see e.g., Kim and Atuahene-Gima, 2010; Molina-Castillo et al., 2011; O'Cass et al., 2014). Exploration activities are activities that search for new knowledge, while exploitation activities are related to organizations' efforts to improve on what they already know (Levinthal and March, 1993). This third study examines how exploration and exploitation activities influence design innovation as well as project-level market and process performance. This study contributes to the literature by investigating the impact of design innovation on project-level performance, while prior research has focused on investigating how integrating design or designers in innovation impacts this outcome (Gemser et al., 2011; Hise et al., 1989; Roy and Potter, 1993; Roy and Riedel, 1997). In addition, the third study investigates the ideal level of decision freedom that should be given to designers in order to positively impact design innovation, market and process performance. This is important, as prior studies have suggested that the level of decision freedom granted to designers may enhance the level of product innovativeness but may lower performance (Black and Baker, 1987; Micheli et al., 2012; Ravasi and Lojacono, 2005; Turner, 2000), but these studies have not empirically investigated this proposition.

The practical implications of these studies can be found in terms of improving the collaboration between designers and managers. More specifically, the findings allow designers and managers to be more aware of the differences in their ways of working and cognitive styles, and provide insight into how they can manage these differences more effectively (e.g., by creating process understanding and/or by improving decision making). Overall, the findings from the present thesis allow designers and managers to improve their collaboration and thereby achieve higher financial, market and process performance in their projects.



## 1.3 METHODOLOGY

The empirical focus of this thesis is on external designers and managers who collaborate in innovation projects for which an innovating organization has hired an external design consultancy. This context is appropriate for this thesis as the differences between external designers and managers may be more pronounced than the differences between designers and managers working within the same innovating organization (Bruce and Docherty, 1993; Bruce and Morris, 1994; Perks et al., 2005), and because design management of these external designers may be more challenging than design management of internal designers (Bruce and Docherty, 1993; Bruce and Morris, 1994) (see also section 1.1.1).

The first study (presented in Chapter 2) relies on case study research conducted with one design consultancy in the Netherlands. More specifically, this study relied on an embedded single case study of this design consultancy as well as two innovation projects (one radical and one incremental) that this design consultancy conducted for its clients. This research method is appropriate as the first study aims to *explore* how process understanding can be created when developing radical and incremental innovation projects (Yin, 2009). As part of this study, three senior designers at the design consultancy and two project managers at the innovating organizations were interviewed.

The second and third studies (presented in Chapters 3 and Chapter 4, respectively) use a survey research methodology, and collected data on 83 innovation projects conducted by design consultancies and their clients in the Netherlands. This research method is appropriate as the second and third studies are *explanatory* in nature (Yin, 2009). That is, the second study aims to explain how designers and managers complement each other in their cognitive styles to enhance financial performance, while the third study aims to explain how designers' decision freedom influences design innovation and other outcomes. Chapter 3 and 4 use the same data-collection process, which may cause some overlap in the methodology sections of these chapters. In specific, data were collected from a senior designer and a project manager for each innovation project, resulting in a dataset of 166 responses (83 designers and 83 managers). The data were analysed through PLS structural equation modelling (PLS-SEM) (Lohmoller, 1989; Wold, 1975). This method is useful when the goal is prediction of the dependent variables to develop or extend theory (Hair et al., 2011; Hair et al., 2012). Since the aim of this thesis is to extend theory on the antecedents and consequences of effective collaboration between designers and managers, PLS-SEM is the appropriate method to use.

## 1.4
## STRUCTURE OF THE THESIS

The present thesis consists of five chapters (see Table 1.1). Chapter 1 discusses prior research on the antecedents and consequences of collaboration between designers and managers, the academic and practical relevance of the work, and the research methods that were used for each of the studies. Chapters 2 to 4 describe the three empirical studies that were conducted on the antecedents and consequences of effective collaboration between designers and managers. Chapter 2 describes how process understanding can be achieved by identifying the design practices and abilities that designers can use through an embedded single case study of a Dutch design consultancy. Chapters 3 and 4 investigate the collaboration between designers and managers by using survey research of 83 innovation projects conducted by design consultancies and their clients in the Netherlands. Chapter 3 investigates how designers and managers complement each other in their cognitive style (in terms of creativity, conformity and attention to details) to positively influence financial performance through a PLS-SEM analysis of 83 innovation projects conducted by design consultancies and their clients in the Netherlands. Chapter 4 also uses a PLS-SEM analysis of 83 innovation projects (conducted by design consultancies and their clients in the Netherlands) to identify how exploration and exploitation activities influence design innovation and performance, and investigates the role of designers' decision freedom in achieving these outcomes. Chapter 5 integrates the findings from the empirical studies by discussing the implications for theory and practice, the limitations and directions for future research.



## TABLE 1.1
## AN OUTLINE OF THE THESIS

| CHAPTER | WHAT THE CHAPTER IS ABOUT |
|---|---|
| 1<br>Introduction | This chapter introduces the topic of the antecedents and consequences of the collaboration between designers and managers. It elaborates on the prior research on this topic as published in the design and innovation management literatures. Moreover, it discusses the aim of the thesis, which includes a description of the studies that are part of the thesis as well as their academic and practical relevance. This chapter ends with a description of the methodology of the thesis. |
| 2<br>Study 1 – Designers' role in creating proces understanding: practices and abilities for radical and incremental projects | This chapter presents a qualitative study that investigates how designers can create process understanding in radical and incremental innovation projects. It identifies design practices and abilities through an embedded single case study of a Dutch design consultancy and its clients, and describes how these design practices and abilities are used in two innovation projects. |
| 3<br>Study 2 – Do designers and managers complement each other? The influence of cognitive style on financial performance | This chapter presents a quantitative study that uses survey research and investigates how designers and managers complement each other in their cognitive style (in terms of creativity, conformity and attention to details) to positively influence financial performance. It does this through a PLS-SEM analysis of 83 innovation projects conducted by design consultancies and their clients in the Netherlands. |
| 4<br>Study 3 – Exploration and exploitation activities in design innovation | This chapter presents a quantitative study that uses survey research and investigates the role of exploration and exploitation activities in design innovation and performance, and provides insights into the role of designers' decision freedom in achieving these outcomes. It does this through a PLS-SEM analysis of 83 innovation projects conducted by design consultancies and their clients in the Netherlands. |
| 5<br>Discussion and conclusions | This chapter discusses the major implications of the studies in this thesis, elaborates on its limitations and presents directions for future research. |

# 2
# Designers' role in creating process understanding: practices and abilities for radical and incremental innovation projects

Authors: K. Tabeau, G. Gemser, J. Oberdorf
This chapter has been accepted for publication as a book chapter in:
G. Calabretta, G. Gemser, I. Karpen (Eds.) Strategic Design Practices for Competitive Advantage.
Amsterdam: BIS Publishers (in press).

Prior research has suggested that design is increasingly playing a strategic role in organizations. Strategic design is a creative process whose results cannot be specified up front, inherently creating uncertainty. This uncertainty may clash with the very nature of managers, who have been described as risk averse and analytical. To provide these managers with some kind of certainty, designers can create process understanding. While prior research has suggested that process understanding is important in strategic design, it has not clarified how it can be created. This study aims to fill this gap in the extant literature by identifying design practices and abilities that designers may use to create process understanding for managers. The results from a case study of the design consultancy npk design and two innovation projects (one radical and one incremental) that this consultancy conducted for its clients suggest that designers use six design practices to create process understanding, which are: making the process accountable, making the process tangible, synchronizing designers' and clients' processes, creating ownership for the process, bringing the result of the process to life, and getting clients accustomed to designerly ways of working. Moreover, designers need six abilities to support them in creating process understanding; that is, they need the abilities to oversee the process, steer the process forward, iteratively adjust the process, connect with clients, tell a coherent and complete story, and create client engagement. Lastly, the results from this study suggest that creating process understanding is more complex in radical than in incremental innovation projects. That is, in radical innovation projects designers need to draw on the full range of design practices and abilities, while in incremental projects they only need two design abilities and two practices in order to create process understanding.

## 2 .1
## INTRODUCTION

Strategic design moves organizations in new directions (Fitzsimmons et al., 1991; Hertenstein and Platt, 1997; Ravasi and Lojacono, 2005). Indeed, strategic design is a creative process whose results cannot be specified up front, creating uncertainty (De Mozota and Kim, 2009). This very nature of strategic design may clash with managers' tendency to avoid risk and uncertainty and to follow an analytical process (Ravasi and Lojacono, 2005). When describing differences between designers and managers, designers have been characterized as being intuitive and driven by the future, pursuing radical change, while managers have been described as being analytical and driven by the past, favouring incremental change (Beverland and Farrelly, 2011; Beverland et al., 2015; Liedtka, 2010; Micheli et al., 2012).

The need for upfront certainty and specification may be even more pronounced when hiring an external design consultancy rather than in-house designers for a strategic design project. This increased need may be caused by the fact that the work of external design consultancies is more difficult to control than the work of in-house designers (Bruce and Morris, 1994). In the case of strategic design projects, detailed specifications about outcomes are often hard to provide up front (Moenaert et al., 2010). Such projects focus on shaping the future (Golsby-Smith, 2007), which often involves solving ill-defined and complex problems (Duck, 2012), and may include intangible or difficult to identify contributions to organizations' strategy (Stevens and Moultrie, 2011). A strategy to reduce clients' uncertainty is to provide '*process understanding*'. Process understanding entails assuring that clients understand the process of strategic design. This understanding can be achieved by providing clients with specifications about the design process: that is, about the sequence of activities that designers will perform to bring about outcomes (Roozenburg and Eekels, 1995). Prior research has suggested that it is important to have this process understanding to, for example, point out critical decisions (Duck, 2012), negotiate (Maciver, 2012) and assure commitment (Hertenstein and Platt, 1997). Moreover, process understanding can lead to higher client satisfaction and longer relationships with clients (Bruce and Docherty, 1993; Hakatie and Ryynänen, 2007), which benefits designers in competing with other designers in their field of work.

Even though prior research has suggested that creating process understanding is important, it is not sufficiently clear how designers can help clients to gain this understanding. Our research sets out to explore this important topic by investigating the practices that designers use to create process understanding, and the abilities that support these practices. We investigate both a radical and an incremental innovation project since the level of uncertainty between these projects differs (Danneels and Kleinschmidt, 2001; Garcia and Calantone, 2002). Incremental innovation projects are projects that focus on the improvement of existing technology and/or design for a market that is known to an organization (cf. Garcia and Calantone, 2002; Verganti, 2008b). Radical innovation projects, on the other hand, focus on the development of new technology and/or design for a market that is new to organizations and the industry they are operating in (cf. Garcia and Calantone, 2002; Verganti, 2008b). Due to the different nature of incremental and radical innovation projects, designers may need different practices and abilities to create process understanding for both types of innovation projects.

To investigate these topics, we conducted a case study of *npk design*, a design consultancy in the Netherlands that is specialized in the strategy, design and realization of new and improved products, and two innovation projects completed by this organization (see Box 2.1 for a description of *npk design*).

The remainder of this chapter is structured as follows. First, we discuss current research on how designers create process understanding, and the practices and abilities that they use to do so. Then, we explain our method and discuss our findings. The final section provides conclusions and implications, and discusses the limitations of our study.

### BOX 2 .1
### NPK DESIGN

*npk design* is an industrial design consultancy based in Leiden, the Netherlands. *npk design* was founded in 1985 by Bruno Ninaber, Wolfram Peters and Peter Krouwel, and currently (2015) has 35 employees. The consultancy's focus is on the development of products and product-service combinations. Examples of products and product-service combinations developed by *npk design* include baby strollers, portable payment units and coffee machines, as well as mass evacuation solutions for high-rise buildings, telemedicine adherence systems, and innovations for the refuelling industry. To develop these offerings, *npk design* offers its clients a wide range of services from strategic advice, industrial design, public design and graphic design to engineering and supply chain management. Its clients include multinationals, start-ups, governments and municipalities. Over the years, *npk design* has received many design awards for the offerings it has developed, such as Red Dot Awards (14 awards), iF Awards (37 awards), GIO Awards (38 awards) and Dutch Design Awards (12 awards).

## 2 .2
## THEORETICAL BACKGROUND

The focus of this chapter is on process understanding. Specifically, we focus on managers' understanding of the process of designers (see e.g., Duck, 2012; Hertenstein and Platt, 1997). In this context, process understanding is defined as the extent to which *managers* understand the sequence of activities that *designers* are going to perform to bring about outcomes (cf. Roozenburg and Eekels, 1994). Although prior research has suggested that managers' understanding of the process of designers is important to ensure their effective collaboration (Duck, 2012; Hakatie and Ryynänen, 2007; Hertenstein and Platt, 1997; Maciver, 2012;), it is not clear how designers can create this understanding by using particular practices and abilities. However, there are studies that have identified actions that designers can take to explain their process to managers (Duck, 2012; Hakatie and Ryynänen, 2007; Hertenstein and Platt, 1997; Maciver, 2012). For instance, Hertenstein and Platt (1997) have suggested that formally documenting the process may clarify the role of designers in the process and Duck (2012) proposed that visualizations may help managers to understand the process and to identify hotspots. These studies, however, do not clarify how such actions are part of the practices that designers perform in order to create understanding about their process for managers, and they do not specify the abilities that designers need in order to perform such practices. Therefore, the focus of this chapter is to identify these design practices and abilities for process understanding (see Figure 2.1). Based on prior research, we expect that designers need abilities to perform practices effectively (Michlewski, 2008), and their performing of such practices will ensure that managers have higher levels of process understanding (cf. Duck, 2012; Hakatie and Ryynänen, 2007; Hertenstein and Platt, 1997; Maciver, 2012). In the next sections, we define practices and abilities and we discuss prior research on the practices and abilities of designers.


Figure 2 .1
Focus of this chapter



### 2 .2 .1
### PRACTICES FOR PROCESS UNDERSTANDING: DEFINITION AND PRIOR RESEARCH

We are interested in identifying the practices that designers perform in order to create understanding about their process for managers. We follow prior research in viewing practices as 'routinized actions' (Reckwitz, 2002). In other words, practices are learned responses (actions, interactions) that represent a habituated way of doing and dealing with things. Indeed, practices are 'skilful behaviours, dependent (as the term suggests) on practice until they become automatic' (Scheer, 2012, p.202). Practices are framed, shaped and manifested within a social context (Warde, 2005). Although practices might be performed by a single actor, through their interactive nature they are often enacted in teams or departments.

Prior literature has provided designers with models or methods that help them to structure their design process. These include, for example, the basic design cycle (Roozenburg and Eekels, 1995), the design process of Pahl and Beitz (Pahl and Beitz, 1996) or vision in product design (Hekkert and Van Dijk, 2011). Designers can use these models or methods to divide their process in phases, define the activities that will be completed within each phase, and describe which tools and methods they will use for each activity.

Next to research on design models or methods, there are also studies that have described design practices or designers' way of working when developing new products or services (Calabretta and Gemser, 2015; Kembaren et al., 2014; Stigliani and Fayard, 2010; Zomerdijk and Voss, 2011). For example, based on case study research with professional design consultancies, Calabretta and Gemser (2015) identified the design practices that designers can use to help organizations overcome challenges in the fuzzy front end of the innovation process, including practices such as *reframing*, *holistic thinking*, *sensing*, *knowledge brokering*, *translating*, *condensing*, *animating* (*which involves communicating condensed information in an engaging manner*), *inspiring*, *co-creating* (*which involves stimulating the active participation of stakeholders in the process and frequent interaction with them*) and *integrating*. The design practices identified in the prior literature do not specifically address the creation of process understanding but innovation in general; that is, they address designers' way of working for the development and/or improvement of products and services.

### 2 .2 .2
### ABILITIES FOR PROCESS UNDERSTANDING: DEFINITION AND PRIOR RESEARCH

Prior research has suggested that to implement design practices effectively, designers need certain abilities (Michlewski, 2008). In this chapter, we focus on the abilities that designers need to have in order to create understanding about their process for managers. An ability is defined here as an individual's performance on a task or class of tasks in a specific situation (Lohman, 2001). In essence, abilities stipulate action and are needed for the effective and efficient realization of practices.

No prior research has identified design abilities or skills needed for creating process understanding. However, there is prior research that has described designers' abilities and skills in general (see e.g., Michlewski, 2008) or those of design leaders (i.e., designers that, because of their seniority, are involved in setting out the direction for design and ensuring it is effectively implemented) in specific (Han and Bromilow, 2010; Miller and Moultrie, 2013; Perks et al., 2005). For example, based on interviews with senior designers of design-led organizations, Michlewski (2008) described the design attitude of professional designers in terms of their ability to *consolidate multidimensional meaning*, *create and bring to life*, *embrace discontinuity and open-endedness*, *engage polysensorial aesthetics*, and *engage personal and commercial empathy*. Similar to the literature on design practices, prior literature on design abilities has not specifically addressed design abilities needed to create process understanding.

The literature on design leadership has identified abilities and skills related to collaboration and communication that are also important in the context of creating process understanding. For example, based on case studies with manufacturing companies in the U.K., Perks et al. (2005) found that in order to manage the design process, designers should be able to motivate, negotiate and persuade, while Han and Bromilow (2010) indicated (using interviews with graphic designers from U.K. design consultancies) that the ability to influence and manage interpersonal relationships is important when setting out a vision for design. Perks et al. (2005) also found that communication is important to access and interpret information, while Miller and Moultrie (2013) drew attention to skills that involve collecting, processing and disseminating information.

Overall, this chapter's review of the relevant literature showed that there is no research on design practices and abilities for process understanding. In the following sections, this chapter takes the first step in identifying and relating, based on empirical research, the practices and abilities for process understanding.



In addition, this research sets out to distinguish how the practices and abilities for process understanding are used within a radical and an incremental innovation project, and provides examples of this usage in two innovation projects conducted by *npk design*. In summary, we aim to answer the following questions: *what are the design practices and abilities for creating process understanding*, *how do these design practices and abilities relate*, *and how do they contribute to process understanding in radical and incremental innovation projects?*

## 2 .3
## METHOD

### 2 .3 .1
### RESEARCH METHODOLOGY

To investigate design practices and abilities for process understanding and their relations, we conducted a single case study (Yin, 2009). A case study approach is particularly suitable for investigating complex phenomena that are characterized by a large number of (interrelated) variables for which the boundaries between phenomenon and context are not clear (Yin, 2009). The purpose of our case study was exploratory (Yin, 2009), allowing us to describe an under-investigated phenomenon using rich, context-dependent knowledge (Flyvbjerg, 2006).

### 2 .3 .2
### SAMPLING STRATEGY

This research investigates design practices and abilities for process understanding, which are constructed in a social context (Warde, 2005). The social context that professional designers work in is their organization; i.e., the design consultancy. Therefore, the unit of analysis in this study is the design consultancy. We selected a design consultancy that represents an 'extreme case' in terms of the dependent variable, that is, the extent to which it is successful in creating process understanding for its clients (Seawright and Gerring, 2008; Yin, 2009). In our view, *npk design* represents such an extreme case for several reasons. First, *npk design* is an internationally known consultancy with more than thirty years of experience in the field, which indicates its knowledge and expertise in the effective and efficient execution of design processes for its clients. Secondly, the quality management system of *npk design* is ISO certified (ISO9001:2008), indicating that the consultancy continuously involves clients in its design processes and the improvement of these processes. Thirdly, *npk design* clients value its design processes, as suggested by the long-term relationships the consultancy establishes with them (e.g., *npk design*

has worked with Kimberly Clark for 20 years, with Honeywell for 15 and with Heineken for 14).

We also investigate design practices and abilities at the level of the innovation project. We selected two projects following a 'most different' strategy (Seawright and Gerring, 2008; Yin, 2009); that is, we selected one radical and one incremental innovation project for our study. We considered a project incremental when it focussed on improving existing technology and/or design for a market that was known to an organization, while we considered a project radical when it involved the development of new technology and/or design (both for an organization as well as the industry it operates in) (cf. Garcia and Calantone, 2002; Verganti, 2008b). In addition, we made sure that the projects adhered to the following criteria: first, the projects had to be strategic design projects (i.e., projects that contribute to organizations' corporate and business objectives (cf. Fitzsimmons et al., 1991)) and secondly, the projects had to be finalized to make it possible to reflect on how the design practices and abilities for process understanding were used. On the basis of these criteria we selected the Bike Accessory Portfolio project (in which incremental bike accessories were developed for SKS Germany) and the Cloud Heater project (in which a radically new heating system based on computer servers was developed for Nerdalize) for further study. Boxes 2.2 and 2.3 provide descriptions of the problem and solution in these innovation projects.

### 2 .3 .3 DATA COLLECTION

The data collection procedure was carefully designed to deal with reliability and validity issues up front. We used semi-structured interview guides to collect our data; we guaranteed informants a certain degree of anonymity (i.e., while we identify the design consultancy these informants work for, we do not disclose their names); we used multiple data sources (interviews, documents, artefacts) to triangulate our data; and we discussed emergent case study outcomes with our informants and adjusted accordingly (Miles and Huberman, 1994; Yin, 2009).

We conducted interviews with three senior designers of *npk design*. The interviewees have between 11 and 18 years of experience as professional designers and are involved in both the execution and management of innovation projects. This choice suggests that the senior designers are the appropriate informants for our interviews. Two senior designers were also actively involved in the radical and incremental innovation projects, which makes them appropriate informants for our research as well. We also interviewed the project manager of the radical innovation project, who was the individual to whom npk's designers explained their process. The project manager of the incremental innovation project was not employed at SKS Germany anymore, and was therefore not interviewed for this research. Instead, we interviewed the current project manager employed at SKS Germany, who was familiar with how npk's designers create process understanding in general. This makes these project managers appropriate informants for our research as well.

As a first step, we interviewed one senior designer to identify design practices and abilities for process understanding, to get insight into their relationships, and to obtain preliminary information on how the identified design practices and abilities contributed to process understanding in radical and incremental innovation projects. As a second step, we interviewed two other senior designers to verify the identified design practices and abilities. Furthermore, these two other senior designers provided in-depth information on the design practices and abilities that were used in the two selected case projects. As a third step, we verified the usage of the design practices and abilities in the radical and incremental innovation projects by interviewing the project managers. To complement the interviews, we collected documentation such as project contracts, project planning documentation, innovation process descriptions, IT documentation system overviews, cloud-based information sharing system overviews, presentations, drawings, pictures and movies. This documentation provided examples of practices through which the designers of *npk design* create process understanding. Finally, we collected information about the physical artefacts that were developed in the Bike Accessory Portfolio and Cloud Heater projects to understand how these outcomes related to the design practices and abilities that were used.

The data collection resulted in a total of 478 pages of transcribed interviews, 117 pages of documentation, 85 pictures and 18 movies (see Appendix 2.1 for examples of pictures and movie stills).

### 2 .3 .4 DATA ANALYSIS

We used the definitions of practices, abilities and how these two are related as the starting point of the data analysis process (see section 2.2). This process involved identifying design practices and abilities for process understanding, and verifying their use in two innovation projects.

The process of identifying design practices and abilities involved coding and categorizing (Saldana, 2009). We went through a phase of first cycle coding, in which we assigned descriptive codes to pieces of text (Saldana, 2009). The first cycle coding resulted in an initial list of design practices. These initial design practices were then

categorized, after which we assigned codes to these categories in a phase of second cycle coding (Saldana, 2009). A similar process was followed to identify design abilities, which included defining their relation to the design practices. This process resulted in more than 70 codes. After several rounds of discussion and refinement of codes and categories between the main and secondary researchers, this processes resulted in the identification of a set of six design practices and six design abilities. The six identified design practices are *making the process accountable*, *making the process tangible*, *synchronizing designers' and clients' processes*, *creating ownership for the process*, *bringing the result of the process to life*, and *getting clients accustomed to designerly ways of working. Overseeing the process*, *steering the process forward*, *adjusting the process iteratively*, *connecting with clients*, *telling a coherent and compelling story*, and *creating client engagement* are the six design abilities we identified.

The process of verifying and understanding the use of these design practices and involved coding and categorizing as well (Saldana, 2009). We used the codes and categories generated earlier to verify the use of design practices and abilities in radical and incremental innovation projects, after which we searched for patterns in their use within and between projects (Yin, 2009). This analysis led to insights into the patterns of use of practices and abilities within and between these innovation projects.

## 2 .4
## DESIGNERS' PRACTICES AND ABILITIES TO CREATE PROCESS UNDERSTANDING

The following sections elaborate on the six design practices and six abilities for process understanding, and on how designers use these design practices and abilities in the design process of innovation projects.

### 2 .4 .1
### PRACTICES FOR PROCESS UNDERSTANDING

To help clients understand the design process, designers at *npk design* use six main practices. Table 2.1 shows these six practices and their definitions. First, we give an overview of *when* designers use the practices throughout the innovation process, after which we specify *why and how* they use each practice at a certain moment.



### 2 .4 .1 .1
### USING PRACTICES THROUGHOUT THE INNOVATION PROCESS: AN OVERVIEW

We will discuss how the designers at *npk design* use the six practices during the innovation process (see also Figure 2.2). *npk design* divides the innovation process into three phases, namely: the strategy, design and realization phases. Such a division is similar to that of Roozenburg and Eekels (1994), who divide the innovation process into the product planning, product development and realization phases. The strategy phase focuses on defining the problem that will be solved in the project as well as exploring the context in which the solution for the problem will be introduced. The strategy phase ends with a design brief that describes the solution space. Next, ideas for the solution are developed in the design phase, after which a selected idea is prototyped, tested and engineered. Finally, in the realization phase, the engineered solution is produced. In this final phase, *npk design* guides the production of the developed solution for its clients. For example, *npk design* helps ensure that the produced solution adheres to quality standards. The role of *npk design* in realizing the solution ends when the first series of the solution is delivered. As shown in Figure 2.2, the six design practices are used throughout the whole process, but most are used in the strategy and design phases. The practices of making the process tangible and accountable are used at set moments in the innovation process: that is, at the beginning and/or at the end of each phase. The practices of synchronizing designers' and clients' processes and creating ownership for the process are most important in the strategy and design phases, while the practices of bringing the results of the process to life and getting clients accustomed to designerly ways of working are emphasized in the strategy phase and first half of the design phase. Below, we discuss in more detail why and how the design practices are used at certain moments in the innovation process.

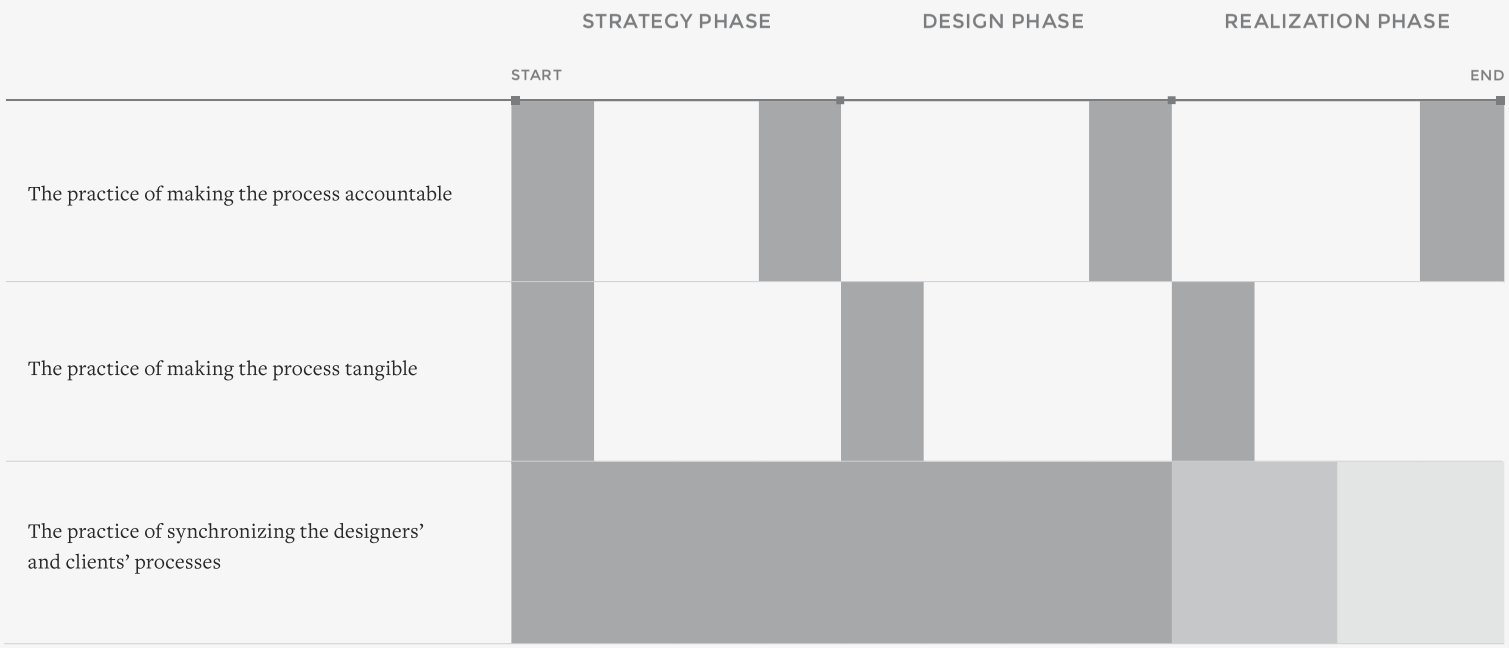
### 2 .4 .1 .2
### EXPLORING THE USE OF PRACTICE THROUGHOUT THE INNOVATION PROCESS

The first practice for creating process understanding, *making the process accountable*, relates to designers' efforts in standardizing, formalizing and documenting the process. Examples of actions include the use of contracts to formalize the process, using an IT system to document the process or working in compliance with an ISO standard throughout the process. The practice of making the process accountable is particularly important at the start of the innovation project, in the strategy phase, when the contract is drafted.

## TABLE 2 .1
## DESIGN PRACTICES FOR PROCESS UNDERSTANDING

| PRACTICE | DEFINITION | ACTIONS DESIGNERS CAN TAKE |
|---|---|---|
| 1<br>The practice of making the process accountable | Designers' efforts in standardizing, formalizing and documenting the process to ensure agreement with clients on which actions are taken throughout it, and which not. | - Using contracts<br>- Using IT systems to document the process<br>- Working by an ISO standard |
| 2<br>The practice of making the process tangible | Designers' efforts in creating visual representations of the process for the purpose of explaining and clarifying it to clients, and to give examples of what this process will look like in the project in question. | - Making flowcharts of the process<br>- Showing the process from previous projects<br>- Making movies about the process |
| 3<br>The practice of synchronizing the designers' and clients' processes | Designers' and clients' efforts in continuously sharing the progress of the process with each other to ensure that they move towards the same outcome with matching speed and actions. | - Collaborating through cloud-based file sharing<br>- Making and updating the project plans<br>- Frequent contact (email, phone, meetings) |
| 4<br>The practice of creating ownership for the process | Designers' efforts in shaping the process according to clients' preferences to ensure that they consider it 'their own', that they support it fully and are willing to follow it. | - Using clients' information in shaping the process<br>- Letting clients make decisions and give feedback about the process<br>- Monitoring clients' satisfaction |
| 5<br>The practice of bringing the result of the process to life | Designers' efforts in creating visual and tangible representations of the outcome to create agreement with clients on what is going to be developed in the process as well as to show that the process is appropriate for doing this. | - Using drawings, 2D and 3D visualizations<br>- Showing the solution in context through film or photography<br>- Letting clients engage with the solution in product tests |
| 6<br>The practice of getting clients accustomed to designerly ways of working | Designers' efforts in actively involving clients in designerly activities to let them understand the process and to let them gain empathy for designers and their work. | - Making clients part of the design team<br>- Letting clients design (sketch, make models, etc.)<br>- Involving clients in user research |

**FIGURE 2 .2**
**USAGE OF THE PRACTICES IN THE STRATEGY, DESIGN AND REALIZATION PHASES**



When drafting this contract, it is important not only to specify the tasks to be executed by the design consultancy but also to be clear about exclusions, that is, what the design consultancy is not going to do in terms of the process ('We have to be very clear about its exclusions. What we are not responsible for'). However, making the process accountable is also used at the end of the other two phases (design and realization) since it is important for updating and communicating purposes. Carefully documenting the process, from beginning to end, helps designers explain why certain decisions were made at certain times:

> 'The more you go towards the end of a process... people seem to forget why you took certain decisions. People say: "the context changed". And then you have to be able to respond: "Yes, we took that decision at that moment because the context looked like that." That's why we document.'

Designers' second practice is *making the process tangible*. This practice relates to designers' efforts to make visual representations of the process for the purpose of explaining and clarifying it to clients, and to show how the process will evolve in the project in question. For example, designers achieve this by making drawings and flow charts of the process (see e.g., Figures 2.3 and 2.4), by showing the process followed in previous projects and by making movies about parts of the process (e.g., user research, concept generation). Making the process tangible is important in the strategy phase when essential decisions are made about the process. A tangible representation of this process can, for example, clarify the consequences of choices. Making the process tangible also helps designers to educate clients who are not familiar with the strategic design process about the phases and steps that it consists of ('A lot of clients do not think in terms of a process with steps that have to be taken. They see it as one big thing (...) So I am teaching them how design works.'). Educating clients by making the process tangible is important not only at the beginning of the project, in the strategy phase, but also at the start of the other phases (design and realization). At these moments, visual representations function as a quick reminder for clients about what is going to happen in the next phase and also create connections with earlier phases.

To create process understanding, the designers at *npk design* also use the practice of *synchronizing the designers' and clients' processes*, which involves continuously sharing progress updates about the process to ensure that the design consultancy and client move towards the same outcome with matching speed and actions. Making and updating the project plans and frequent contact (through email, phone and meetings) are examples of actions that designers can take. These are informal actions, as opposed to actions associated with the practice of making the process accountable, which involve a strict and formalized way of working. Synchronizing processes is important at the beginning, in the strategy phase, to understand what kind of

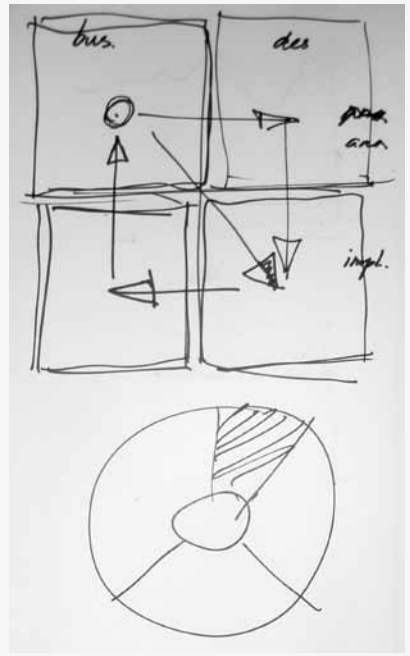



Figure 2 .3
Making the process tangible
by using a drawing of the process

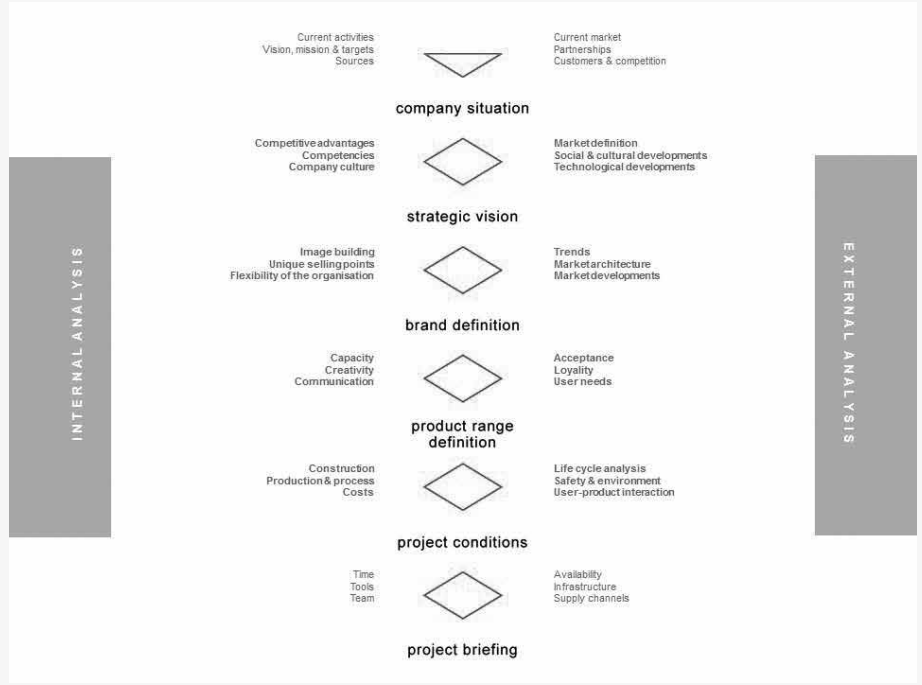



Figure 2 .4
Making the process tangible by using a flowchart of the process

approach is most appropriate for clients ('What you often see is that it is about matching organizations. How do we work, how do you work? Can we find a format that fits?'). Maintaining this synchronized approach is, however, also important in the design and realization phases to guarantee that everybody is aware of the actions that are taken to reach the project's outcome. Continuous alignment is made easy by the use of the latest ICT techniques and tools such as cloud-based file sharing:

> 'Nowadays, you see that there is a lot of contact [too] in between meetings. There are no clear moments in which we get aligned. We align all the time (...) [By means of cloud-based file sharing, clients] check every day what the progress is, follow email conversations with every actor, they are on top of it.'

The fourth practice for process understanding is *creating ownership for the process*, which relates to designers' efforts in shaping the process according to clients' preferences to ensure that they consider the process 'their own', that they support it, and are willing to follow it. This practice involves actions such as using clients' information in shaping the process, letting clients make decisions about and give feedback on the process, and monitoring their satisfaction with the process. Creating ownership for the process is important in all three phases, but particularly in the strategy and design phases. During the strategy phase, clients are involved in decisions about aspects such as what the process will look like, while during the design phase they give feedback on every step of the idea generation process through which they influence the further actions to be taken. Monitoring of clients' satisfaction is thus done on a continuous basis to ensure client satisfaction with the process and outcomes ('With every step that we take, we check: "Are you happy? Or not?" We do this to prevent that we take one step forward and two steps back.').

The fifth practice, *bringing the result of the process to life*, relates to designers' efforts in creating visual and tangible representations of (interim) outcomes, for example, using drawings, visualizing the solution with 2D and 3D tools, showing the solution in context through film or photography, or letting clients engage with the solution in product tests. At the beginning of the project, in the strategy phase, it is important to bring the solution spaces of the process to life to get everybody on the same page as regards the direction to be taken and what actions are required. An example of a drawing that was used by *npk design* for this purpose is shown in Figure 2.5. This drawing leaves plenty of room for interpretation, but helped the designers to discuss with the client about the direction of the project and the kind of process required to 'make it happen' ('We also do a "quick and dirty" design process to see whether what we wrote down is feasible. A kind of reality check. Is it possible, all those high ambitions?'). Bringing solution spaces of the process to life is, of course, also important in the design phase, when product or service concepts are being

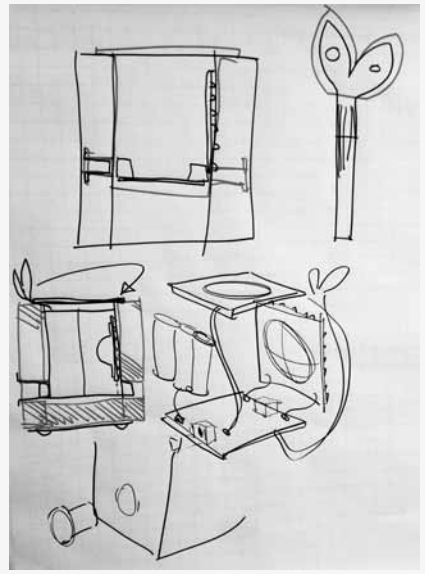


Figure 2 .5
Bringing the result of the process to life by using a drawing of the solution

developed. Towards the end of the design phase, when the solution has largely taken shape, bringing the end solution to life through film and photography can help to visualize it in its context. All these actions enhance clients' understanding of the process by providing 'proof' that the proposed process is 'delivering results'.

The final practice that designers use for process understanding is *getting clients accustomed to designerly ways of working*, which relates to actively involving clients in the process to enable them to understand it and gain empathy for designers and their activities. Actions such as making clients part of the design team, letting them sketch, make models or prototypes, and engaging them in ethnographic research are examples of this practice. Getting clients accustomed to designerly ways of working is valuable in the strategy phase and even more so in the design phase since clients often do not understand the uncertainty and 'messiness' associated with these phases ('design is a process of increasing complexity and increasing details. [Clients] often think that, when you propose a first idea, that it's already perfect'). Making the client part of the design team can attenuate this problem as the client will experience first-hand the 'messiness' and uncertainty ('I involve them [clients], so that they feel that it is not easy. Sometimes things remain unsolved. And when they are part of the process they understand this much better.'). Moreover, by letting clients sketch out their own ideas, they are better able to assess the quality of these ideas ('We make the client sketch. (...) When something is in your head, you think that it's a great idea! (...) Until you start drawing, and then you think: "Oh no, this is not it"'). Towards the end of the design phase, the end solution has largely taken shape, after which letting clients experience designerly ways of working becomes less relevant.

### 2 .4 .2 ABILITIES SUPPORTING PROCESS UNDERSTANDING

Table 2.2 presents the six abilities, and their definitions, that support designers in the creation of process understanding. The abilities that we identify in Table 2.2 can be of relevance for different types of practices. However, in Table 2.2, we only identify the practice for which a specific ability seems of particular relevance. Below, we discuss the relations between design practices and abilities in more detail (see Appendix 2.2 for exemplifying quotes of the relations between design practices and abilities).

An important ability that a designer should have to support process understanding is the ability to *oversee the process*. A design process consists of many interrelated elements that a designer needs to take into account ('More and more aspects come together. More elements that you have to do magic with to make sure the process goes smoothly.'). Designers' ability to oversee the process includes, for example, keeping track of whether the process is being completed in line with the plans and budget. This ability is, in general, only obtained after years of practice. While a design team typically receives different kinds of information, for example about how much money has been spent from the budget and how the project is progressing, only an experienced designer is able to tie all the information together and follow up with concrete process-related activities. A junior designer tends to thinks in terms of outcomes and not in terms of activities needed to achieve those outcomes. Closely related to the practice of making the process accountable is the ability of the designer to act in a rational, formalized manner as regards the process and its progress ('That [type of working] is very formal. You could say, you are very close to stage-gate kind of approaches: which documents do I need, signed, sealed, delivered, to go on.'). Designers must be able to 'translate' different types of information into a 'language' that explicitly relates to the process and its progress ('You have to translate your results, intermediate results, into a bookkeeping language to make it accountable').

Designers' second ability, *steering the process forward*, includes their ability to make stakeholders adhere to the process. This ability requires designers to have true mastery of the design process, as this process (and the different steps to be undertaken) needs to be explained to and 'ratified by' those stakeholders. Mastering the process involves not only an in-depth understanding of what it entails, but also being able to adapt to the specific project in question ('I know what my idea of the process is. But I have to develop a new story for every project'). To explain and obtain ratification for the process, designers need to be able to show the process in a visual way ('Often you have to visualize, or be able to tell which steps you are going to take and why. Just having them in your head is not enough') and to be able to tell a convincing story based on prior experience ('You tell your story, and you also build up credibility. You say: "It worked there, so we are also going to do it like this." Or the other way around: "It didn't work there so we are not going to do it for this and this reason"').

The ability to *adjust the process iteratively* relates to the ability of designers to continuously align activities and expectations with those of clients. By doing so, designers assure that they move through the process with the same speed and towards the same solution as clients. To align actions and expectations, designers have regular formal meetings in which designers communicate the status quo of the process, determine – together with clients – the next activities to be undertaken, and continuously explain and adjust the solution space so that it is in line with clients' wishes. To ensure that processes and outcomes are aligned, it is important that designers adopt an 'analytical frame of mind', examining how to adjust the process and solution spaces, taking into account the specifics of the project rather than deciding on feelings or general worldviews:

> 'Clients think that designers are emotional people with a very strong vision on the world and the things around them. That they have an opinion about everything. Most designers do [have an opinion about everything], as a person. That is something else than understanding "What does this [opinion] mean for the project?"'

The ability to *connect with clients* relates to the designers' ability to sense what type of clients they are working with, what their needs are and how these needs change over time, and to use these empathic skills to shape the process in a way that is appropriate. This ability is important in assuring that clients have a feeling of ownership for the process. To ensure that clients perceive the process as their own, and are willing to follow it, often a personal relationship needs to be established with them so that they become closely involved in the process. This personal relationship makes it easier to uncover the (deeper) motives of clients for doing the project, and to shape the process accordingly. A personal relationship between designers and clients also provides designers with some leeway when mistakes are made in the process, giving designers room to fix these mistakes ('If you have a connection with the client, he will give you the space to correct things: "You screwed up and you have the opportunity to make it right."'). To establish this relationship, designers need to be adept in switching between formality and informality, as the two are often mixed up in the process:

> 'With the same guy I'm talking money, budgets and planning at one moment. He's quite formal at that point in time. Five minutes later we tap on each other's back: "Hey, do you want to grab a beer? What have you been up to yesterday evening?" That's an entirely different level. It goes back and forth all the time.'

## TABLE 2 .2
## DESIGN ABILITIES FOR PROCESS UNDERSTANDING*

| ABILITY | DEFINITION | SUPPORTS DESIGNERS IN: |
|---|---|---|
| 1<br>The ability<br>to oversee the process | Designers' ability to infer the status quo of the process by interpreting and integrating all activities that are taken in the process, and to document this status quo in a rational and formalized manner. | Making the process accountable |
| 2<br>The ability to steer<br>the process forward | Designers' ability to make stakeholders adhere to the process by showing they master this process and by explaining and clarifying it in terms they understand and know. | Making the process tangible |
| 3<br>The ability to adjust<br>the process iteratively | Designers' ability to align designers' and clients' activities and expectations on a continuous basis. | Synchronizing the designers' and clients' processes |
| 4<br>The ability<br>to connect with clients | Designers' ability to sense what clients they are working with, what their needs are, and how these needs change over time and to use these empathic skills to shape the process in a way that is appropriate. | Creating ownership for the process |
| 5<br>The ability to tell<br>a coherent and<br>compelling story | Designers' ability to integrate all activities that are taken in the process into a narrative that brings the result of the process to life and illustrates the relevance of the process to follow. | Bringing the result of the process to life |
| 6<br>The ability to create<br>client engagement | Designers' ability to stimulate clients' (emotional and cognitive) involvement (interaction) with the process. | Getting clients accustomed<br>to designerly ways of working |

* Abilities can be relevant for different practices. In this table we identify the practice for which an ability is of particular relevance.

The ability to *create a coherent and compelling story* relates to designers' ability to create a narrative, often together with the client, that brings the results of the process to life and helps to illustrate the relevance of the process to be followed. At the start of the process, designers have to propose 'a storyline' that 'grabs' the client and can subsequently be further developed together with the client. This story sets the stage for the process to be followed. Indeed, any process-related decisions designers make should be 'story-based' to ensure that everything is developed in a coherent way. In addition, the story sets the stage for selecting appropriate solution spaces, which should 'fit with the storyline'. In developing the story, the designers need to take different stakeholder interests into account, making sure that all the puzzle pieces fall into place, as then the storyline is more convincing:

> 'A good storyline connects all these aspects. It says something about which problems you solve for the end-user, why it is good. Then there is an element that indicates why it is good for the client. Namely, that you have a commercially viable product that supports the organization's results. In many cases you also have a storyline that says something about the higher goals that you are trying to reach. It can be aesthetics, it can be improving the world, it can be sustainability. An ambition on a meta level.'

The last ability, that is, the ability to *create client engagement*, relates to designers' ability to stimulate clients' (emotional and cognitive) involvement with the process. Client engagement may be created by generating positive experiences by, for example, transforming the process into a show or play ('That you boost that enthusiasm, make sure it is a party'). Engagement also involves making clients feel part of the process ('They become members of the team, and they move in with you, so to speak. They sleep under your desk'). Engagement ensures that clients will commit to the process and its outcomes. However, to do so, designers need to have the ability to convince and generate enthusiasm at the right time ('During the presentation, you often have one opportunity to give your arguments, about why it is a good solution, [and you should do so] in a compact way. You should grab this opportunity'). Client engagement also relates to designers being able to actively involve clients in identifying the problem and solution space ('they start to think along with us'), which enables clients to get accustomed to how designers work as well.

## 2 .4 .3 INCREMENTAL VS. RADICAL PROJECTS

This section provides an overview of the design practices and abilities used in two different projects conducted by *npk design*. These two projects are discussed in Box 2.2 (incremental innovation project for SKS Germany; the Bike Accessory Portfolio project) and Box 2.3 (radical innovation project for Nerdalize; the Cloud Heater project). Table 2.3 summarizes the design practices and abilities used in the two projects. As shown in Table 2.3, all the design practices and abilities discussed in the prior sections have been identified in both case studies. However, on the basis of our interviews with design professionals from *npk design*, we find that some practices and abilities are emphasized less in the case of incremental innovation projects as compared to radical innovation projects (see Appendix 2.3 for quotes that show that certain practices and abilities are emphasized less in incremental projects as compared to radical projects).

In the case of incremental innovation projects, making the process accountable and making the process tangible, and the related two abilities (overseeing the process and steering the process forward), are of particular relevance. These two practices and abilities have an impact at the start of the project, after which the designer can often work without much client interaction or involvement ('For incremental things, (...) the client comes, he gives an assignment, and we see each other six weeks later when we put the solution on the table'). For example, in the Bike Accessory Portfolio project, to make the process accountable, the designers of *npk design* specified up front the need for three portfolio management workshops and explained the rationale of these workshops, what they would entail and the outcomes. The designers' ability to oversee the project in terms of what workshops were needed to reach the project's goals were especially relevant here. Table 2.3 shows that to make the process tangible in the Bike Accessory project, npk's designers showed several (bike) projects they had worked on in the past. Their ability to steer the process forward and thereby show that they master the process and are experts in terms of conducting such processes was important to gain the client's trust, especially because *npk design* had not worked for the client before.

Of less importance, but still relevant for incremental projects, are the practices of synchronizing designers' and clients' processes and creating ownership for the process, and designers' ability to adjust the process iteratively and to connect with clients. Overall, these practices and abilities ensure that the client is kept informed and that a 'smooth' process is being followed. Table 2.3 specifies how these practices and abilities were enacted in the Bike Accessory project. In this specific project, the designers' ability to adjust the process iteratively enabled them to steer and manage the project from one originally aimed at the development of style guides to one focused more broadly on portfolio management, and their ability to connect with clients resulted in the establishment of a more long-term relationship with SKS Germany.

## BOX 2 .2
## THE BIKE ACCESSORY PORTFOLIO PROJECT FOR SKS GERMANY

SKS Germany is a manufacturer of bike accessories based in Sunder, Germany. SKS Germany develops and sells products such as bicycle mini-pumps and frame pumps, mudguards, chain guards, bike tools, bike bags, bike bottles and bike bottle holders. The company aims mainly at the high end of the market in terms of quality and price, with a focus on both functionality and design. The company has an in-house research and development department and its own production plants.

### INITIATION

SKS Germany contacted *npk design* to develop style guides for its products. However, SKS Germany was also looking for a long-term design partner for its new product development initiatives. The project's underlying motive for SKS Germany thus was also to appraise *npk design*'s capabilities as the companies had not worked with each other before. Building a relationship required SKS Germany to understand the design process that *npk design* follows, so creating process understanding was important in the project. SKS Germany involved *npk design* in the strategy and design phase; *npk design* was not involved in the realization phase as the management of SKS Germany considered they had sufficient capabilities in-house to complete this phase on their own.

### STRATEGY PHASE: CONDUCTING THREE PORTFOLIO MANAGEMENT WORKSHOPS

In the strategy phase, *npk design* conducted three portfolio management workshops together with representatives from SKS Germany. These workshops not only aimed at developing style guides for SKS Germany (as was the original assignment) but also aimed at a broader evaluation of SKS Germany's product portfolio. The workshops were also important for the establishment of a more enduring product development partnership, as they helped SKS Germany and *npk design* in assessing each other's expectations and capabilities. The strategy phase started with an investigation of competing products on the market and the current portfolio of SKS Germany, the results of which were discussed in the first workshop. This first workshop led to the insight that the portfolio of SKS Germany should be structured according to its target markets. *npk design* created three personas to represent the target markets of SKS Germany, which were the mountain biker, the all road biker and the road biker. These personas were discussed in the second joint workshop and subsequently style guides were created for these personas. In the third workshop, priorities for product development were determined, based on whether the existing products of SKS Germany were fitting for the defined target markets and personas. On the basis of this evaluation, two initiatives were selected for the design phase: the development of a high-end and a low-end mini-bicycle pump to cover a broad spectrum of design styles represented in the portfolio of SKS Germany.

### DESIGN PHASE: DEVELOPING TWO BICYCLE PUMPS AND STYLE GUIDES

In the design phase, the two mini bicycle pumps and style guides were developed. The designers of *npk design* developed ideas and concepts, and presented these outcomes to SKS Germany in several meetings. In these meetings, 2D and 3D visualizations were used to show both the interim outcomes and the process through which these interim outcomes emerged. SKS Germany provided feedback on the interim outcomes, and decided which outcomes to continue with, and which not. The selected concepts were detailed by the designers of *npk design* by using CAD/CAM software, and at the end of the design phases *npk design* handed over the files to SKS Germany. As a last step, the initial style guides were adjusted based on the insights from the design phase.

### REALIZATION PHASE: ENGINEERING AND PRODUCING TWO BICYCLE PUMPS

SKS Germany was responsible for realizing the concepts. The files they received from *npk design* detailed the outer shape of the bicycle pumps: the inside of the pumps was detailed by the engineers of SKS Germany. Hereafter, the bicycle pumps were taken into production, which was also handled by SKS Germany.

### AFTER THE PROJECT

*npk design* became the long-term partner of SKS Germany for its product development initiatives. After the two bicycle pumps, more projects followed that focused on restructuring the portfolio of SKS Germany as evaluated in the workshops. Projects included bicycle pumps, mudguards and bike bottle holders.

## BOX 2 .3
## THE CLOUD HEATER PROJECT FOR NERDALIZE

Nerdalize is a provider of computing power services to both industry and academia and is based in Delft, the Netherlands. The organization was founded in 2013 by three entrepreneurs with the vision of creating a world in which heating is free and computing power an affordable commodity. Currently (2015), the organization consists of five employees with backgrounds in international business, entrepreneurship, software engineering and computer science.

### INITIATION

When Nerdalize contacted *npk design* (in 2012) it was still in the start-up phase, trying to sell affordable computing power by installing servers in consumers' houses. The project Nerdalize wanted to initiate with *npk design* focused on developing a heater in which the servers could be placed. *npk design* suggested that developing this heater would not be enough to help Nerdalize set up its affordable computing power business. Thus, the project was extended to product-service system design, through which a complete overview of service and product touchpoints was specified. As this process is complicated, there was a need for creating process understanding for Nerdalize so the company could follow this process.

### STRATEGY PHASE: PRODUCT-SERVICE SYSTEM DESIGN – SPECIFYING A COMPLETE OVERVIEW OF PRODUCT AND SERVICE TOUCHPOINTS

In the strategy phase, *npk design* went through a process of product-service system design together with Nerdalize, which involved specifying a complete overview of product and service touchpoints. This process was important to set up the whole business of Nerdalize in a coherent way, instead of just focusing on one of the touchpoints, i.e., the heater. The strategy phase started with ethnographic user research. *npk design* organized multiple ethnographic user research sessions at which the stakeholders from Nerdalize were present. The first analysis of the results was done by the designers of *npk design*; the stakeholders of Nerdalize were closely involved in the iterations that followed. The insights from the ethnographic user research provided input for the business modelling workshop, in which the designers of *npk design* stepped back and let Nerdalize take the lead, resulting in a stakeholder value map. A customer journey was also created by the designers of *npk design* and the stakeholders of Nerdalize; the creation of this customer journey took several iterations of creation and improvement. The last step of the strategy phase focused on creating a service blueprint as a collaborative effort between the designers of *npk design* and the stakeholders of Nerdalize. All insights from this phase were summarized in a document explaining the service blueprint, stakeholder map and the guidelines for all service (e.g., call centre, installer) and product (e.g., heater, app, website) touchpoints.

### DESIGN PHASE: DEVELOPING ONE OF THE TOUCHPOINTS, THE HEATER

The design phase focused on the development of one of the product touchpoints, i.e., the heater in which the servers that generate computing power and heat consumers' houses would be placed. This phase involved ideation, concept development, prototyping and testing. The designers of *npk design* used drawings, 2D and 3D visualizations to visualize the appearance of the heater. To provide insight into what the heater would look like in consumers' houses, they also created visualizations showing the heater in its real environment (e.g., the living room). In this phase, the stakeholders of Nerdalize provided feedback on the visualizations that the designers of *npk design* created to ensure that the outcome was in line with their needs. *npk design* also played a role in the engineering of the product (e.g., by investigating the cooling of the heater), while software development was handled by Nerdalize (e.g., the calculations concerning the servers' computing power). The design phase ended with prototyping and testing of the heater.

### REALIZATION PHASE: PRODUCING THE HEATER

*npk design* was involved in the realization of the heaters. In particular, *npk design* helped Nerdalize to select the appropriate producer, provided the producer with information, kept Nerdalize updated about the process of production, and ensured that the heaters were produced according to quality standards. When the first series of heaters was produced, *npk design* assisted Nerdalize in installing the heaters for the pilot.

### AFTER THE PROJECT

Nerdalize continued improving the proposition of their product-service system. *npk design* is involved in the improvement of this proposition and in the design of other touchpoints.

## TABLE 2 .3
## DESIGN PRACTICES AND ABILITIES IN RADICAL VERSUS INCREMENTAL PROJECTS

| PROJECTS ⟶ | INCREMENTAL: BIKE ACCESSORIES PORTFOLIO PROJECT FOR SKS GERMANY | | RADICAL: CLOUD HEATER PROJECT FOR NERDALIZE | |
|---|---|---|---|---|
| PRACTICE AND ABILITY | PRACTICE | ABILITY | PRACTICE | ABILITY |
| Making accountable and overseeing the process | *Making the process accountable by*: using project proposals, using contracts, documenting emails. | *Overseeing the process in terms of*: other products on the market, the portfolio of SKS Germany, the three portfolio management workshops, the two innovation projects (bicycle pumps). | *Making the process accountable by*: using project proposals, using contracts, following scientific process, creating project binders, creating meeting reports, creating project reports, creating notes, creating memos. | *Overseeing the process in terms of*: the service design and the product design processes, the service and product touchpoints, the stakeholders and their interrelations, project budget. |
| Making tangible and steering the process forward | *Making the process tangible by*: showing previous (bike) projects, explaining the process of portfolio management, explaining the process of ideation and concept development. | *Steering the process forward in terms of*: the design process as adjusted for the bike industry, the process of portfolio management, the idea and concept development process. | *Making the process tangible by*: presenting the process of *npk design*, showing previous (ethnographic user research) projects, explaining the product-service system design process (e.g., stakeholder mapping, customer journey making, service blueprinting). | *Steering the process forward in terms of*: the ethnographic user research process, the service design process, the product design process. |
| Synchronizing designers' and clients' processes and adjusting the process iteratively | *Synchronizing processes by*: organizing meetings quickly after each other (e.g., portfolio management, idea and concept development), sharing information in between meetings by email (e.g., workshop preparation). | *Adjusting the process iteratively in terms of*: the assignment given by SKS Germany (style guide versus portfolio management), the portfolio management workshops, the ideas and concept developed by *npk design*. | *Synchronizing processes by*: sharing information through email, phone and meetings, collaborating through cloud-based file sharing, making and updating the project plans. | *Adjusting the process iteratively in terms of*: the assignment given by Nerdalize (product versus product-service system design), the service and product touchpoints developed by *npk design*, the project planning. |
| Creating ownership for the process and connecting with clients | *Creating ownership for the process by*: involving various SKS Germany stakeholders in the process (e.g., sales, engineering, top management), letting SKS Germany make decisions, evaluating the satisfaction of SKS Germany with the process. | *Connecting with the client in terms of*: evaluating SKS Germany's previous partnerships, setting expectations for the partnership with *npk design*, establishing an informal relationship with SKS Germany, investigating SKS Germany (e.g., brand, internal design process, internal engineering process). | *Creating ownership for the process by*: involving the whole management team of Nerdalize in the process, letting Nerdalize make decisions, evaluating the satisfaction of Nerdalize with the process. | *Connecting with the client in terms of*: investigating Nerdalize (business proposition, principles behind heater), establishing an informal relationship with Nerdalize, switching between formality and informality in the relationship with Nerdalize. |
| Bringing the result of the process to life and telling a coherent and compelling story | *Bringing the result of the process to life by*: visualizing SKS Germany's brand, creating personas, creating moodboards, visualizing bicycle pumps (drawings, 2D visualizations, 3D visualizations, prototypes), creating style guides. | *Telling a coherent and compelling story in terms of*: the relation between personas, the relation between persona, products and style guide. | *Bringing the result of the process to life by*: creating stakeholder maps, creating customer journeys, creating service blueprints, visualizing heater (drawings, 2D visualizations, 3D visualizations, prototypes), making photographs of the heater in context (e.g., living room), prototyping heater. | *Telling a coherent and compelling story in terms of*: the relation between all service and product touchpoints, the relation between the service and product touchpoints and the business of Nerdalize, the relation between the service and product touchpoints and all stakeholders. |
| Getting clients accustomed to designerly ways of working and creating client engagement | *Getting clients accustomed to designerly ways of working by*: letting SKS Germany come up with metaphors of their brand, letting SKS Germany identify themselves with personas, letting SKS Germany bring objects representing the organization's future, letting SKS Germany select design details for the style guides. | *Creating client engagement in terms of*: participation in the portfolio management workshops. | *Getting clients accustomed to designerly ways of working by*: letting Nerdalize be present at ethnographic user research sessions, letting Nerdalize co-analyze the ethnographic user research results, involving Nerdalize in design workshops (i.e., customer journeys, stakeholder mapping, service blueprinting), involving Nerdalize in product tests of the heater. | *Creating client engagement in terms of*: participation in ethnographic user research, participation in service and product design, participation in prototyping, testing and installing of heater. |

practice is emphasized in the innovation project

practice is not emphasized in the innovation project

In incremental innovation projects, the practice of bringing the solution of the process to life is only of relevance at the end of the design phase, when the outcome is crystallized. The solution space is often clear up front and discussion about it is not necessary ('A coffee machine with a certain interior… you don't have to talk about this'). As described in Table 2.3, in the Bike Accessory project, the designers of *npk design* made many visualizations of interim outcomes and created personas. Designers' ability to create a story between proposed outcomes and personas proved to be of importance in bringing the solution to life.

In incremental projects, there is only a limited need to accustom clients to designerly ways of working because the process to be followed is straightforward ('[the client] knows what he gets, he knows the format, 3D renderings, a foam model'). In the Bike Accessory project, SKS Germany became accustomed to designerly ways of working in the strategy phase through three portfolio management workshops, in which designers actively engaged SKS Germany team members in design activities (see Table 2.3).

In contrast, all design practices and abilities are of importance for radical innovation projects. In radical innovation projects, the practices of making the process accountable and tangible tend to be used 'to get a grip' on the process, and to search for 'the right way' to go. In this 'way finding', the client plays an important role:

> 'In incremental projects you know very well: this is the goal, you should walk straight towards it. Very efficient. With radical innovations you don't know very clearly where you are going and you have to, sort of speak, be able to change your strategy or your story in every phase of the project. You can't do that alone, you have to do this with the client. He has to carry and support it and he has to see it.'

Table 2.3 describes how in the Cloud Heater project, the designers of *npk design* tried to make the process accountable and tangible, which mainly related to codifying information in written form (e.g., project proposals, contracts, meeting reports, project reports, memos) and extensive explanations of the process and demonstrations of the tools and techniques it would involve (e.g., stakeholder mapping, customer journey mapping, service blueprinting, etc.). Prior experience in similar projects helped npk's designers to oversee the design process, the many changes this process entailed and to steer the process forward.

In radical innovation projects, the practices of synchronizing the designers' and clients' processes and creating ownership for the process and related abilities played an important role because these practices allowed *npk design* to involve Nerdalize in shaping the process. For example, in the Cloud Heater project, the designers of *npk design* shared information on a continuous basis, iteratively, and on the basis of joint decision making they adjusted the process in terms of the service and product touchpoints that were being created or in terms of the planning for the project (see Table 2.3). Designers' ability to connect with the client in terms of switching between formality and informality proved to be of particular relevance in this project, as Nerdalize was a start-up with an informal way of working.

In radical innovation projects, it is also important to bring potential solution spaces of the process to life, from the early beginnings onward, to gauge sentiments and co-create solutions ('The more complex the problem is, the more abstract the problem, the more important visualizations become to get feedback from the project group. We visualize a lot to get reactions'). For example, in the Cloud Heater project (see Table 2.3), the story that the designers created between the service and the product touchpoints was relevant to bringing the solution of the process to life.

Getting the client accustomed to designerly ways of working is important in radical projects as well, because these projects often involve a way of working that clients are not used to ('We make jumps that are different. So I have to detach them from their old way of working, we have to hop around, to figure out the right way to do it'). In the Cloud Heater project, interim outcomes were created in iterations together with the client, and in the creation of some outcomes the client even took the lead (e.g., stakeholder mapping; see Table 2.3). The ability to create client engagement made Nerdalize feel it was part of the team and enabled it to participate strongly in the design activities ('I really feel that we've created [the results] together! (…) I am really proud of something that I didn't make. Of something that we made as a team').

In summary, we identify design practices and abilities for process understanding (see Figure 2.6). Our results suggest that designers can use six practices to create understanding about their process for managers. These practices are *making the process accountable*, *making the process tangible*, *synchronizing designers' and clients' processes*, *creating ownership for the process*, *bringing the result of the process to life*, and *getting clients accustomed to designerly ways of working*. Moreover, in order to perform the practices effectively, we find that designers need to develop six design abilities: *overseeing the process*, *steering the process forward*, *adjusting the process iteratively*, *connecting with clients*, *telling a coherent and compelling story*, and *creating client engagement*. Lastly, our results suggest that the type of innovation project, radical or incremental, influences the creation of process understanding in terms of which practices and abilities designers should emphasize to explain their process to managers.

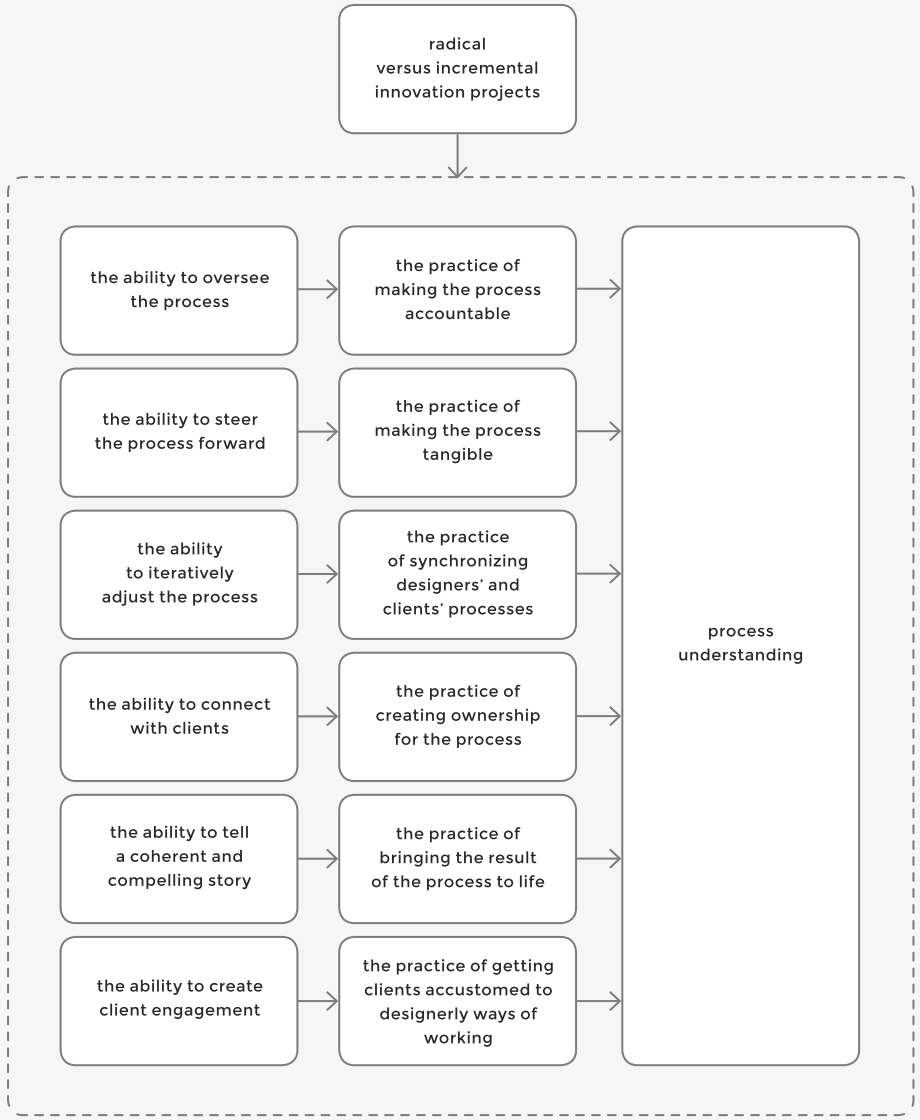



Figure 2 .6
Summary of the results

## 2 .5
## DISCUSSION AND CONCLUSION

The main objective of this study was to identify relevant design practices and abilities for creating process understanding. To do so, we conducted a single case study of *npk design*, and two innovation projects conducted at this design consultancy, which are the Bike Accessory Portfolio project for SKS Germany and the Cloud Heater project for Nerdalize. We interviewed three senior designers and two project managers, and studied various company documents such as project planning overviews, the IT documentation system and presentations, but also movies and tangible outcomes of the innovation projects.

Our results suggest that designers use six practices to create process understanding, namely: *making the process accountable*, *making the process tangible*, *synchronizing the designers' and the client's processes*, *creating ownership for the process*, *bringing the result of the process to life*, and *getting the client accustomed to designerly ways of working*. These practices are used throughout the whole process of strategic design projects, although most are used in the strategy and design phases. In the strategy and design phases of a strategic design project, the greatest uncertainty involves the ultimate outcome of the process, and creating process understanding can decrease this uncertainty. Next to the six design practices, we also identified six design abilities that support designers in the creation of process understanding, which are: *overseeing the whole process*, *steering the process forward*, *adjusting the process iteratively*, *connecting with clients*, *telling a coherent and compelling story*, and *creating client engagement*. Furthermore, we also specified how the design practices and abilities are related.

No prior research has identified practices and abilities for process understanding and specified their relations. However, some of our six design practices for process understanding are similar to design practices identified in different contexts for different purposes. For example, our practice of *bringing the solution of the process to life* resonates with the practice of *animating* (which involves communicating condensed information in an engaging manner), as identified by Calabretta and Gemser (2015) in their study on effective design practices in the fuzzy front end (i.e., the strategy phase) of an innovation project. It also resonates with the practice of *making experiences tangible* (i.e., transforming abstract information and insights into something real and tangible by using visual tools and techniques) identified by Stigliani and Fayard (2010) in their study on service design. Another example is our practice of *getting clients accustomed to designerly ways of working*, which resonates with research suggesting that design practices, tools and methods should be used to involve stakeholders in the creation of outcomes (see e.g., Calabretta and Gemser, 2015; Zomerdijk and Voss, 2011). Some of the design abilities we identify are also

similar to general design skills identified in prior research. For example, Perks et al. (2005) suggested that managing the design process involves *motivating, negotiating and persuading clients*, skills that can be considered to be part of our identified ability to *steer the process forward*; designers' ability to *engage personal and commercial empathy*, identified by Michlewski (2008), is closely related to our identified ability to *connect with clients*.

Thus, while our study is based on an in-depth case study of design professionals working at one specific design consultancy, our identified list of practices and abilities resonates with earlier findings in the literature. This finding in turn suggests that our results may be generalizable to design professionals in general. However, future research is needed to ascertain this. Future research may, for example, show that our six identified design practices and abilities need to be supplemented with other practices and abilities. Furthermore, future research is needed to examine in depth the relations between the practices and abilities identified in this study. Indeed, we recognize that each of our identified design abilities may have an influence on more than one practice or that our identified practices may need more than one design ability to be executed well. Thus, Table 2.2, in which we connect abilities and practices one-on-one, is a stylized version of reality. Future research may also investigate the potential negative outcomes of using the design practices and abilities. For example, although not mentioned by our respondents, creating ownership might result in clients being unsatisfied when the process does not go according to their wishes, even though they are co-owners of this process. Finally, future research should investigate the costs and time associated with using the design practices and abilities in order to help designers make more informed decisions about how to effectively and efficiently create process understanding in innovation projects.

We contribute to the literature not only by identifying several important design practices and abilities for process understanding and suggesting how these are related, but also by exploring how the context may influence the use of practices and abilities. More specifically, our results suggest that, depending on the project's nature, the designer may need to emphasize different practices and abilities. In incremental innovation projects, the practices of *making the process accountable* and *making the process tangible* and the abilities to *oversee the process* and *steer the process forward* are particularly important for developing understanding about the process. In radical projects, creating process understanding is more difficult and designers need to emphasize all six identified practices and abilities. Although our research provides preliminary insights on the influence of the context on the usage of practices and abilities by studying the influence of type of project, their usage can also differ depending on other factors such as type of client or industry. Future research may provide more insights into this.

Our findings offer several guidelines for designers working on strategic design projects. First, our results provide a list of relevant practices and abilities for creating process understanding. We 'operationalize' these practices and abilities by discussing concrete examples of how these practices and abilities were enacted in practice. Doing so helps design professionals to develop abilities in this area. Second, we provide insights into how the context can influence what practices and abilities are needed. In particular, designers may use fewer practices and abilities to create process understanding in incremental as compared to radical innovation projects. Furthermore, designers should focus on creating process understanding in the strategy and design phases, as most of design practices for this purpose are used in these parts of the project. Providing insight into the context will help in selecting designers with the necessary set of practices and abilities for the type of project or project phase involved.

# 3
# Do designers and managers complement each other? The influence of cognitive style on financial performance

Authors: K. Tabeau, G. Gemser, H.J. Hultink, N.M. Wijnberg
A previous version of this chapter was presented at the 19th Academic Design Management Conference.

Prior research has suggested that designers may complement managers in achieving successful innovation outcomes because of their different ways of approaching problems and opportunities. Designers have, for example, been described as focussed at radical change, future-oriented and intuitive, while managers have been described as being rational and driven by the past and having a preference for incremental change. However, there is not much empirical research examining whether designers and managers indeed think differently, and how this affects innovation outcomes. We attempt to fill this gap in the extant literature by examining how designers' and managers' cognitive styles (in terms of creativity, conformity and attention to details) influence the financial performance of innovation projects. Our results indicate that conformist managers enhance financial performance, while creative designers contribute to higher levels of performance by developing products that are both unique and of high quality. Moreover, designers' and managers' cognitive styles complement each other, indicating that to achieve higher levels of financial performance, creative designers should not conform to rules and group norms, and conformist managers should not be creative. However, our results also indicate that financial performance is enhanced when both designers and managers are attentive to details, indicating that these professionals supplement (rather than complement) each other's abilities as well.

## 3 .1
## INTRODUCTION

To gain and sustain a competitive advantage, organizations increasingly rely on innovation (Song et al., 2011). *Successful* innovation requires the generation of new ideas and the implementation of these ideas into new products, services or processes (Amabile and Fisher, 2009). Designers can effectively assist companies in the generation and successful implementation of innovations (Abecassis-Moedas and Benghozi, 2012; Dell'Era and Verganti, 2009, 2010; Perks et al., 2005).
The effectiveness of designers in innovation has, in part, been attributed to designers' unique orientation towards the work at hand, and the mental attitude with which they approach problems and respond to situations. Indeed, 'design thinking' has gained considerable attention in the management literature, since designers contribute to innovation in ways managers cannot (Beverland et al., 2015; Liedtka, 2015; Micheli et al., 2012). Prior research has described designers as being explorative, future-oriented and intuitive (Beverland and Farrelly, 2011; Hassi and Laakso, 2011; Liedtka, 2010; Von Stamm, 2004). Beverland and Farrelly (2011) suggested that designers view the environment as mutable, change as radical and exciting, knowledge as intuitive and the future as the driver of the present. This mentality is different from that of individuals working in business functions, such as managers, who tend to view the environment as fixed and view change as incremental, knowledge as measurable and the past as a basis for their decisions in the present (Beverland and Farrelly, 2011).
Even though prior research has suggested that designers and managers have different mentalities, there is not much empirical evidence that designers and managers indeed differ in mentality and that this would have an effect on innovation outcomes.
This research sets out to explore this topic and focuses on how these professionals' cognitive styles (in terms of creativity, conformity and attention to details) influence the financial performance of innovation projects. A cognitive style is an individual's 'preferred way of gathering, processing, and evaluating information' (Hayes and Allinson, 1998, p.850), reflecting how individuals approach problems, process information and learn (Hayes and Allinson, 1994; Kirton, 1976; Miron-Spektor et al., 2011). When interpreting design thinking as a mentality that indicates how individuals approach problems and respond to situations, cognitive styles are a good representation of this mentality.

The purpose of this study is to explore (i) how managers' cognitive styles influence financial performance, (ii) how designers' cognitive styles influence financial performance and (iii) how the two actors complement each other in achieving this innovation outcome. To investigate these topics, we collected data on 83 innovation projects for which an innovating organization hired an external design consultancy. The dataset contains the responses from both the external senior designer and project manager that were involved in the project (n=166, 83 designers and 83 managers).



The results from our PLS structural equation model show that for higher levels of financial performance, designers should be creative (and not conformist) and managers should conform to rules and group norms (and not be creative), indicating that the two professionals complement each other. However, our results also show that it is important for both designers and managers to pay attention to details to achieve higher levels of performance, showing that they supplement (rather than complement) each other's abilities as well.

The remainder of this paper is structured as follows. First, we discuss the theoretical background and present our hypotheses. We then present the method and discuss our results. The final section provides conclusions and discusses the limitations of our study and directions for future research.

## 3 .2
## THEORETICAL BACKGROUND AND HYPOTHESES

### 3 .2 .1
### COGNITIVE STYLES AND THE OUTCOMES OF INNOVATION PROJECTS

A cognitive style refers to individuals' problem-solving process rather than the content of the activity (Hayes and Allinson, 1994; Kirton, 1976; Miron-Spektor et al., 2011) and describes how people 'perceive, think, solve problems, learn and relate to others' (Hayes and Allinson, 1994, p.53). Prior research has described individuals' cognitive style in terms of two extremes, such as intuition and analysis (Allinson and Hayes, 1996) or adaption and innovation (Kirton, 1976). This aggregation of the dimensions of cognitive style into one continuum with two poles, however, has been criticized, since such a division can mask the effects of the underlying attributes on performance (see e.g., Payne, 1987). In response to this criticism, Miron et al. (2004) developed and tested a three-factor structure of cognitive style. Such a conceptualization of cognitive style is relevant for our study as we are interested in examining differences in the cognitive styles of designers and managers, and a three factor structure of cognitive style makes no implicit assumptions about such differences. Miron et al. (2004) examined cognitive style in terms of creativity, conformity and attention to details. Creativity refers to individuals' ability to identify problems, reframe them and come up with many solutions (Miron-Spektor et al., 2011; Miron et al., 2004). Individuals who conform to rules and group norms seek consensus and generate ideas that will be likely to be accepted by their group (Miron-Spektor et al., 2011; Miron et al., 2004).
Finally, those who are attentive to details are efficient, reliable, systematic and precise (Miron-Spektor et al., 2011; Miron et al., 2004).

We hypothesize that the cognitive style of managers responsible for innovation projects will directly influence the financial performance of these projects. Managers are involved in the organization of innovation projects by controlling, among other things, budget and planning (Beverland, 2005; Bonner et al., 2002; Liedtka, 2010; Micheli et al., 2012), and by determining product pricing to ensure profitability (Beverland, 2005; Beverland and Farrelly, 2011). Therefore, we expect that managers' cognitive style influences the extent to which the product is effectively and efficiently implemented. We propose that managers' creativity will have a negative influence on financial performance. Creative individuals tend to follow an unstructured and unorthodox process when developing solutions to complex problems (Amabile and Fisher, 2009; Cummings and Oldham, 1997). Moreover, they tend to navigate away from what is already known (Amabile and Fisher, 2009; Cummings and Oldham, 1997) and prefer to develop radical solutions (Miron-Spektor et al., 2011), which may be difficult to integrate within the organization (Baer, 2012). These characteristics often result in inefficiency (Kirton and De Ciantis, 1986), which in turn may negatively affect financial performance. We suggest that managers' conformity to rules and group norms will have a positive influence on financial performance. Managers who conform to rules and group norms will be focused on solutions that will be accepted by their organization, creating support for these solutions and ensuring these solutions fit with organizational resources (Kaplan et al., 2009). Moreover, conformists are likely to abide to project planning and budget since they consider rules and regulations important (Miron-Spektor et al., 2011; Miron et al., 2004), facilitating the efficient implementation of the project and thereby stimulating financial performance. Finally, we propose that managers' tendency to pay attention to details will have a positive influence on financial performance. Managers who are attentive to details are thorough, efficient and enjoy improving rather than changing the status quo (Miron-Spektor et al., 2011; Miron et al., 2004). These characteristics aid in bringing innovations to the market quickly and cost-efficiently, which may positively influence the financial performance of the innovation. Therefore:

**H1A** Managers' creativity has a negative influence on financial performance.
**H1B** Managers' conformity has a positive influence on financial performance.
**H1C** Managers' attention to details has a positive influence on financial performance.

Designers are rarely responsible for business aspects that have a direct effect on financial performance such as budget, planning and price setting. Rather, designers will influence, above all, the qualities and features of the outcome itself (Beverland, 2005; Liedtka, 2010; Micheli et al., 2012). Therefore, we propose that designers' cognitive styles do not directly influence financial performance but instead contribute to successful innovation through the development of product advantage. Product advantage is the extent to which an innovation is unique, superior at meeting customer needs and has a better quality than competing products (McNally et al., 2010; Rijsdijk et al., 2011). Designers' creativity will have a positive influence on product advantage since creativity enhances innovativeness (Miron-Spektor et al., 2011). As described earlier, creative individuals enjoy developing radical solutions (Miron-Spektor et al., 2011), and they tend to navigate away from what is familiar (Amabile and Fisher, 2009; Cummings and Oldham, 1997), enhancing the development of uniqueness in the solution. On the other hand, designers' conformity to rules and group norms will result in less innovative outcomes. Conformists are strong at developing products that are likely to be accepted by their group (Kaplan et al., 2009; Miron-Spektor et al., 2011; Miron et al., 2004). This suggests that conformist designers may be more incremental in their ideas, proposing ones that meet current customer needs, rather than trying to develop future customer needs. Designers' conformity might thus result in developing products that resemble what is already on the market, reducing product advantage. Designers' attention to details will have a positive influence on product advantage since attention to details enhances reliability (Miron-Spektor et al., 2011; Miron et al., 2004). Those individuals who are attentive to details are thorough and focus on small details of the task (Miron-Spektor et al., 2011; Miron et al., 2004), and as such can ensure that the quality of the final solution is better than that of competing products. Therefore, we propose:

**H2A** Designers' creativity has a positive influence on product advantage.
**H2B** Designers' conformity has a negative influence on product advantage.
**H2C** Designers' attention to details has a positive influence on product advantage.

### 3 .2 .2 COMPLEMENTARY FIT BETWEEN COGNITIVE STYLES AND THE OUTCOMES OF INNOVATION PROJECTS

Person-environment fit theory explains how the fit between individuals and their environment influences their performance (Kristof-Brown et al., 2005). For example, the more individuals fit the requirements of a job they have to perform, the higher their satisfaction and performance in this function (Chilton et al., 2005). The environment of the individual may include, for example, the organization someone works in, the team someone is part of, or direct co-workers (Kristof-Brown et al., 2005). In this research, we focus on the fit between co-workers. Examples include subordinates and supervisors, mentors and protégées, and salespeople and their managers (Kristof-Brown et al., 2005). In particular, we focus on the dyadic relation between designers and managers, where managers represent the environment in which the designers have to perform. Depending on the type of dyadic relation, there are two types of fit that can play a role in performance outcomes: *complementary fit*

and *supplementary fit* (Kristof-Brown et al., 2005). Complementary fit refers to a situation where co-workers have an offsetting pattern of characteristics, and reflects a situation in which one person has what the other needs (Kristof-Brown et al., 2005). Complementary fit plays a large role in performance when the exchange of resources or services between individuals is key (Kammeyer-Mueller et al., 2012). Supplementary fit is reflected by a situation in which co-workers share similar characteristics, ensuring the harmonious relation between both actors (Kammeyer-Mueller et al., 2012).

We expect that complementary fit between the designer and manager will play a large role in achieving product advantage since designers and managers will each have different capabilities and skills due to their training and experience (see e.g., Abecassis-Moedas and Benghozi, 2012; Bruce and Docherty, 1993; Perks et al., 2005). In line with complementary fit principles, we expect that higher levels of product advantage will be achieved when designers and managers complement each other in their creativity; i.e., when one actor is highly creative and the other is not. When both actors are creative, the project may focus on developing new solutions, a strength of creative individuals (Miron-Spektor et al., 2011; Miron et al., 2004), but they may fail to implement those solutions (Baer, 2012). Conformity to rules and group norms will ensure efficiency but may also result in 'me-too' products that do not provide superior product advantage. When both the designer and manager conform to rules and group norms, they will no longer challenge each other with respect to what the customer wants (Nemeth and Goncalo, 2005), which may negatively influence product advantage. Therefore, we also expect that designers and managers should complement each other for higher levels of product advantage: i.e., one actor should conform to rules, while the other should not. While attention to detail is important for higher levels of product quality, we expect that when the designer and manager both have high levels of attention to detail, the project will revolve around improving characteristics of competing offerings rather than developing unique offerings (Miron et al., 2004). Therefore, we again expect that when designers and managers complement each other, product advantage will be positively influenced.
Thus, we propose:

**H3A** The extent to which designers and managers complement each other in terms of creativity has a positive influence on product advantage: the positive influence of designers' creativity on product advantage is stronger when managers' creativity is low.

**H3B** The extent to which designers and managers complement each other in terms of conformity has a positive influence on product advantage: the negative influence of designers' conformity on product advantage is weaker when managers' conformity is high.

**H3C** The extent to which designers and managers complement each other in terms of attention to details has a positive influence on product advantage: the positive influence of designers' attention to details on product advantage is stronger when managers' attention to details is low.

Our final hypothesis concerns the influence of product advantage on financial performance. Several meta-analyses on the antecedents of financial performance have shown that product advantage enhances the extent to which products meet their margin, profitability and ROI goals (Evanschitzky et al., 2012; Henard and Szymanski, 2001; Pattikawa et al., 2006; Storey et al., 2016). In line with the results from these meta-analyses, we expect that product advantage enhances financial performance. We therefore propose:

**H4** Product advantage has a positive influence on financial performance.

Figure 3.1 presents the research model.

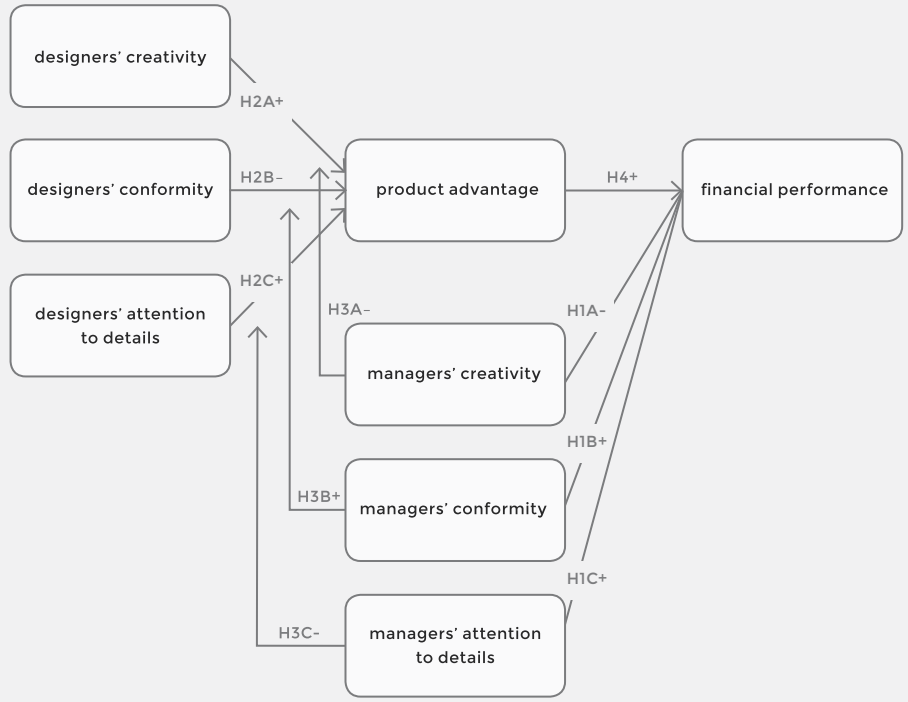



Figure 3 .1
Research model

## 3 .3
## METHODOLOGY

### 3 .3 .1
### DATA COLLECTION

The empirical focus of this study was on innovation projects for which an innovating organization hired an external design consultancy. This context is appropriate for our research as external design consultancies are often hired to complement clients in terms of their skills (see e.g., Abecassis-Moedas and Benghozi, 2012; Bruce and Docherty, 1993; Perks et al., 2005). We collected data for this study in the period from November 2012 to January 2014.

With the help of Dutch design organizations, we created a list of 227 design consultancies representing a wide range of firm sizes and design fields. We contacted these design consultancies by phone to ask for their participation in the research. In total, 43 design consultancies agreed to participate, which is similar to prior studies (see e.g., Sok and O'Cass, 2015). Design consultancies were sometimes hesitant as we asked for the participation of not only one of their senior staff members, but also a staff member of one of their clients. After companies agreed to participate, we asked the design consultancies to select up to three relevant innovation projects based on three criteria. First, the innovation projects had to be completed; second, the innovation projects had to be completed no longer than three years ago; and third, the senior design consultant at the design consultancy side and project manager at the client side (i.e., the innovating organization) had to be willing to participate in the research. This selection process resulted in a database of 113 innovation projects..

We considered the senior design consultant and project manager to be the most appropriate respondents for this study as they were actively involved in the projects and were knowledgeable about the constructs under study, namely the content of the project (product advantage) as well as its (financial) performance. In addition, the senior design consultant and project manager are the individuals whose cognitive styles have a strong influence on the constructs under study, as they are the representatives of the design consultancy and the client, respectively. By collecting data from these two respondents, we were able to deal with issues of common method bias, and to include the viewpoints of both essential actors in our research.



We called the respondents to explain our research, after which they received the link to an online survey by email. One week after sending the survey, the respondents received a reminder, and after two weeks they were called to answer any questions about the research, after which they received the link to the survey again. This data collection process resulted in 213 valid responses, which equals 103 dyads (for seven innovation projects we only received answers from one respondent). The performance data was missing for 20 innovation projects, and they were thus excluded from further analysis. As a result, our final dataset consists of 83 innovation projects.

### 3 .3 .2
### MEASURES

We reviewed the extant literature to identify measures for the constructs of interest: see Table 3.1 for the summary of the construct operationalization. All constructs in our survey were assessed by using multi-item reflective measures, which we adapted from prior research.

#### 3 .3 .2 .1
#### DEPENDENT VARIABLES: FINANCIAL PERFORMANCE AND PRODUCT ADVANTAGE

We operationalized financial performance as the extent to which the innovation outcome met margin, profitability and return on investment goals (Griffin and Page, 1993). Product advantage was operationalized as the extent to which the innovation outcome offered unique attributes or performance characteristics, met customer needs in a superior way and was superior in quality as compared to competing products (McNally et al., 2010).

#### 3 .3 .2 .2
#### INDEPENDENT VARIABLE: COGNITIVE STYLE

We operationalized designers' and managers' cognitive style in terms of creativity, conformity to rules and group norms, and attention to details (Miron et al., 2004). Creativity was operationalized as the ability to generate novel and appropriate ideas, conformity to rules and group norms as the ability to perform within constraints and to promote group unity, and attention to details as the ability to work in a thorough, precise and methodical way (Miron-Spektor et al., 2011).

## TABLE 3 .1
## MEASURES AND SOURCES

| CONSTRUCT AND SOURCE | MEASUREMENT |
|---|---|
| Financial performance<br>(adapted from Griffin and Page, 1993) | For each of the following questions, please indicate on a scale from 1 to 7 (1=completely disagree, 4=neither agree nor disagree, 7=completely agree) the response that most closely describes the performance of the product.<br><br>- The product attained its profitability goals.<br>- The product attained its margin goals.<br>- The product attained its ROI goals. |
| Product advantage<br>(adapted from McNally et al., 2010) | For each of the following questions, please indicate on a scale from 1 to 7 (1=completely disagree, 4=neither agree nor disagree, 7=completely agree) the response that most closely describes the product in comparison to competing products.<br><br>- The product quality was superior to that of competing products.<br>- The product was superior to competing products in terms of meeting the customer's needs.<br>- The product offered the customer unique attributes or performance characteristics that are not provided by competing products |
| Creativity<br>(adapted from Miron et al., 2004) | For each of the following questions, please indicate on a scale from 1 to 7 (1=completely disagree, 4=neither agree nor disagree, 7=completely agree) the response that most closely describes how you solve problems.<br><br>- I have a lot of creative ideas.<br>- I prefer tasks that enable me to think creatively.<br>- I like to be innovative.<br>- I like to do things in an original way. [a] |
| Conformity<br>(adapted from Miron et al., 2004) | For each of the following questions, please indicate on a scale from 1 to 7 (1=completely disagree, 4=neither agree nor disagree, 7=completely agree) the response that most closely describes how you solve problems.<br><br>- I try not to oppose other members of a team to which I belong.<br>- I adapt myself to the organizational system.<br>- I adhere to accepted rules in my area of work. [a]<br>- I avoid cutting corners. [a] |
| Attention to details<br>(adapted from Miron et al., 2004) | For each of the following questions, please indicate on a scale from 1 to 7 (1=completely disagree, 4=neither agree nor disagree, 7=completely agree) the response that most closely describes how you solve problems.<br><br>- I like to address the small details that are needed to perform a task.<br>- I can perform a task accurately over a long period of time.<br>- I am good in tasks that require dealing with details.<br>- I am thorough when solving problems. [a] |

[a] We deleted these items in the scale purification process.

### 3 .3 .2 .3 CONTROL VARIABLES

We controlled for the type of project that organizations provided, distinguishing between product (n=50) and service innovation (n=33), as prior research has shown that outcomes may be affected by the type of offering that is developed (Szymanski et al., 2007). Moreover, we controlled for the number of projects organizations provided, which ranged between 1 and 5 projects (with a median of two).

## 3 .3 .3 ANALYSIS

### 3 .3 .3 .1 STRUCTURAL EQUATION MODELLING USING SMARTPLS

We analysed the data through PLS structural equation modelling (PLS-SEM) (Lohmoller, 1989; Wold, 1975) using SmartPLS version 2.0 (Ringle et al., 2005). PLS-SEM is useful when the goal is prediction of the dependent variables to develop or extend theory (Hair et al., 2011; Hair et al., 2012). As we aim to extend current theory by investigating how designers' and managers' cognitive styles complement each other for higher levels of financial performance, PLS-SEM is the appropriate method to use. In addition, PLS-SEM is useful for research that involves small sample sizes (Hair et al., 2011; Hair et al., 2012). Based on prior research, we expect to explain between 20% and 30% of the variance in our dependent variables (see e.g., Miron-Spektor et al., 2011). Consequently, we need a sample of 73 innovation projects for our PLS-SEM analysis to ensure that the power of the test is 0.80 at a significance level of 0.05 (Cohen, 1988). This suggests that our sample of 83 innovation projects is sufficient for our study.

### 3 .3 .3 .2 DEALING WITH MULTI- RESPONDENT DATA

We collected data from two respondents to address issues related to common method bias. We used one method to evaluate whether common method is a problem in our study, and two methods to reduce it. We first analysed whether common method is a problem by using Harman's single-factor test (Podsakoff and Organ, 1986), which showed that this is not the case since only 17.9% of the variance is explained by the first factor. Secondly, we took common method bias into account when constructing our survey by separating our independent and dependent variables by including questions not belonging to this study (Podsakoff et al., 2003). Lastly, we used two strategies proposed by prior research to reduce common method bias: using different informants for our independent and dependent variables, and aggregating informants' answers (Bruggen et al., 2002; Podsakoff et al., 2003). We used the data from the project managers to assess the financial performance measure as we expected these actors would have the most complete overview of the performance of the project. We calculated the average of the design consultants' and project managers' answers to reflect product advantage, as both respondents were actively involved in the project. The interrater reliability for this construct, as measured through the intraclass correlation coefficient ($r=0.50$, $p<0.05$), was fair to good (Fleiss, 1986). We followed prior research (Miron-Spektor et al., 2011; Miron et al., 2004; Sok and O'Cass, 2015) by using the data of the designers to reflect their cognitive style, and we did the same for the cognitive styles of the project managers.

## 3 .4 RESULTS

### 3 .4 .1 OUTER MODEL EVALUATION

We removed four items belonging to the cognitive styles constructs, both for the designers and the managers, due to low outer loadings. The outer loadings of the remaining items varied between 0.55 and 0.95, which suggests that their indicator reliability is satisfactory (Hulland, 1999). The composite reliability (CR) estimates ranged from 0.71 to 0.93, which is above the threshold level of 0.70 (Bagozzi and Yi, 1988). We evaluated convergent validity by examining the values of average variance extracted (AVE), which were all above the critical value of 0.50 (Bagozzi and Yi, 1988). Moreover, the values of the square root of AVE for each construct (see Table 3.2) were greater than the correlation between that construct and any other constructs, providing indication of discriminant validity (Fornell and Larcker, 1981). Discriminant validity was also suggested by the fact that the loading of each indicator was greater than the cross-loadings with other reflective indicators (Chin, 1998). See Appendix 3.1. for a summary of the reliability and validity of the measures.

## TABLE 3 .2
## DESCRIPTIVE STATISTICS AND CORRELATIONS (2 TAILED)

| VARIABLE | MEAN | S.D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 Financial performance | 4.66 | 1.27 | ***0.88*** | | | | | | | |
| 2 Product advantage | 5.68 | 0.83 | 0.24 ** | ***0.84*** | | | | | | |
| 3 Designers' creativity | 6.07 | 0.78 | 0.02 | 0.23 ** | ***0.81*** | | | | | |
| 4 Designers' conformity to rules | 4.27 | 1.25 | −0.27 ** | −0.15 | −0.18 | ***0.80*** | | | | |
| 5 Designers' attention to details | 5.09 | 1.20 | −0.15 | 0.04 | −0.12 | 0.28 ** | ***0.78*** | | | |
| 6 Managers' creativity | 6.00 | 0.90 | 0.10 | 0.05 | 0.02 | −0.11 | −0.06 | ***0.85*** | | |
| 7 Managers' conformity to rules | 4.03 | 1.14 | 0.24 ** | −0.26 ** | −0.04 | 0.05 | −0.13 | 0.07 | ***0.75*** | |
| 8 Managers' attention to details | 4.55 | 1.60 | 0.11 | 0.07 | −0.09 | −0.03 | −0.08 | 0.09 | 0.19 * | ***0.91*** |

*** p<0.01, ** p<0.05, * p<0.10; scores marked in bold italics are the square root of the construct's AVE.



## TABLE 3 .3
## RESULTS FROM THE STRUCTURAL EQUATION ANALYSIS

| | MODEL 1: MAIN EFFECTS | MODEL 2: MODERATORS | MODEL 3: INTERACTIONS |
|---|---|---|---|
| **Dependent: Financial performance** | | | |
| Product advantage | 0.37 (2.95) *** | 0.37 (2.89) *** | 0.36 (2.84) *** |
| Managers' creativity | 0.10 (1.41) | 0.09 (1.15) | 0.09 (1.12) |
| Managers' conformity | 0.34 (3.19) *** | 0.34 (3.07) *** | 0.34 (3.02) *** |
| Managers' attention to details | -0.01 (0.11) | -0.01 (0.09) | -0.01 (0.04) |
| **Dependent: product advantage** | 0.22 (2.22) ** | 0.26 (2.47) *** | |
| Designers' creativity | -0.15 (1.74) * | -0.13 (1.59) | 0.24 (2.44) *** |
| Designers' conformity | 0.12 (1.23) | 0.10 (1.18) | -0.12 (1.42) |
| Designers' attention to details | | 0.02 (0.29) | 0.03 (0.42) |
| Managers' creativity | | -0.31 (2.95) *** | 0.03 (0.38) |
| Managers' conformity | | 0.18 (1.84) * | -0.26 (2.51) *** |
| Managers' attention to details | | | 0.17 (1.82) * |
| Designers' creativity x Managers' creativity | | | -0.21 (2.03) ** |
| Designers' conformity x Managers' conformity | | | -0.15 (1.70) * |
| Designers' attention to details x Managers' attention to details | | | 0.22 (2.07) ** |

*** p<0.01, ** p<0.05, * p<0.10.

[a] Bold figures indicate variance explained in endogenous variables.

### 3 .4 .2
## INNER MODEL EVALUATION

### 3 .4 .2 .1
### PREDICTIVE POWER

The predictive power of the model was assessed by the values for $R^2$, see Table 3.3. The $R^2$ value for financial performance is 0.20 and that of product advantage is 0.28 (model 3). Prior research has indicated that the research context is essential in determining which $R^2$ values are satisfactory (Hair et al., 2010). In research on the outcomes of cognitive styles, $R^2$ values of 0.20 to 0.30 are common (see e.g., Miron-Spektor et al., 2011). This suggests that the $R^2$ of financial performance and product advantage are satisfactory to good.

Similar to prior research, we used the effect size $f^2$ to evaluate how each variable influences a dependent variable (see e.g., Lew and Sinkovics, 2013). To calculate $f^2$, we used the following formula: $f^2 = (R^2\text{included} - R^2\text{excluded}) / (1 - R^2\text{included})$ (Chin, 2010). An $f^2$ of 0.02 was considered a small effect size, 0.15 a medium effect size, and 0.35 a large effect size of the variable (Cohen, 1988). Using this formula, we found that managers' creativity has a very small effect, their conformity a small to medium-sized effect and their attention to details a non-significant effect on financial performance ($f^2$=0.01, $f^2$=0.12 and $f^2$=0.00, respectively). Moreover, designers' creativity had a small effect ($f^2$=0.07) on product advantage, and the effects of their conformity and attention to details on this dependent variable were small ($f^2$=0.02) and very small, respectively ($f^2$=0.01). The effect of managers' creativity on the relation between designers' creativity and product advantage was small as well ($f^2$=0.04), which was similar to the effect of their conformity on the relation between designers' conformity and product advantage, and their attention to details on the relation between designers' attention to details and product advantage ($f^2$=0.03 and $f^2$=0.06). Finally, we evaluated the effect size of product advantage on financial performance, which could be considered a medium-sized effect ($f^2$=0.16).

Lastly, we used the blindfolding procedure to assess the validity of our measurement and structural models through Stoner-Geisser's $Q^2$ (Chin, 1998; Geisser, 1975; Stone, 1974). Both the value for communality-based and the value for the redundancy-based Stoner-Geisser $Q^2$ were greater than zero, which suggested that our model has predictive relevance (Hair et al., 2011; Hair et al., 2012).



### 3 .4 .2 .2
### HYPOTHESIS TESTING

Before testing our hypotheses, we first evaluated whether our control variables have a significant effect on product advantage and financial performance. We included the two variables (type of offering developed in a project and the number of projects provided by organizations) in our main model (without the interaction effects). The variables did not have a significant effect on product advantage and financial performance, so we excluded them from our further analyses.

Table 3.3 shows the results of our structural equation modelling, based on a bootstrapping procedure with 5000 samples (Berghman et al., 2013). Our results show no significant influence of managers' creativity (Model 1: $\beta$=0.10, $p$>0.05) and attention to details (Model 1: $\beta$=−0.01, $p$>0.05) on financial performance, and thus we do not find support hypotheses H1A and H1C. H1B is supported since managers' conformity enhances financial performance (Model 1: $\beta$=0.34, $p$<0.05). As hypothesized, we find that designers' creativity has a positive influence on product advantage (Model 1: $\beta$=0.22, $p$<0.05), providing support for H2A. H2B was supported as well, showing that designers' conformity diminishes product advantage (Model 1: $\beta$=−0.15, $p$<0.10). We did not find a significant influence of designers' attention to details on product advantage (Model 1: $\beta$=0.12, $p$>0.05), failing to support H2C. To assess the complementary fit between designers and managers, we created interactions between their cognitive styles, which is a common procedure in research on person-environment fit (Kristof-Brown et al., 2005). We found that managers' creativity moderates the relation between designers' creativity and this outcome (Model 3: $\beta$=−0.21, $p$<0.05). We visualized this effect in Figure 3.2, which shows that managers' creativity diminishes the positive effect of designers' creativity on product advantage. These results indicate that designers and managers should indeed complement each other's creativity, allowing us to accept H3A. Managers' conformity moderates the effect of designers' conformity on product advantage (Model 1: $\beta$=−0.15, $p$<0.10). However, we do not find support for H3B since Figure 3.3 shows that the negative influence of designers' conformity is stronger (weaker) when managers' conformity is high (low). We concluded earlier that designers' attention to detail does not influence product advantage, but in subsequent analyses we found that this relation is moderated by managers' attention to detail (Model 1: $\beta$=0.22, $p$<0.05). Figure 3.4 shows that designers' attention to details has a positive influence when managers' attention to details is high, indicating a need for supplementary fit between the professionals. This result suggests that there is no support for H3C. Finally, our results indicate that product advantage enhances financial performance, and thus H4 is supported (Model 3: $\beta$=0.36, $p$<0.05). The findings are summarized in Figure 3.5.

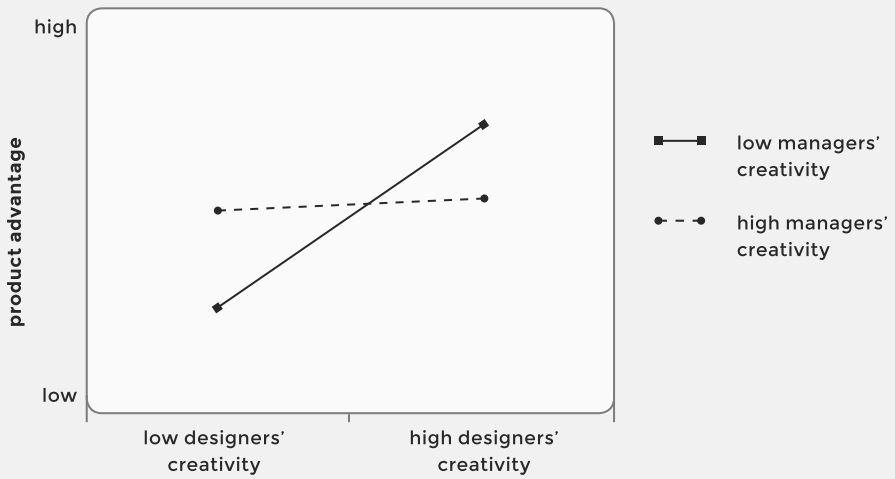



Figure 3 .2
The moderating effect of managers' creativity on the relation between designers' creativity and product advantage.

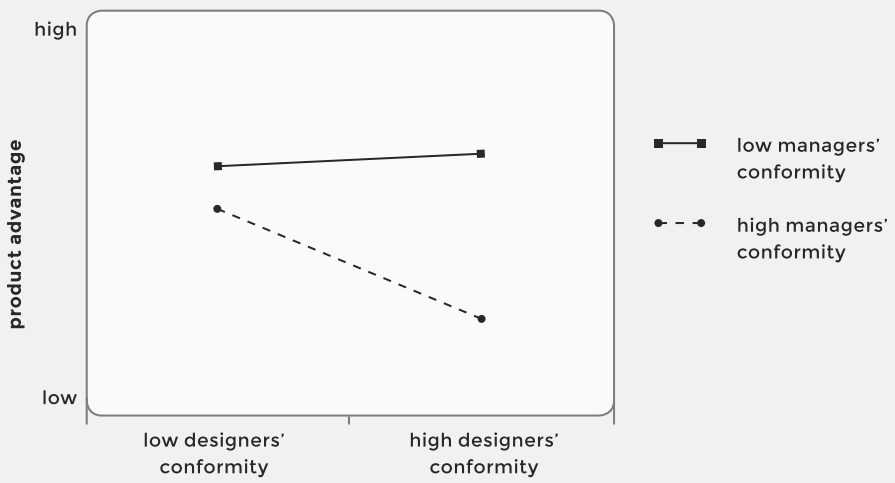



Figure 3 .3
The moderating effect of managers' conformity on the relation between designers' conformity and product advantage.

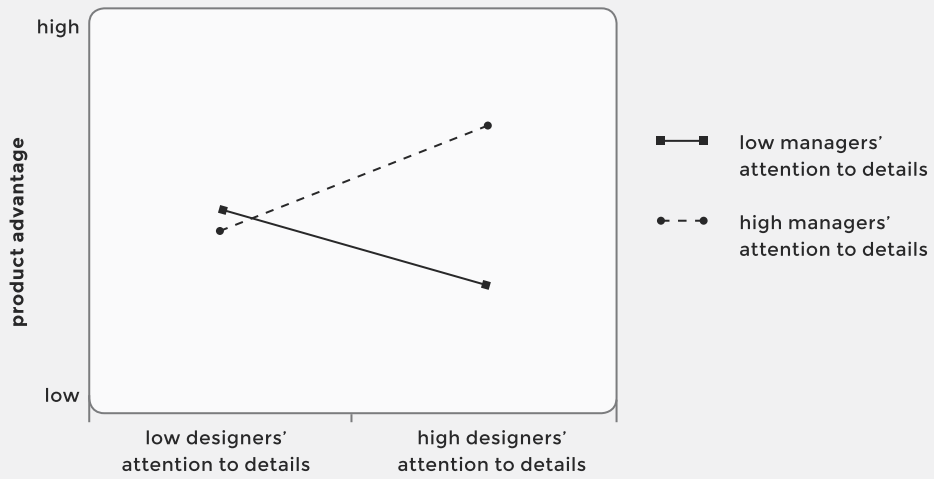



Figure 3 .4
The moderating effect of managers' attention to details on the relation between designers' attention to details and product advantage.

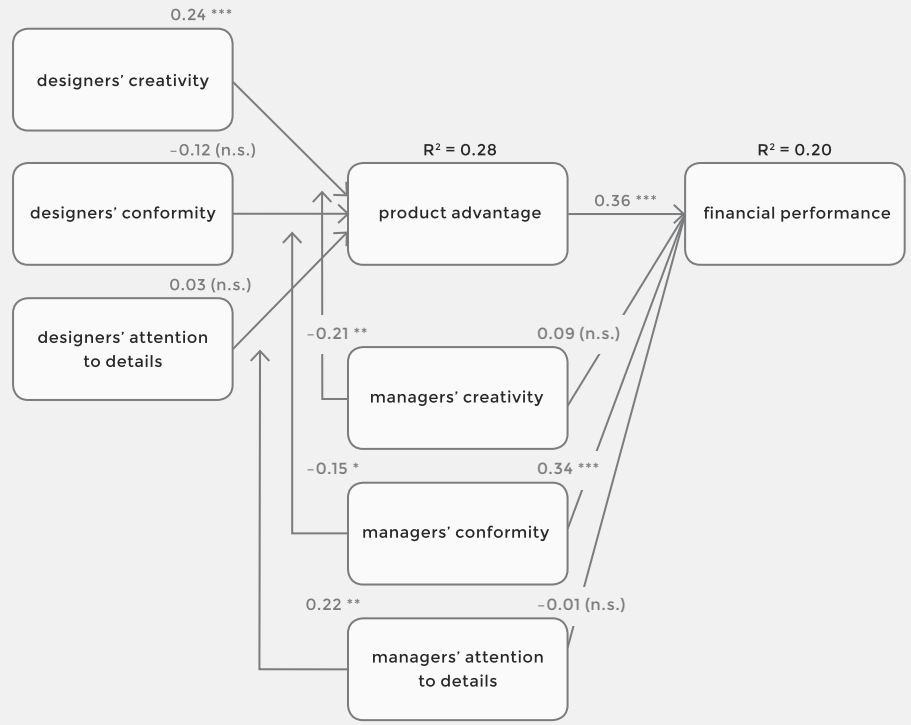



Figure 3 .5
Summary of the findings (model 3) *** p<0.01, ** p<0.05, * p<0.10

## 3 .5
## DISCUSSION AND CONCLUSION

This chapter aims to provide insights into how designers' and managers' cognitive styles (in terms of creativity, conformity and attention to details) influence the financial performance of innovation projects. First, we investigate the influence of managers' creativity, conformity and attention to details on financial performance. Secondly, we suggest that designers impact financial performance through their influence on product advantage, and we study the effect of their creativity, conformity and attention to details on this outcome. Thirdly, we investigate how designers' and managers' cognitive styles complement each other by studying the moderating effect of managers' creativity, conformity and attention to details on the relationship between designers' creativity, conformity and attention to details and product advantage.

As hypothesized, we find that designers' creativity enhances product advantage, and that managers' creativity moderates this relationship in such a way that the effect of designers' creativity is stronger (weaker) when managers' creativity is low (high). We also find that managers' conformity to rules and group norms has a positive influence on financial performance, and that designers' conformity decreases product advantage. Overall, these results provide support for our hypotheses by suggesting that designers and managers complement each other in their creativity and conformity to rules and group norms: that is, the results suggest that designers should be creative (and not conform to rules and group norms), and managers should conform to rules and group norms (and not be creative).

Next to the support for our hypotheses, there are three findings that are different than expected. First, we find that managers' creativity and attention to details do not significantly influence financial performance, while we do find effects for product advantage. This may be explained by the fact that financial performance and product advantage are outcomes of a different nature. For example, it is possible that we did not find an effect of managers' creativity and attention to details on financial performance because this is a long-term measure of performance that is influenced by many more factors such as the launch strategy or the attractiveness of the market (Evanschitzky et al., 2012; Henard and Szymanski, 2001; Storey et al., 2016). Future research may ascertain whether managers' creativity and attention to details do not influence financial performance by controlling for these, and other, factors.

Secondly, we find that managers' conformity negatively moderates the relationship between designers' conformity and product advantage, while we find a positive effect of managers' conformity on financial performance. These different effects of managers' conformity on financial and product performance may be explained by the fact that product advantage requires breaking away from rules and regulations, which is not possible when both designers and managers conform to rules and group norms, while adhering to rules and regulations is important for enhancing financial performance. Future research may further investigate this topic by breaking down the effect of managers' conformity on product advantage in terms of meaningfulness and superiority, of which the latter may require some adherence to rules and regulations (Rijsdijk et al., 2011). Another avenue for future research is to investigate the influence of managers' conformity to rules and group norms in radical and incremental innovation. As the level of uncertainty between radical and incremental innovation differs (Danneels and Kleinschmidt, 2001; Garcia and Calantone, 2002), the effects of conformity to rules and group norms on product advantage may be different in these types of projects.

Thirdly, we find that designers' attention to details does not significantly influence product advantage, but that its effect depends on managers' attention to details. Specifically, we find that designers' attention to details has a positive (negative) influence on product advantage when managers' attention to details is high (low). This finding suggests that designers and managers should supplement each other in their attention to details (while we find that designers and managers should complement each other in their creativity and conformity). This may be explained by the fact that creativity and conformity may be important in those phases of an innovation project in which product advantage is developed (e.g., in the strategy and design phases), while attention to details may be important when it is realized (Perks et al., 2005). Future research may test this proposition by, for example, explicitly investigating the effects of designers' and managers' cognitive styles on the *development* and *realization* of product advantage.

Building on these overall findings, our study offers two important guidelines for designers and managers who aim to achieve high levels of financial performance for their innovation projects. First, our results suggest that designers and managers should complement each other in their creativity and conformity; that is, designers should be creative (and not conform to rules and group norms), while managers should conform to rules and group norms (and they should not be creative). Secondly, we find that designers and managers should supplement each other in their attention to details; that is, both designers and managers should have high attention to details. Managers should keep these findings in mind in order to construct effective dyads in their innovation projects.

## 3 .6
## STRENGTHS, LIMITATIONS AND FUTURE RESEARCH

The design of the current study has several strengths. First, we collected data on innovation projects for which an external design consultancy was hired by an innovating organization. We considered that these projects were appropriate for our research as innovating organizations in general hire external design consultancies to complement them in their skills (see e.g., Abecassis-Moedas and Benghozi, 2012; Bruce and Docherty, 1993; Perks et al., 2005). However, this choice may limit the generalizability of our results. Therefore, future research may want to replicate our findings by studying innovation projects that an innovating organization conducted by using internal designers. Secondly, we collected data from senior designers (at the design consultancy side) and project managers (at the client side) working on these projects, which allowed us to include the viewpoints of two important informants in our study. However, collecting data from two informants from different organizations resulted in a small sample size. Therefore, future research may wish to replicate our findings with a larger dataset. Thirdly, we investigated the effects of designers' and managers' cognitive styles on financial performance. Although we chose financial performance as dependent variables because prior research suggested that designers and managers may complement each other in achieving this particular outcome (Beverland and Farrelly, 2011; Liedtka, 2010; Von Stamm, 2004), there are other variables that deserve the attention of future research as well. For instance, designers and managers may also complement each other in the development of technological epiphanies (Verganti, 2011). Drawing on recent meta-analyses of the predictors of financial performance (Evanschitzky et al., 2012; Henard and Szymanski, 2001; Storey et al., 2016) and on prior research on the outcomes of cognitive styles (Miron-Spektor et al., 2011; Miron et al., 2004), we also included product advantage in our analyses. Future research may focus on including other factors such as the extent to which the product met customer needs or was technologically sophisticated (Evanschitzky et al., 2012; Henard and Szymanski, 2001; Storey et al., 2016). A limitation of our data collection approach is that we used subjective measures of financial performance and product advantage. Although data from two informants allowed us to deal with issues of common method bias, future research may also wish to replicate our findings with objective measures of these outcomes.

# 4
# Exploration and exploitation activities for design innovation

Authors: K. Tabeau, G. Gemser, H.J. Hultink, N.M. Wijnberg
An adapted version of this chapter has been accepted for publication in the Journal of Marketing Management. An earlier version of this chapter was presented at the 39th Product Development and Management Conference.

Prior research suggested that exploration and exploitation activities have different roles in innovation projects. Exploration is important for the development of innovative and differentiated solutions, while exploitation assures their quality and low-cost development. In general, prior studies investigated innovation from the perspective of technical innovativeness (i.e., newness in terms of features, functionality and technology) rather than design innovativeness (i.e., newness in terms of aesthetics, emotions and identity). The present study attempts to fill this gap in the extant literature by studying exploration and exploitation activities for design innovation. We collected data on innovation projects in which external design consultancies were actively involved during the process (n = 83). For each project, we surveyed both the external senior designer and the project manager at the client's side. Our results suggest that exploration enhances design innovativeness, and that design innovativeness results in better market performance. Furthermore, we find that exploitation moderates the relationship between design innovativeness and process performance: when exploitation activities are high (low), design innovativeness results in better (worse) process performance. In addition, we find that when designers have decision freedom, the positive relation between exploration activities and design innovativeness is enhanced. However, our data also suggest that to achieve market success, designers should make decisions together with project managers, since design innovativeness has a negative (positive) influence on market performance when designers have high (low) levels of decision freedom.

## 4 .1
## INTRODUCTION

The idea that companies need to engage in both exploration and exploitation activities to gain a sustainable competitive advantage is generally accepted in the literature (see e.g., Cao et al., 2009; Gupta et al., 2006; He and Wong, 2004). In this well-developed research stream, the focus tends to be on the antecedents and consequences of exploration and exploitation activities at the organizational level (for reviews, see e.g., O'Reilly and Tushman, 2013; Raisch and Birkinshaw, 2008; Raisch et al., 2009). However, exploration and exploitation activities should be managed at multiple levels in the organization: at the organizational, project, team and individual levels (Andriopoulos and Lewis, 2010). A recent stream of research focuses on exploration and exploitation at the project level – in particular in the context of innovation (Ahn et al., 2006; Atuahene-Gima and Murray, 2007; Huang and Li, 2012; Kim and Atuahene-Gima, 2010; Kyriakopoulos and Moorman, 2004; Li, 2013; Li et al., 2010; Molina-Castillo et al., 2011; O'Cass et al., 2014; Tsai and Huang, 2008). In these studies innovation is generally conceptualized in terms of new functionality, features and technology; i.e., 'technical' or utilitarian innovation. Innovation can, however, also relate to newness in terms of products' appearance, the emotions products evoke, and the way they enable customers to express their identity (Gemser et al., 2011). This type of innovativeness, here referred to as design innovation, can have a significant contribution to company and product performance (Gemser and Leenders, 2001; Korenok et al., 2010; Landwehr et al., 2013; Rubera and Droge, 2013; Talke et al., 2009; Verganti, 2008a). Considering the different nature of design innovation as compared to technical innovation, and the growing number of companies investing in design (Cameron et al., 2015; Gemser and Leenders, 2001; Trueman and Jobber, 1998), there is a need for research that examines the effects of exploration and exploitation activities in design innovation projects.

Exploration activities relate to acquiring new knowledge and capabilities; that is, activities that involve searching for new possibilities with respect to products, processes or markets (Mom et al., 2007). Exploitation activities are activities using a firm's present, well-developed knowledge and capabilities; that is, activities that fit with existing company practices (Mom et al., 2007). Although prior research suggested that exploration and exploitation activities have different roles in innovation (Kim and Atuahene-Gima, 2010; Molina-Castillo et al., 2011; O'Cass et al., 2014), there are few empirical studies that examined how exploration and exploitation activities have differential effects on innovation outcomes.

This chapter will also examine designers' decision freedom in design innovation. Prior research suggests that designer decision freedom is an important aspect to manage within innovation projects as it may affect the level of innovativeness of outcomes (Gemser et al. 2011; Micheli et al. 2012; Ravasi and Locajono, 2005) and market success (Micheli et al. 2012; Turner, 2000). However, this prior research is predominantly based on case study results rather than more large-scale survey data (the only exceptions is Gemser et al. 2011) and has not examined how designer decision freedom may affect important process outcomes such as development speed and budget.

We contribute to the existing literature in the following ways. First, we investigate exploration and exploitation activities for design innovation rather than technical innovation, which has been the focus of prior studies. Second, we show the differential effects of exploration and exploitation activities for design innovation and its outcomes. Third, we show the influence of an important factor affecting design innovation and its outcomes: designers' decision freedom. On the basis of our results, better managerial decisions can be made regarding investments in design innovation. From a theoretical perspective, our study contributes to the emerging stream of research examining exploration and exploitation at the project rather than at the company level.

To investigate these topics, we conducted a study of 83 design innovation projects that were launched on the market between 2009 and 2013. We collected data on projects for which companies hired external design consultancies to develop a new product or service. We surveyed two respondents per project: the senior external designer at the design consultancy side and the project manager at the client's side. We thus include the viewpoints from two essential informants (Bruggen et al., 2002), which reduces common method bias (Podsakoff et al., 2003).

The remainder of this chapter is structured as follows. First, we review the relevant literature and present our hypotheses, after which we explain our method. Next, we discuss our findings. We conclude this chapter by discussing multiple implications for theory and managerial practice, and provide directions for future research.

## 4 .2
## THEORETICAL FRAMEWORK

### 4 .2 .1
### EXPLORATION AND EXPLOITATION ACTIVITIES IN INNOVATION

Exploration and exploitation can be conceptualized as two activities within organizational learning (March, 1991). Exploration activities relate to activities

that search for new knowledge (Levinthal and March, 1993) and include activities that can be captured by terms such as 'search, variation, risk taking, experimentation, play, flexibility, discovery' (March, 1991, p.71). The returns from exploration activities are distant in time, uncertain and weakly connected to the current actions of the organization (March, 1991). Exploitation activities, on the other hand, are related to the organization's efforts to improve the knowledge it already has (Levinthal and March, 1993) and can be described by activities such as 'refinement, choice, production, efficiency, selection, implementation and execution' (March, 1991, p.71). These activities improve present returns, which are relatively certain and closely related to the organization's current actions (March, 1991). Prior research suggested that exploration activities are the basis for exploitation activities: once new knowledge is generated, it can be exploited (Levinthal and March, 1993; March, 1991). This also implies that exploitation cannot take place without prior exploration.

Li et al. (2008) suggested that exploration and exploitation activities may need to reflect the nature of the innovation process rather than the nature of the outcome (i.e., more or less innovative) to appropriately reflect the complexity of organizational learning. We follow these authors' suggestion and define exploration and exploitation from an innovation *process* perspective. An innovation process may include both exploration and exploitation activities (Li et al., 2008). Prior research suggested that exploration and exploitation activities have different roles in innovation processes, and influence different innovation outcomes. Exploration seems to be more important for achieving differentiated and innovative outcomes, while exploitation is more likely to contribute to cost efficiency and profit gains, efficiency in producing the product, and to its quality (Kim and Atuahene-Gima, 2010; Molina-Castillo et al., 2011; O'Cass et al., 2014). For instance, Kim and Atuahene-Gima (2010) found that explorative market learning (that is, the acquisition and use of knowledge outside an organizations' current customer and competitor boundaries) has a positive influence on product differentiation, while it does not influence product cost efficiency. In contrast, exploitative market learning (i.e., the acquisition and use of knowledge close to organizations' current customer and competitor boundaries) enhances product cost efficiency, but does not impact product differentiation. O'Cass et al. (2014) showed that exploratory product innovation (i.e., the generation of new routines to develop new products) combined with high levels of exploratory marketing (i.e., the generation of new routines to link new products to customers) result in higher levels of product differentiation. Exploitative product innovation (i.e., the refinement of existing routines to develop new products) combined with exploitative marketing (i.e., the refinement of existing routines to link new products to customers) results in higher levels of product cost efficiency (O'Cass et al., 2014). Molina-Castillo et al. (2011) found that competence exploration (i.e., activities to acquire new skills and technologies) enhances product innovativeness while competence exploitation (i.e., activities to upgrade existing skills and technologies) enhances product quality.



Studies on exploration and exploitation and innovation outcomes generally conceptualized innovation in terms of new functionality or technology (i.e., technical innovation). There are no studies known to us that examine exploitation and exploration in the context of design innovation. Design innovation is, however, becoming increasingly important for achieving company and product performance. In particular, when the degree of design innovativeness is high, performance can be positively influenced (Gemser and Leenders, 2001; Korenok et al., 2010; Landwehr et al., 2013; Rubera and Droge, 2013; Talke et al., 2009). A high degree of design innovativeness implies that the design is substantially different from competing products on the market (Gemser and Leenders, 2001; Landwehr et al., 2013; Rubera and Droge, 2013; Talke et al., 2009). Prior research has predominantly operationalized design innovativeness in terms of newness of aesthetics (Korenok et al., 2010; Landwehr et al., 2013; Person et al., 2008; Rubera and Droge, 2013; Talke et al., 2009). We, however, follow the approach of Gemser et al. (2011), who defined design innovation not only in terms of newness of the products' appearance, but also in terms of the emotions that products evoke, and the way they enable customers to express their identity. As acknowledged in the innovation literature, these dimensions can have a significant impact on market success, particularly if they score high on innovativeness (Verganti, 2008b).

In this paper, we hypothesize that exploration activities influence design innovativeness, and that design innovativeness will have an impact on project performance. We also hypothesize that the relationship between design innovativeness and project performance will be moderated by exploitation activities, as these activities ensure that the new design knowledge generated by the exploration activities is effectively and efficiently implemented. Furthermore, we postulate that the decision freedom of designers will influence the relationship between exploration and design innovativeness. In addition, we postulate that designers' decision freedom will moderate the relationship between design innovativeness and project performance, because giving designers freedom to make decisions on their own will have performance implications. Figure 4.1 provides an overview of our hypotheses. Below, we explain in more depth how exploration and exploitation activities and designer decision freedom play a role in achieving design innovativeness and other outcomes.

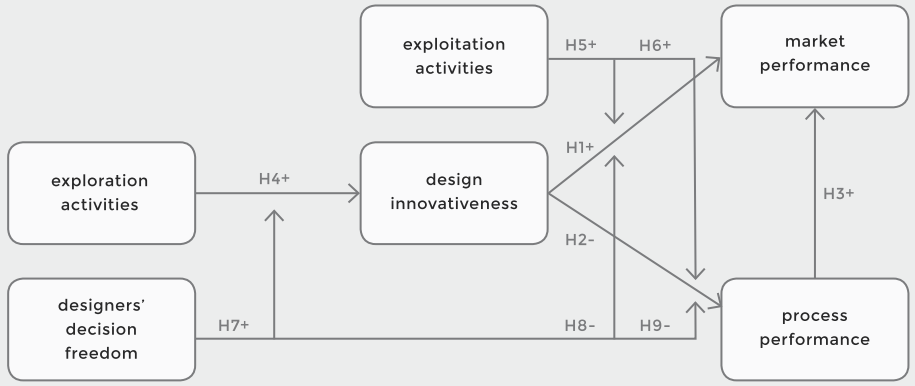



Figure 4 .1
Research Model

### 4 .2 .2 DESIGN INNOVATIVENESS AND PROJECT PERFORMANCE

Prior research suggested that design innovativeness results in higher sales or turnover, or in a growth in market share (Gemser and Leenders, 2001; Korenok et al., 2010; Landwehr et al., 2013; Rubera and Droge, 2013; Talke et al., 2009). Talke et al. (2009), for example, found that design newness, operationalized as the dissimilarity in products' appearance compared with competing products, has a positive influence on automotive sales. The findings of Rubera and Droge (2013) suggested that design innovations (i.e., products with design that is new, original and patented), when branded using corporate branding, enhance product sales. The results of Landwehr et al. (2013) showed that atypical cars (i.e., cars that are dissimilar to a prototypical design in a certain product category) outsell typical cars (those similar to a prototypical design in a certain product category) when consumers had high levels of exposure to these products. Moreover, Gemser and Leenders (2001) showed that organizations that pursue a design innovation strategy (i.e., a strategy focused at introducing designs that are different from competing products in terms of aesthetics and usability) experience a growth in turnover. Korenok et al. (2010) found that changes to vehicle styling, both partial (i.e., changes to the grill, tail lamp or partial changes to the vehicle's sheet metal) and complete (i.e., changes to vehicles' entire sheet metal and glasshouses; changes to styling due to a new entrant), have a positive influence on market share growth. Overall, these results suggest that design innovativeness enhances market performance.

The positive impact of an innovative design on market performance may be explained by greater product differentiation. Innovative designs will catch customers' attention, may generate positive emotions, and 'seduce' customers to choose the product over competitors on the market (Creusen and Schoormans, 2005; Simoni et al., 2014). Furthermore, innovative, distinctive designs enable customers to express their identity and to identify themselves with a specific social group (Creusen and Schoormans, 2005; Simoni et al., 2014). Higher market performance from introducing innovative designs may, however, be counteracted by the higher costs of developing and marketing these radical solutions (Verganti, 2008a). Highly innovative designs break with existing standards and may require 'preparing of the ground' so that customers will accept the innovation (Verganti, 2008a). As suggested by Verganti (2008a), the development of truly innovative designs may require a networked innovation process, involving different types of experts, which is costly and time consuming. For developing innovative designs, companies often integrate designers in the innovation process (Czarnitzki and Thorwarth, 2012). However, as shown by Marion and Meyer (2011), intense use of designers and their methods may result in longer development times. Based on case studies in the fashion industry, Abecassis-Moedas and Benghozi (2012) suggested that design innovativeness comes at the cost of efficiency (in terms of development speed and costs). Using a similar approach in the consumer goods industry, Perks et al. (2005) showed that although involving designers as part of the innovation team is important for radical innovation, it is also time consuming, and the only way to achieve both is to let designers lead the development process. These results suggest that design innovativeness decreases process performance.

Despite this, it is important to keep the cost and time necessary to develop design innovations low, since this stimulates sales (Cankurtaran et al., 2013; Eling et al., 2013; Langerak et al., 2010; Langerak et al., 2008). For example, lower development costs may result in lower product pricing, and lower product prices result in higher sales (Eling et al., 2013). Product sales may also be enhanced by new product development speed (Cankurtaran et al., 2013) and by proficiency in market-entry timing (Langerak et al., 2010; Langerak et al., 2008). Overall, these results suggest that process performance enhances market performance.

**H1** Design innovativeness has a positive influence on market performance
**H2** Design innovativeness has a negative influence on process performance.
**H3** Process performance has a positive influence on market performance.

### 4 .2 .3 THE ROLE OF EXPLORATION AND EXPLOITATION ACTIVITIES IN ACHIEVING DESIGN INNOVATIVENESS AND PROJECT PERFORMANCE

Exploration activities are characterized by search, experimentation and investigation, and can result in new knowledge. This new knowledge, generated through exploration activities, is essential to develop radically new solutions (Atuahene-Gima, 2005). Indeed, prior research showed that exploration activities stimulate the development of product characteristics such as differentiation (Kim and Atuahene-Gima, 2010; O'Cass et al., 2014) and innovativeness (Molina-Castillo et al., 2011). We follow these studies, which showed that exploration activities stimulate innovativeness in terms of technology, by proposing that their completion also enhances outcomes in terms of design innovativeness. We therefore hypothesize:

H4 Exploration activities have a positive influence on design innovativeness.

Exploration activities are important for design innovativeness, but how successful such solutions are on the market, and the speed and cost efficiency of their development depends on the extent to which exploitation activities are completed in the project. Exploitation activities help organizations produce and market an innovative solution by using their current competencies (Danneels, 2002). For example, Li (2013) showed that exploitation activities enhance the positive influence of product innovativeness on product superiority (i.e., the extent to which a product's features and functionalities are better than competing product's features and functionalities) and product meaningfullness (i.e., the exent to which a product's features and functionalities are perceived as relevant, beneficial and useful by customers). Higher levels of product superiority and meaningfullness make it easier to market an innovative solution. Prior research also suggested that exploitation activities enhance product cost efficiency (Kim and Atuahene-Gima, 2010; O'Cass et al., 2014) and the extent to which products meet manufacturing and performance standards (Molina-Castillo et al., 2011). Products that are developed in a cost-efficient way and that meet manufacturing and performance standards are easier and more affordable to manufacture. Overall, these results suggest that exploitation activities help organizations to produce and market an innovative solution by using their current competencies, resulting in higher levels of performance, both in terms of market and process performance.



We therefore propose:

H5 Exploitation activities moderate the relationship between design innovativeness and market performance: the influence of design innovativeness on market performance is more positive when exploitation activities are high rather than low.

H6 Exploitation activities moderate the relationship between design innovativeness and process performance: the influence of design innovativeness on process performance is less negative when exploitation activities are high rather than low.

### 4 .2 .4 THE ROLE OF DESIGNERS' DECISION FREEDOM IN ACHIEVING DESIGN INNOVATIVENESS AND PROJECT PERFORMANCE

Prior research suggested that involving professional designers in the development process for a new product or service may be an effective way to create design innovations (Candi et al., 2011; Cillo and Verona, 2008; Dell'Era and Verganti, 2010). For instance, Candi et al. (2011) suggested that more designer involvement results in higher levels of design innovativeness. This research and other studies also suggested that to create design innovations, designers should be given freedom to act (Beverland, 2010; Candi et al., 2011; Ravasi and Lojacono, 2005; Verganti, 2008b). Designers' freedom to act results from their authority to make decisions on their own, without interference from managers. This is also called designers' decision freedom (cf. Dewar et al., 1980). When designers have decision freedom, they can directly influence the nature and outcome of an innovation process. Designers tend to be explorative in nature, future driven, and open to the 'unknown' (Beverland and Farrelly, 2011). Designers are not only adept at exploration, they also tend to excel at condensing large amounts of information generated by exploration activities into, for example, experiential prototypes (Michlewski, 2008). In summary, we expect that designers are well equipped to generate and make sense of new knowledge developed through exploration activities, and to integrate this knowledge into design innovations. We therefore propose:

H7 Designers' decision freedom moderates the relationship between exploration and design innovativeness: the influence of exploration on design innovativeness is more positive when designers' decision freedom is high rather than low.

Designers' practices and capabilities are geared towards developing new products and services rather than selling these new products and services to the market, which is the field of marketing (Beverland and Farrelly, 2011). If new products and services are radically new in terms of design, the ground may need to be prepared before customers are willing to embrace these new 'meanings' (Verganti, 2008a). This preparing of the ground requires specific activities that may be better performed by marketing specialists rather than design specialists. This suggests that while designer decision freedom is beneficial for design innovativeness, high designer decision freedom may not lead to higher market performance because input from other (marketing) specialists is also needed. In a similar vein, when designers are free to make decisions about innovative designs, they may make decisions based on their wish to create 'iconic' or award-winning designs without being willing to make compromises (Micheli et al., 2012), which may result in increasing costs and development times. We therefore propose:

**H8** Designers' decision freedom moderates the relationship between design innovativeness and market performance: the influence of design innovativeness on market performance is less positive when designers' decision freedom is high rather than low.

**H9** Designers' decision freedom moderates the relationship between design innovativeness and process performance: the influence of design innovativeness on process performance is more negative when designer freedom is high rather than low.

## 4 .3 METHODOLOGY

### 4 .3 .1 DATA COLLECTION

We collected data on projects that involved the collaboration between external design consultancies and their clients. These projects are particularly suitable for our research since design consultancies are often hired for design innovations (Verganti, 2003). The data for this study were collected between November 2012 and January 2014.

Based on data provided by several Dutch design associations, we created a list of 227 Dutch design consultancies, in a wide range of firm sizes and design fields. These design consultancies were contacted by phone to ask for collaboration in the research project. In total, 43 (19%) design consultancies agreed to collaborate, which is similar to prior studies (see e.g., Molina-Castillo et al., 2011). Design consultancies were sometimes hesitant to collaborate since we not only asked a senior staff member of the design consultancy to participate in our research, but also a staff member of one of their clients. After companies agreed to collaborate, we selected relevant innovation projects to study based on three criteria. First, the innovation project had to be completed; second, the project needed to be completed less than three years ago; and third, both the responsible senior designer at the design consultancy and project manager at the client's side (i.e., the developing organization) had to be available for participation in the study. For each design consultancy firm, two to three projects on average were selected, resulting in a database of 113 projects.

Considering their role in the innovation process, the external senior designer and the project manager were considered to be the most appropriate innovation team members to survey, being knowledgeable about the constructs under study, namely the activities (explorative and exploitative) completed in the project, its content (level of design innovativeness), execution (level of designers' decision freedom) and performance (market and process). Surveying both the external senior designer and the project manager at the client's side allowed us to deal with common method bias, and to include the viewpoints of both essential actors in our research.

The respondents received a link to an online survey by email. One week after sending the link, the informants received a reminder, and after two weeks they were called to answer any questions about the research, after which the link to the survey was sent again. Only projects for which both respondents filled in the survey were included in our study, resulting in a dataset of 213 responses, which equals 103 matched dyads (for seven projects, we only received answers from one respondent). For 20 projects, the performance data was missing and these projects were therefore excluded from further analysis. Hence, the sample size is 83 projects.

### 4 .3 .2 MEASURES

#### 4 .3 .2 .1 DEPENDENT VARIABLES: PROJECT PERFORMANCE AND DESIGN INNOVATIVENESS

We defined and operationalized market and process performance as the extent to which the innovation met market and process goals. We defined and operationalized design innovativeness as the extent to which the solution diverged from what was already known on the market in terms of appearance, emotions, and the way products enabled customers to express their identity. Table 4.1 shows the scales and items included in the survey, and the sources of these scales. All items were measured on a seven-point Likert scale.

## TABLE 4 .1
## MEASURES AND SOURCES

| CONSTRUCT | MEASUREMENT |
|---|---|
| Market performance<br>(adapted from Griffin and Page, 1993) | For each of the following questions, please indicate on a scale from 1 to 7 (1=completely disagree, 4=neither agree nor disagree to 7=completely agree) the response that most closely describes the performance of the product.<br>- The product attained its unit sales goals.<br>- The product achieved a high level of customer satisfaction.<br>- The product achieved a high level of customer acceptance. |
| Process performance<br>(adapted from Griffin and Page, 1993) | For each of the following questions, please indicate on a scale from 1 to 7 (1=completely disagree, 4=neither agree nor disagree to 7=completely agree) the response that most closely describes the performance of the product.<br>- The development costs of the product stayed within the budget.<br>- The product was launched on time.<br>- The product had a short 'time-to-market'. |
| Design innovativeness<br>(adapted from Gemser et al., 2011) | For each of the following questions, please indicate on a scale from 1 to 7 (1=completely disagree, 4=neither agree nor disagree to 7=completely agree) the response that most closely describes how new the product was to the industry.<br>- The appearance of the product represented something new or different in the industry of my firm.<br>- The product evoked new or different emotions from customers, emotions that had never before been evoked by products in the industry of my firm.<br>- The product provided customers with a new or different way to express their identity, a way that had never before been provided by products in the industry of my firm. |
| Exploration activities<br>(adapted from Mom et al., 2007) | For each of the following questions, please indicate on a scale from 1 to 7 (1=to a small extent, 4=neither to a small nor to a large extent to 7=to a large extent) the response that most closely describes the extent to which the following work-related activities were completed in the project.<br>- Activities in which the products or processes of my firm were strongly renewed.<br>- Activities that required a degree of adaptability from my firm.<br>- Activities that included the acquiring of new knowledge or skills for my firm.<br>- Activities that were not clearly existing company practice for my firm.<br>- Activities that involved searching for new possibilities with respect to the products, processes or markets of my firm. |
| Exploitation activities<br>(adapted from Mom et al., 2007) | For each of the following questions, please indicate on a scale from 1 to 7 (1=to a small extent, 4=neither to a small nor to a large extent to 7=to a large extent) the response that most closely describes the extent to which the following work-related activities were completed in the project.<br>- Activities that could be carried out as routine by my firm.<br>- Activities in which my firm has accumulated a great deal of experience.<br>- Activities that my firm clearly knew how to conduct.<br>- Activities that could be properly conducted by using the present knowledge of my firm.<br>- Activities that clearly fitted into the existing company policy of my firm. |
| Designers' decision freedom<br>(adapted from Dewar et al., 1980) | For each of the following questions, please indicate on a scale from 1 to 7 (1=completely disagree, 4=neither agree nor disagree to 7=completely agree) the response that most closely describes the collaboration between the design consultant / project manager and you.<br>- I needed to get permission from the project manager every time I wanted to do anything. [a]<br>- The project manager strongly discouraged me from making my own decisions. [a]<br>- Even small matters had to be referred to the project manager for a final answer. [a]<br>- Any decision I made needed to be approved by the project manager. [a] |

[a] We reversed this item to reflect designer freedom.

#### 4 .3 .2 .2 INDEPENDENT VARIABLES: EXPLORATION ACTIVITIES, EXPLOITATION ACTIVITIES, AND DESIGNERS' DECISION FREEDOM

The exploration activities scale measures the extent to which activities related to searching for, discovering, creating, and experimenting with new opportunities were completed in the project, while the exploitation activities scale measures the extent to which activities related to selecting, implementing, improving and refining existing certainties were completed in the project.
The designers' decision freedom scale determines the extent to which designers had the authority to make decisions without the involvement of the project manager. Table 4.1 shows the scales and items included in the survey, and the sources of these scales. All items were measured on a seven-point Likert scale.

#### 4 .3 .2 .3 CONTROL VARIABLES

We controlled for the type of offering that was developed in the projects as the relationships in our model may differ between product (n=50) and service innovation (n=33). The process of service innovation has, for example, been characterized as more ad hoc as compared to product innovation (Dolfsma, 2004; Kelley & Story, 2000), which may influence outcomes. Moreover, we controlled for the number of projects organizations provided, which ranged between 1 and 5 (with a median of 2). We divided the organizations into two groups: those providing 1 or 2 projects (n=51 projects) and those providing 3 to 5 projects (n=32 projects).

### 4 .3 .3 ANALYSIS

#### 4 .3 .3 .1 STRUCTURAL EQUATION MODELLING THROUGH SMARTPLS

We analyzed our data through PLS structural equation modelling (PLS-SEM) (Lohmoller, 1989; Wold, 1975) using SmartPLS software version 2.0 (Ringle et al., 2005). This method is useful when the goal is prediction of the dependent variables to develop or extend theory (Hair et al., 2011; Hair et al., 2012). Since we aim to extend current theory on exploration and exploitation at the project level by investigating how these activities play a role in design innovation, PLS-SEM is the appropriate method to use. Furthermore, PLS-SEM is particularly useful for research that involves small sample sizes (Hair et al., 2011; Hair et al., 2012), indicating that this method is the appropriate choice for our sample of 83 projects. PLS-SEM requires a minimum of 10 times the largest number of structural paths directed at a particular latent construct in the structural model (Barclay et al., 1995). In our model, there is a maximum of 6 structural paths directed at our latent constructs, indicating that the minimum sample requirements of PLS-SEM are met.

#### 4 .3 .3 .2 DEALING WITH MULTI- RESPONDENT DATA

We collected data from two respondents to address issues related to common method bias. In this study, we used one approach to investigate whether common method bias is a problem, and two methods to reduce it. We first analyzed whether common method bias is a problem by using Harman's single-factor test (Podsakoff and Organ, 1986), which showed that this is not the case since only 16.7% of the variance was explained by the first factor. Secondly, we took potential common method bias into account in the construction of our survey: our moderating, independent and dependent variables were separated by questions not belonging to this study (Podsakoff et al., 2003). Lastly, we used strategies proposed by prior research to reduce common method bias by using different informants for dependent and independent variables and by aggregating their answers (Bruggen et al., 2002; Podsakoff et al., 2003). We used the data from the project managers to assess the market and process performance measures as we expected that these actors would have a more complete overview of the success of the project. Since both designers and managers were active participants in the projects, we calculated the average of their answers to reflect the extent to which exploration and exploitation activities were completed, the level of design innovativeness, and the level of designers' decision freedom.

## 4 .4 RESULTS

### 4 .4 .1 OUTER MODEL EVALUATION

We examined indicator reliability by studying the outer loadings of all items in the model, which varied between 0.62 and 0.93 (Hulland, 1999). The composite reliability (CR) estimates ranged from 0.81 to 0.93, which are all greater than the threshold level of 0.70 (Bagozzi and Yi, 1988). Discriminant validity was evaluated by studying the square root of the average variance extracted (AVE) estimates. As shown in Table 4.2, values of the square root of AVE for each construct were

greater than the highest correlation between that construct and any other construct (Fornell and Larcker, 1981). Additionally, the loadings of each indicator were greater than the cross- loadings with other reflective indicators, giving further indication of discriminant validity (Chin, 1998). Convergent validity was evaluated by using the values for AVE, of which all values were higher than 0.50 (Bagozzi and Yi, 1988). Appendix 4.1 presents the reliability and validity of the measures.

## 4 .4 .2 INNER MODEL EVALUATION

### 4 .4 .2 .1 PREDICTIVE POWER

The predictive power of the model was assessed by the values for $R^2$ (see Table 4.3). The $R^2$ value for market performance is 0.28, the value for process performance is 0.16, and the $R^2$ for design innovation is 0.41. Prior research indicated that the research context is essential in determining which $R^2$ values are satisfactory (Hair et al., 2010). In research on performance in design innovation, $R^2$ values between 0.15 and 0.30 are common (Gemser and Leenders, 2001; Korenok et al., 2010; Landwehr et al., 2013; Rubera and Droge, 2013; Talke et al., 2009). This suggests that in our study, the $R^2$ values of market performance and design innovativeness are good, and that the $R^2$ value of process performance can be considered satisfactory.

Similar to Lew and Sinkovics (2013), we used the effect size $f^2$ to evaluate how each variable influences a dependent variable (Chin, 2010). The effect size of each variable $f^2$ was computed by using the following formula: $f^2 = (R^2\text{included} - R^2\text{excluded}) / (1 - R^2\text{included})$ (Chin, 2010). An $f^2$ of 0.02 was considered a small effect size, 0.15 a medium effect size, and 0.35 a large effect size of the variable (Cohen, 1988). Using this formula, we found that design innovativeness has a small effect on market and process performance ($f^2$=0.06 and $f^2$=0.02, respectively), and that the effect of process performance on market performance is medium sized ($f^2$=0.16). The effect of exploration activities on design innovativeness is large ($f^2$=0.39), while the effect of exploitation activities on the relation between design innovativeness and market performance is non-significant ($f^2$=0.00) and its effect on the relation between design innovativeness on process performance is small ($f^2$=0.08). Finally, the effect of designer decision freedom on the relation between exploration activities and design innovativeness is medium sized ($f^2$=0.15), and its effect on the relation between design innovativeness and market and process performance is small ($f^2$=0.13 and $f^2$=0.09, respectively).



Lastly, we assessed the validity of the measurement and structural model using Stoner-Geissers $Q^2$ through blindfolding (Chin, 1998; Geisser, 1975; Stone, 1974). The values for communality based and redundancy based Stoner-Geissers $Q^2$ were greater than zero, suggesting that our model has predictive relevance (Hair et al., 2011; Hair et al., 2012).

### 4 .4 .2 .2 HYPOTHESIS TESTING

Table 4.3 shows the structural equation modelling results, based on a bootstrapping procedure with 5000 samples (see e.g., Berghman et al., 2013). In support of H1, our data show that design innovativeness increases market performance (Model 1: $\beta$=0.23, $p<0.05$). The effect of design innovativeness on process performance is negative but non-signficant (Model 1: $\beta$=–0.12, $p>0.10$), which does not provide support for H2. H3 is supported: process performance has a positive influence on market performance (Model 1: $\beta$=0.37, $p<0.01$). In support of H4, our results further show that exploration activities enhance design innovativeness (Model 1: $\beta$=0.53, $p<0.01$). Exploitation activities do not moderate the relation between design innovativeness and market performance (Model 3: $\beta$=0.05, $p>0.10$), which does not provide support for H5. However, the extent to which exploitation activities are completed in the project does moderate the relation between design innovativeness and process performance (Model 3: $\beta$=0.27, $p<0.01$). Figure 4.2 shows that design innovativeness has a negative infuence on process performance when exploitation activities are low, and a positive influence when exploitation activities are high, which provides support for H6. Table 4.3 further shows that the relation between exploration activities and design innovativeness is moderated by designers' decision freedom (Model 3: $\beta$=0.31, $p<0$ .01). Figure 4.3 visualizes this effect, showing that exploration activities have a more positive effect on design innovativeness when designers' decision freedom is high rather than low, which provides support for H7. Finally, our results indicate that designers' decision freedom moderates the relations between design innovativenesss and market performance (Model 3: $\beta$=–0.32, $p<0.01$), and between design innovativeness and process performance (Model 3: $\beta$=0.27, $p<0.01$). We find support for H8 since our data show that design innovativenss has a negative influence on market performance when designers have high levels of decision freedom, and a positive influence when they have low levels of decision freedom (see Figure 4.4). H9 is not supported since Figure 4.5 shows that process performance is positively (negatively) affected by design innovativenss when designers have high (low) levels of decision freedom rather than the other way around as predicted. The findings are summarized in Figure 4.6.

## TABLE 4 .2
## DESCRIPTIVE STATISTICS AND CORRELATIONS (2 TAILED)

| VARIABLE | MEAN | S.D. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|
| 1 Market performance | 5.33 | 1.01 | ***0.86*** | | | | | |
| 2 Process performance | 4.27 | 1.44 | 0.33 *** | ***0.77*** | | | | |
| 3 Design innovativeness | 4.72 | 1.26 | 0.18 | −0.13 | ***0.87*** | | | |
| 4 Exploration activities | 5.03 | 1.02 | 0.01 | −0.02 | 0.52 *** | **0.80** | | |
| 5 Exploitation activities | 4.19 | 1.10 | 0.07 | 0.04 | −0.19 * | −0.31 *** | ***0.85*** | |
| 6 Designers' decision freedom | 5.22 | 0.88 | −0.02 | 0.15 | −0.07 | 0.23 ** | −0.10 | ***0.76*** |

*** p<0.01, ** p<0.05, * p<0.10; scores marked in bold italics are the square root of the construct's AVE.



## TABLE 4 .3
## RESULTS FROM THE STRUCTURAL EQUATION ANALYSIS

| | MODEL 1: MAIN EFFECTS | MODEL 2: MODERATORS | MODEL 3: INTERACTIONS |
|---|---|---|---|
| **Dependent: market performance** | **0.17** [a] | **0.18** | **0.28** |
| Process performance | 0.37 (3.66) *** | 0.36 (3.18) *** | 0.37 (3.43) *** |
| Design innovativeness | 0.23 (2.25) ** | 0.26 (2.43) *** | 0.25 (2.57) *** |
| Exploitation activities | | 0.12 (1.15) | 0.13 (1.39) |
| Designers' decision freedom | | -0.02 (0.25) | -0.09 (0.99) |
| Design innovation x exploitation activities | | | 0.05 (0.50) |
| Design innovation x designers' dec. freedom | | | -0.32 (3.43) *** |
| **Dependent: process performance** | **0.02** | **0.04** | **0.16** |
| Design innovativeness | -0.12 (1.32) | -0.10 (1.17) | -0.11 (1.42) |
| Exploitation activities | | 0.05 (0.55) | -0.01 (0.07) |
| Designers' decision freedom | | 0.16 (1.55) | 0.11 (1.20) |
| Design innovation x exploitation activities | | | 0.27 (2.40) *** |
| Design innovation x designers' dec. freedom | | | 0.27 (2.67) *** |
| **Dependent: design innovativeness** | **0.28** | **0.32** | **0.41** |
| Exploration activities | 0.53 (6.36) *** | 0.57 (6.98) *** | 0.49 (5.98) *** |
| Designers' decision freedom | | -0.21 (2.05) ** | -0.15 (1.75) * |
| Exploration activities x designers' dec. freedom | | | 0.31 (4.35) *** |

*** p<0.01, ** p<0.05, * p<0.10.

[a] Bold figures indicate variance explained in endogenous variables.

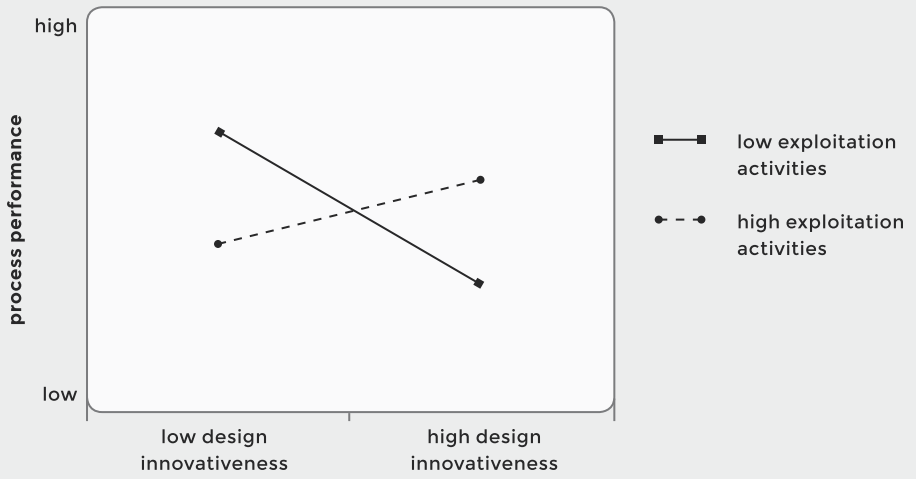



Figure 4 .2
Moderating effect of exploitation activities on the relation between design innovativeness and process performance (H6).

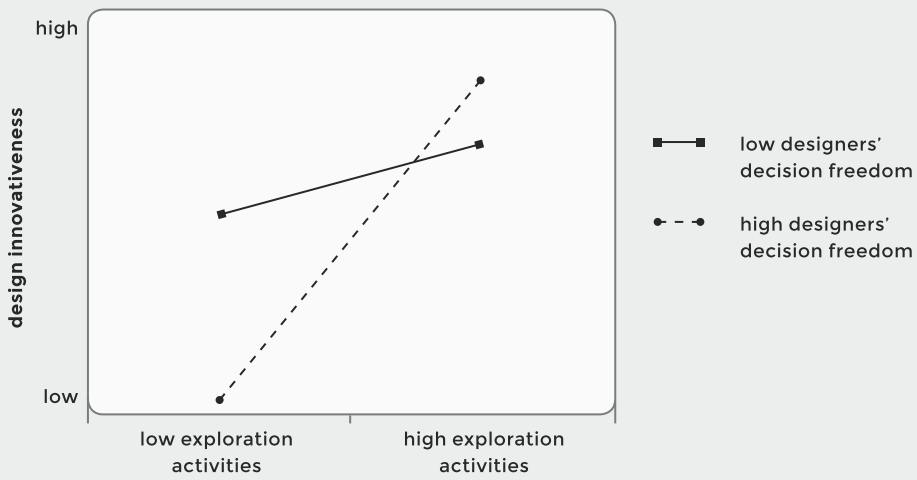



Figure 4 .3
Moderating effect of designers' decision freedom on the relation between exploration activities and design innovativeness (H7).



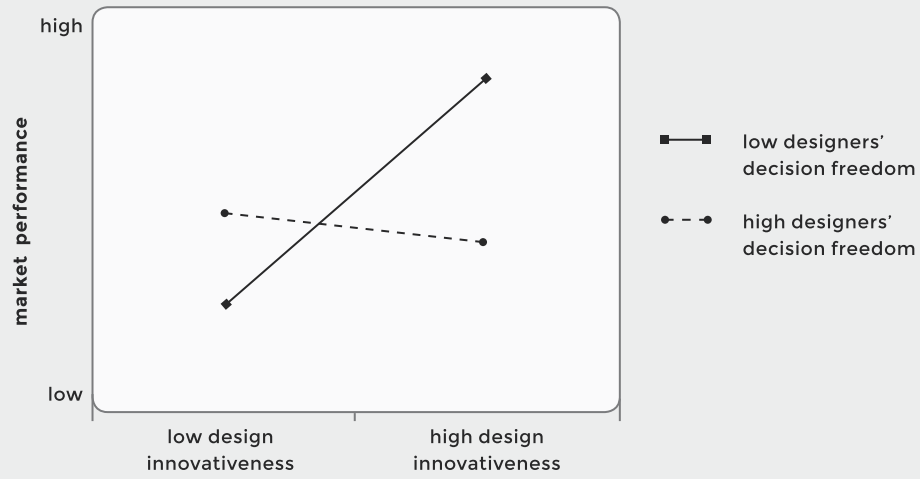



Figure 4 .4
Moderating effect of designers' decision freedom on the relation between design innovativeness and market performance (H8).

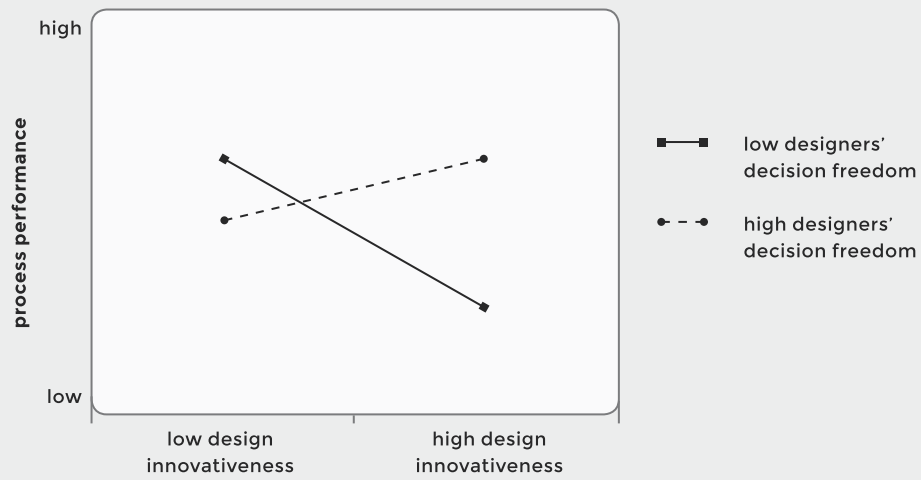



Figure 4 .5
Moderating effect of designers' decision freedom on the relation between design innovativeness and process performance (H9).

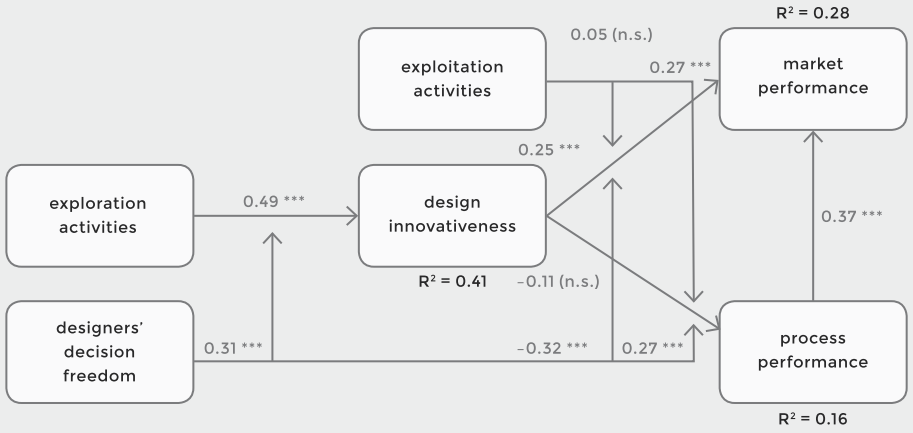



Figure 4 .6
Summary of the findings (model 3) *** p<0.01, ** p<0.05, * p<0.10

### 4 .4 .3
### POST-HOC ANALYSES

We conducted multi-group analyses to investigate whether the relationships in our model differ for product (n=50) versus service innovation (n=33), and for organizations providing low (1 or 2 projects: n=51) versus high numbers of projects (3 to 5 projects: n=32). Due to sample size restrictions, we conducted these analyses on the model without the designer decision freedom construct. Table 4.4 summarizes the $R^2$ values of the dependent variables and the PLS estimates of the paths in our model.
We compared the groups using a parametric approach (see e.g., Lew & Sinkovics, 2013). Through 5000 bootstrapping samples, we obtained the standard errors of the paths in the two groups, after which we tested the differences in the path coefficients using t-statistics. Table 4.4 shows that the differences in the path coefficient between the product and the service innovation groups are not significant. The differences in the path coefficients between the group of organizations providing low versus the group of organizations providing high numbers of projects are non-significant as well, with the exception of the relationship between exploration activities and design innovation. We find that this relationship is significantly more positive for organizations that provided high numbers of projects (organizations providing low numbers of projects: β=0.41, p<0.01. Organizations providing high numbers of projects: β=0.73, p<0.01). Nevertheless, we find positive effects of exploration on design innovation for both groups, which is in line with our initial hypothesis.

**TABLE 4 .4**
**MULTI-GROUP ANALYSES**

| | PRODUCT INNOVATION (N=50) | SERVICE INNOVATION (N=33) | DIFFERENCE \|PI-SI\| | T-STATISTIC (DF=81) | LOW NO. PROJECTS (N=51) | HIGH NO. PROJECTS (N=32) | DIFFERENCE \|LP-HP\| | T-STATISTIC (DF=81) |
|---|---|---|---|---|---|---|---|---|
| **$R^2$** | | | | | | | | |
| Market performance | 0.28 | 0.25 | | | 0.20 | 0.42 | | |
| Process performance | 0.22 | 0.07 | | | 0.12 | 0.28 | | |
| Design innovativeness | 0.35 | 0.23 | | | 0.17 | 0.53 | | |
| **Paths** | | | | | | | | |
| Design innov. → market perf. | 0.17 | 0.36 ** | 0.19 | 1.01 (n.s.) | 0.22 | 0.42 *** | 0.20 | 0.96 (n.s.) |
| Design innov. x exploitation → market perf. | 0.21 | 0.14 | 0.07 | 0.34 (n.s.) | 0.14 | 0.37 ** | 0.23 | 0.98 (n.s.) |
| Design innov. → process perf. | 0.05 | -0.13 | 0.18 | 1.16 (n.s.) | 0.00 | -0.22 | 0.22 | 1.11 (n.s.) |
| Design innov. x exploitation → process perf. | 0.42 *** | 0.20 | 0.22 | 1.02 (n.s.) | 0.31 ** | 0.25 | 0.06 | 0.28 (n.s.) |
| Process perf. → market perf. | 0.48 *** | 0.26 * | 0.22 | 1.13 (n.s.) | 0.29 ** | 0.60 *** | 0.31 | 1.46 (n.s.) |
| Exploration → design innov. | 0.59 *** | 0.48 *** | 0.11 | 0.80 (n.s.) | 0.41 *** | 0.73 *** | 0.32 | 2.15 ** |

*** p<0.01, ** p<0.05, * p<0.10, n.s.=non-significant. PI=product innovation, SI=service innovation,
LP=organizations providing low numbers (1 or 2) of projects, HP=organizations providing high numbers of projects (3 to 5).

## 4 .5
## DISCUSSION AND CONCLUSION

The main objective of this research is to investigate exploration and exploitation activities in design innovation. More specifically, this research aims to examine the effect of exploration on design innovativeness, and the moderating effect of exploitation on the relationship between design innovativeness and performance. Additionally, we investigate the effect of designers' decision freedom on design innovativeness and other outcomes.

As hypothesized, we find that exploration enhances design innovativeness, and that the effect of design innovativeness on process performance is positive (negative) when exploitation is high (low). However, our results also suggest that exploitation does not moderate the positive relation between design innovativeness and market performance. This may be explained by the fact that when exploration leads to high levels of design innovativeness, the added value of exploitation for market performance is curtailed because activities that involve current knowledge and competences do not fit well with what is needed to market radically new design innovations.

Our data also show that the extent to which designers have the freedom to make decisions on their own moderates the relation between exploration activities and design innovativeness. In particular, we hypothesize and find that when designers have high levels of decision freedom, exploration has a more positive influence on design innovativeness than when they have low levels of decision freedom. Designers' decision freedom also moderates the relation between design innovativeness and performance. As expected, design innovativeness has a negative (positive) influence on market performance when designers have high (low) levels of decision freedom. The moderating effect of designers' decision freedom on the relation between design innovativeness and process performance is different from our hypothesis: we find that this relation is positive (negative) when designers' decision freedom is high (low). This may, perhaps, be explained by the fact that designers, when they can make decisions on their own, tend to do this quickly by using their expert intuition (Beverland and Farrelly, 2011; Lorenz, 1994).

We contribute to the existing literature in the following ways. First, we examine exploration and exploitation activities in design innovation, as opposed to technological innovation, which was the focus of prior research (see e.g., Huang and Li, 2012; Kyriakopoulos and Moorman, 2004; Li, 2013). Second, we show that exploration and exploitation activities have different roles in such projects. More specifically, we find that exploration enhances design innovativeness, and exploitation moderates the relation between design innovativeness and process performance. These findings extend prior research on the different roles of exploration and exploitation, which showed that exploration is important to achieve innovativeness (Molina-Castillo et al., 2011) and differentiation (Kim and Atuahene-Gima, 2010; O'Cass et al., 2014), while exploitation assures quality (Molina-Castillo et al., 2011) and cost efficiency (Kim and Atuahene-Gima, 2010; O'Cass et al., 2014). Moreover, our results answer recent calls for more research on the influence of exploration and exploitation activities on the degree of product innovativeness (Li et al., 2008). Third, we show how designers' decision freedom influences design innovativeness and other outcomes. Prior research focused on how designers' decision freedom moderates the relation between investments in design and design innovation (Candi et al., 2011). We extend these findings by showing the moderating effect of designers' decision freedom on the relationship between exploration and design innovativeness, and between design innovativeness and performance.

Our study offers several guidelines to help managers develop successful design innovations. First, the findings underscore the necessity for managers to undertake both exploration and exploitation activities in design innovation projects. Second, as the two activities have different roles, managers should keep in mind that exploration enhances design innovativeness while exploitation assures the development of such solutions on time and within budget. Finally, managers should keep in mind that the degree to which they give designers the freedom to make decisions on their own influences the level of design innovativeness of the outcome as well as its performance. While high levels of freedom are most appropriate to achieve high levels of innovativeness, managers face a trade-off between market and process performance. Deciding between these two outcomes is important as it relates to effective and efficient use of resources. Better market performance is achieved when designers make decisions together with project managers, while to achieve process performance, designers need to have the authority to make decisions on their own.

## 4 .6
## LIMITATIONS AND FUTURE RESEARCH

This research has some limitations, which give rise to avenues for future research. First, our sample size is relatively small. While the purpose of our study is to extend rather than confirm theory, future studies might want to replicate our findings with a larger dataset. Secondly, our research uses subjective measures of performance. Although project managers are in general well informed about the performance of the projects they work on, future studies might want to repeat our research with objective measures of sales, development costs and times. Thirdly, our research

focused on design innovations resulting from collaborations with external designers. Since organizations that hire designers internally have a higher degree of design management skills than those that hire them externally (Chiva and Alegre, 2007), it would be interesting to study whether our findings are generalizable to exploration and exploitation activities within organizational boundaries. Future research may investigate, for example, whether the non-significant moderating effect of exploitation activities on the relation between design innovation and market performance is also valid for organizations that hire designers internally. Exploitation may be more useful for achieving market performance in this context because these organization are better at managing designers in these activities. Another, related avenue for future research may relate to the role of designers' decision freedom for design innovation and performance in the case when internal instead of external designers are involved in innovation projects. Prior research suggested that controlling the work of external designers is more important than controlling the work of internal designers to assure that the solutions that are developed are relevant for the organization and its customers (Bruce and Docherty, 1993). This suggests that in the case when internal designers are involved in innovation projects, the role of managers in decision making may be less important to achieve market performance. Future research is needed to ascertain this as well.

# 5
# Discussion and conclusion

The main aim of this thesis is to investigate the antecedents and consequences of effective collaboration between designers and managers in innovation projects. This thesis is comprised of three studies. The first study focuses on how designers can create understanding for their way of working, in particular as regards process understanding. This will help with the realization of effective collaboration because it will support designers and managers to communicate about the designers' process. The findings from the second study will help in the construction of effective dyads by taking actors' cognitive styles into consideration. Specifically, this second study investigates how designers' and managers' cognitive styles complement each other to enhance financial performance. The third study investigates how decision making can be optimized by studying the impact of designers' decision freedom on design innovation and performance. The findings of this study will help with the realization of effective collaboration by providing insights on whether designers should make decisions alone or together with managers, depending on the desired outcome of the innovation project. The following sections summarize the main findings of the three studies, and discuss the implications of these findings for theory as well as design and managerial practice.

## 5 .1
## SUMMARY OF THE FINDINGS

The three studies have several important findings, which relate to the antecedents and consequences of effective collaboration between designers and managers.

### 5 .1 .1
### STUDY 1 – DESIGNERS' ROLE IN CREATING PROCESS UNDERSTANDING: PRACTICES AND ABILITIES FOR RADICAL AND INCREMENTAL INNOVATION PROJECTS

The first study investigates how designers can create process understanding by using design practices and abilities. It identifies the following six design practices, which designers use throughout the process of innovation projects (although most are used in the strategy and design phases): *making the process accountable*, *making the process tangible*, *synchronizing designers' and clients' processes*, *creating ownership for the process*, *bringing the result of the process to life*, and *getting clients accustomed to designerly ways of working*. The first study also finds that designers need six design abilities to create process understanding. These design abilities are: *overseeing the process*, *steering the process forward*, *iteratively adjusting the process*, *connecting with clients*, *telling a coherent and compelling story*, and *creating client engagement*. Lastly, this first study finds that in incremental innovation projects, the design practices of making the process accountable and making the process tangible, and the design abilities to oversee the process and steer the process forward seem to be of most importance, while in radical innovation projects all six design practices and six abilities seem to be of importance to create process understanding.

### 5 .1 .2
### STUDY 2 – DO DESIGNERS AND MANAGERS COMPLEMENT EACH OTHER? THE INFLUENCE OF COGNITIVE STYLE ON FINANCIAL PERFORMANCE

The second study investigates how designers and managers complement each other in their cognitive styles (in terms of creativity, conformity and attention to details) in order to positively influence financial performance. The findings show, as expected, that designers and managers should complement each other in their creativity and conformity: that is, designers should be creative (and not conform to rules and group norms) while managers should be conformist (and not creative). However, the findings also suggest that both designers and managers should be attentive to details, which also implies that they should supplement (rather than complement) each other.



### 5 .1 .3
### STUDY 3 – EXPLORATION AND EXPLOITATION ACTIVITIES FOR DESIGN INNOVATION

The third study investigates how exploration and exploitation activities influence design innovation and performance, while simultaneously studying the impact of designers' decision freedom on these outcomes. As expected, the third study finds that exploration activities enhance design innovation while exploitation activities moderate the relation between design innovation and process performance in such a way that this relationship is positive (negative) when exploitation is high (low). As regards designers' decision freedom, the third study finds that designers should make decisions on their own to achieve design innovation and/or process performance, while high market performance is achieved when they make decisions together with managers.

## 5 .2
## THEORETICAL IMPLICATIONS

Taken together, the three studies in this thesis make several contributions to our understanding of the antecedents and consequences of effective collaboration between designers and managers.

### 5 .2 .1
### IMPLICATIONS FOR THEME 1: ANTECEDENTS OF EFFECTIVE COLLABORATION BETWEEN DESIGNERS AND MANAGERS

This thesis presents the first empirical studies that explicitly address three important antecedents of effective collaboration between designers and managers: the differences in the ways of working of designers and managers, the differences in their cognitive styles, and the management of these differences in decision making.

First, this thesis contributes to the literature by showing that, on the one hand, designers and managers should cherish each other's different ways of working and cognitive styles to collaborate effectively, but on the other hand, they should adapt to each other. Specifically, the first study identifies design practices and abilities that require designers to emphasize their own process when creating process understanding (e.g., the practice of *getting clients accustomed to designerly ways of working* and the ability to *create client engagement*), but it also identifies design

practices and abilities that require designers to adopt managers' way of working (e.g., the practice of *making the process accountable* and the ability to *oversee the process*). Similarly, the second study shows that designers and managers should complement each other in their creativity and conformity, while they should supplement each other in their attention to details. Prior research has suggested that designers and managers have different ways of working (Beverland and Farrelly, 2011; Liedtka, 2010, 2015; Seidel and Fixson, 2013) and cognitive styles (Beverland and Farrelly, 2011; Chang et al., 2013; Collins, 2013; Fixson and Read, 2012; Liedtka, 2010; Lockwood, 2010; Lorenz, 1994; Von Stamm, 2004), and that these differences are important for effective collaboration (Beverland and Farrelly, 2011; Duck, 2012; Goffin and Micheli, 2010; Hakatie and Ryynänen, 2007; Hertenstein and Platt, 1997; Liedtka, 2010; Maciver, 2012; Micheli et al., 2012; Von Stamm, 2004). This thesis contributes to the extant literature by suggesting that effective collaboration does not rely on these different ways of working and cognitive styles per se, but rather on how these differences are managed. Future research may investigate when the most appropriate managerial strategy is to cherish and when to adapt to each other's differences. The findings from this thesis suggest that cherishing each other's different ways of working and cognitive styles may be the most effective in radical innovation projects and during the development of innovations (e.g., strategy and design phases), while adapting to each other's different ways of working and cognitive styles may be most effective in incremental innovation projects and during the realization of solutions. Another avenue for future research may be to investigate how the differences between designers and managers should be managed depending on whether short or long term relations are established with external designers. It may be that cherishing is more important when short term relations are established with external designers while adapting is more relevant when they are hired on a long term basis. However, future research is needed to verify these propositions.

Secondly, the findings from this thesis suggest that effective collaboration also relies on managing differences in decision making by showing that there is a need for designers making decisions alone, as well as a need for designers and managers to make decisions together (study 3). Prior research has suggested that designers should make decisions alone to achieve innovative outcomes, while they should make decisions together with managers to achieve high levels of performance (Black and Baker, 1987; Micheli et al., 2012; Ravasi and Lojacono, 2005; Turner, 2000). This thesis tested and confirmed this proposition, and lays the foundation for future research in this area. An interesting avenue for future research may be, for example, to investigate whether designers should make decisions alone or together with managers depending on the type of innovation that the project concerns. The findings of this thesis suggest that designers should make decisions alone when the project concerns design innovation, while making decisions together with managers may be more effective in technological innovation. Another avenue for future research is to investigate how the educational background of designers is of influence on whether they should make decisions on their own or together with managers. For instance, designers with an educational background in art may be less effective at achieving high levels of process performance than those with a background in business. However, future research is needed to investigate these propositions.

Taken together, the results from this thesis contribute to the literature by suggesting that designers and managers should cherish their different ways of working and cognitive styles and give designers the freedom to make decisions on their own in projects that concern radical innovation or during the development of innovations (e.g., the strategy and design phases), while adapting to each other's way of working and cognitive styles and making decisions together may be more relevant for incremental innovation and during the realization of innovations. This finding underscores the importance of designers' different ways of working, cognitive styles and decision-making perspectives when their role moves from an operational to a strategic one, and lays the foundation for future research in this area.

### 5 .2 .2 IMPLICATIONS FOR THEME 2: CONSEQUENCES OF EFFECTIVE COLLABORATION BETWEEN DESIGNERS AND MANAGERS

This thesis also presents the first empirical studies that explicitly investigate the consequences of effective collaboration between designers and managers. Specifically, it examines the impact of such collaboration on project-level financial, market and process performance.

First, the findings of this thesis contribute to the literature by showing that designers and managers need each other's cognitive styles and decision-making perspectives to positively influence financial or market performance. Specifically, the findings from the second study show that designers and managers need to complement each other in their creativity and conformity and supplement each other in their attention to details to enhance financial performance, and the third study shows that designers and managers need to make decisions together to have a positive effect on market performance. Prior research has suggested that involving designers in innovation enhances financial and market performance (Czarnitzki and Thorwarth, 2012; Gemser et al., 2011; Hise et al., 1989; Roy and Potter, 1993; Roy and Riedel, 1997). The findings from the present thesis contribute to this literature by showing that involving designers in innovation may not be enough to achieve these outcomes.

Rather, it depends on the cognitive styles of these designers and the managers they collaborate with, as well as on effective decision making. Future research may build on these findings by investigating whether designers should make decisions alone or together with managers to enhance market performance depending on the type of managers they collaborate with. The findings from this thesis suggest that designers should make decisions together with project managers, who play an operational role in innovation projects, to positively influence market performance. It may be less important for designers to make decisions together with managers to enhance market performance when they collaborate with top or senior managers, who play a strategic role in innovation, because these managers may be less involved in the execution of the project. However, future research is necessary to test this proposition.

Secondly, the findings from this thesis show that designers can enhance process performance in terms of adhering to budget and plans when they have the authority to make decisions on their own (study 3). Prior research has shown that involving designers in innovation has negative effects on process performance in terms of development duration (Marion and Meyer, 2011). This thesis contributes to the literature by showing that involving designers in innovation may not have a negative influence on this outcome when designers can make decisions on their own. Future research may explore this finding by investigating whether designers should make decisions on their own to enhance process performance (in terms of meeting budget and planning goals) or whether they should do this together with managers depending on how they are hired: externally or internally to the organization. This thesis finds that external designers should make decisions on their own, which may be explained by the fact that they act as project managers at the design consultancy side, while internal designers usually do not have this strategic role. Although this suggests that letting these designers make decisions on their own may be less effective in terms of achieving budget and planning goals, future research needs to investigate this proposition.

Thirdly, this thesis contributes to the literature by showing that designers can also positively influence process performance in terms of design innovativeness when they have the authority to make decisions on their own (study 3). Prior research has shown that involving designers in innovation has positive effects on product innovativeness (Cillo and Verona, 2008; Gemser et al., 2011; Person et al., 2008; Ravasi and Lojacono, 2005). This thesis confirms this finding and lays the foundation for future research in this area. For example, future research may investigate whether designers should also make decisions on their own or together with managers depending on the functional background of these managers. It is possible, for example, that letting designers make decisions on their own is less important to achieving design innovativeness when managers work in the design function, because these managers have similar ways of working and cognitive styles as the designers.



Overall, the findings from this thesis contribute to the literature by showing that designers and managers need each other's cognitive styles and they need to make decisions together to positively influence financial and market performance, while designers can enhance process performance (both in terms of meeting budget and planning goals as well as product innovativeness) by making decisions on their own. Although these findings suggest that the strategic role of designers is more important for achieving process outcomes, future research is needed to ascertain this proposition.

## 5 .3
## PRACTICAL IMPLICATIONS

The findings in this thesis have several practical implications for effective collaboration between designers and managers, as well as for the optimization of the strategic role of designers in innovation projects.

The findings in this thesis have three important implications for effective collaboration between designers and managers. First, the findings of the first study provide managers with insight into the different ways of working of designers. Namely, managers can gain understanding about the way of working of designers by studying the practices and abilities. Furthermore, the findings of this chapter help designers to improve their practices and abilities in order to achieve process understanding. Overall, the proposed framework contributes to better collaboration between designers and managers as it can function as a communication tool on designers' ways of working, and it can help them to improve the process of creating process understanding. Secondly, the findings of the second study allow managers to form more effective project teams by explicitly taking cognitive styles into account – both their own and those of potential designers to be selected in the team – and to assure that these cognitive styles are complementary to each other. In particular, managers should assure that designers score high on creativity when they themselves score high on conformity, and/or that they and designers score high on attention to details. Thirdly, the findings from the third study allow for better decision making in terms of the degree of decision freedom given to designers. When striving for a high degree of design innovation or process performance, managers should give designers a high degree of decision freedom. In the case of market performance, managers should make decisions together with designers.

The findings from this thesis also have two important implications for the optimization of designers' strategic role in innovation projects. First, the findings suggest that designers and managers should cherish designers' different ways of working, cognitive styles and decision-making perspectives to optimize their

strategic role in innovation projects. Managers are advised to select designers with different cognitive styles and ways of working, and let these designers make decisions on their own in innovation projects. Second, the findings demonstrate that designers' strategic role has an impact on the process outcomes of innovation projects: that is, it influences the extent to which these projects meet their budget and planning goals, and the extent to which innovative outcomes are developed. Managers should enable designers to play a strategic role when these outcomes are at stake.

## 5 .4
## CONCLUSION

This thesis investigates the antecedents and consequences of effective collaboration between designers and managers. It specifically focuses on designers' and managers' differences in ways of working and cognitive styles, and the management of these differences in decision making as a way to achieve effective collaboration, and the financial, market and process performance outcomes of this collaboration. While the present thesis investigates these factors in innovation projects for which an external design consultancy was hired by an innovating organization, these findings are relevant beyond this narrow scope. The degree to which the findings are transferable to innovation projects beyond the one investigated in this thesis is a matter of future research. Based on the finding that designers' different ways of working, cognitive styles and decision-making perspectives are important when their role moves from an operational to a strategic one, I hope that future research will investigate the role of these characteristics in networked innovation projects, where heterogeneous stakeholders collaborate to create outcomes.

# References

## A

Abecassis-Moedas, C., Benghozi, P.-J., 2012. Efficiency and Innovativeness as Determinants of Design Architecture Choices. Journal of Product Innovation Management 29, 405–418.

Ahn, J.-H., Lee, D.-J., Lee, S.-Y., 2006. Balancing Business Performance and Knowledge Performance of New Product Development: Lessons from ITS Industry. Long Range Planning 39, 525–542.

Allinson, C., Hayes, J., 1996. The Cognitive Style Index: A Measure of Intuition-Analysis for Organizational Research. Journal of Management Studies 33, 119–135.

Amabile, T.M., Fisher, C.M., 2009. Stimulate Creativity by Fueling Passion, Handbook of Principles of Organizational Behavior. John Wiley and Sons, West Suxxex, U.K., pp. 481–497.

Andriopoulos, C., Lewis, M.W., 2010. Managing Innovation Paradoxes: Ambidexterity Lessons from Leading Product Design Companies. Long Range Planning 43, 104–122.

Atuahene-Gima, K., 2005. Resolving the Capability—Rigidity Paradox in New Product Innovation. Journal of Marketing 69, 61–83

Atuahene-Gima, K., Murray, J.Y., 2007. Exploratory and Exploitative Learning in New Product Development: A Social Capital Perspective on New Technology Ventures in China. Journal of International Marketing 15, 1–29.

## B

Baer, M., 2012. Putting Creativity to Work: The Implementation of Creative Ideas in Organizations. Academy of Management Journal 55, 1102–1119.

Bagozzi, R., Yi, Y., 1988. On the Evaluation of Structural Equation Models. Journal of the Academy of Marketing Science 16, 74–94.

Barclay, D., Higgins, C., Thompson, R., 1995. The Partial Least Square(PLS) Approach to Casual Modeling: Personal Computer Adoption and Use as an Illustration. Technology 2, 285–309.

Berends, H., Reymen, I., Stultiëns, R. G. L, Peutz, M., 2011. External Designers in Product Design Processes of Small Manufacturing Firms. Design Studies 32, 86–108.

Berghman, L., Matthyssens, P., Streukens, S., Vandenbempt, K., 2013. Deliberate Learning Mechanisms for Stimulating Strategic Innovation Capacity. Long Range Planning 46, 39–71.

Beverland, M., 2005. Managing the Design Innovation – Brand Marketing Interface: Resolving the Tension between Artistic Creation and Commercial Imperatives*. Journal of Product Innovation Management 22, 193–207.

Beverland, M., 2010. Right-Wing Customers – The Enemy of Innovation. Design Management Review 21, 64–71.

Beverland, M., Farrelly, F.J., 2011. Designers and Marketers: Toward a Shared Understanding. Design Management Review 22, 62–70.

Beverland, M., Wilner, S.S., Micheli, P., 2015. Reconciling the Tension Between Consistency and Relevance: Design Thinking as a Mechanism for Brand Ambidexterity. Journal of the Academy of Marketing Science, 1–21.

Beverland, M.B., Micheli, P., Farrelly, F.J., 2016. Resourceful Sensemaking: Overcoming Barriers between Marketing and Design in NPD. Journal of Product Innovation Management, advance online publication.

Black, C.D., Baker, M.J., 1987. Success Through Design. Design Studies 8, 207–216.

Bonner, J.M., Ruekert, R.W., Walker Jr, O.C., 2002. Upper Management Control of New Product Development Projects and Project Performance. Journal of Product Innovation Management 19, 233–245.

Bruce, M., Docherty, C., 1993. It's All in a Relationship: A Comparative Study of Client- Design Consultant Relationships. Design Studies 14, 402–422.

Bruce, M., Morris, B., 1994. Managing External Design Professionals in the Product Development Process. Technovation 14, 585–599.

Bruggen, G.H., Lilien, G.L., Kacker, M., 2002. Informants in Organizational Marketing Research: Why Use Multiple Informants and How to Aggregate Responses. Journal of Marketing Research 39, 469–478.

## C

Calabretta, G., Gemser, G., 2015. Integrating Design into the Fuzzy Front End of the Innovation Process, PDMA's Essentials 2: Design and Design Thinking. John Wiley and Sons, New York.

Cameron, D., Knight, T., Hargreaves, J., May, M., Goulding, N., 2015. Creative Industries Economic Estimates. Department for Culture, Media and Sports.

Candi, M., 2010. Benefits of Aesthetic Design as an Element of New Service Development*. Journal of Product Innovation Management 27, 1047–1064.

Candi, M., Gemser, G., 2010. An Agenda for Research on the Relationships between Industrial Design and Performance. International Journal of Design 4, 67–77.

Candi, M., Gemser, G., Van Den Ende, J., 2011. Design Effectiveness: Industry Report. Rotterdam School of Management, Erasmus University Rotterdam, Rotterdam, The Netherlands.

Cankurtaran, P., Langerak, F., Griffin, A., 2013. Consequences of New Product Development Speed: A Meta-Analysis. Journal of Product Innovation Management 30, 465–486.

Cao, Q., Gedajlovic, E., Zhang, H., 2009. Unpacking Organizational Ambidexterity: Dimensions, Contingencies, and Synergistic Effects. Organization Science 20, 781–796.

Chang, Y., Kim, J., Joo, J., 2013. An Exploratory Study on the Evolution of Design Thinking: Comparison of Apple and Samsung. Design Management Journal 8, 22–34.

Chilton, M.A., Hardgrave, B.C., Armstrong, D.J., 2005. Person-Job Cognitive Style Fit for Software Developers: The Effect on Strain and Performance. Journal of Management Information Systems 22, 193–226.

Chin, W.W., 1998. The Partial Lest Squares Approach to Structural Equation Modeling, in: Marcoulides, G.A. (Ed.), Modern Methods for Business Research. Lawrence Erlbaum Associates, Mahway, New Jersey, pp. 295–336.

Chin, W.W., 2010. How to Write Up and Report PLS Analyses, in: Esposito Vinzi, V., Chin, W.W., Henseler, J., Wang, H. (Eds.), Handbook of Partial Least Squares. Springer, Berlin Heidelberg, pp. 655–690.

Chiva, R., Alegre, J., 2007. Linking Design Management Skills and Design Function Organization: An Empirical Study of Spanish and Italian Ceramic Tile Producers. Technovation 27, 616–627.

Chiva, R., Alegre, J., 2009. Investment in Design and Firm Performance: The Mediating Role of Design Management. Journal of Product Innovation Management 26, 434–440.

Cillo, P., Verona, G., 2008.
Search Styles in Style Searching:
Exploring Innovation Strategies in Fashion
Firms. Long Range Planning 41, 650–671.

Cohen, J., 1988. Statistica Power Analysis
for the Behavioral Sciences, 2nd Edition ed.
Lawrence Earlbaum, Hillsdale, NJ.

Collins, H., 2013. Can Design Thinking Still Add
Value? Design Management Review 24, 35–39.

Creusen, M.E.H., Schoormans, J.P.L., 2005.
The Different Roles of Product Appearance
in Consumer Choice*. Journal of Product
Innovation Management 22, 63–81.

Cummings, A., Oldham, G., 1997.
Enhancing Creativity: Managing Work
Contexts for the High Potential Employee.
California Management Reviewe 40, 22–38.

Czarnitzki, D., Thorwarth, S., 2012.
The Contribution of In-house and External
Design Activities to Product Market
Performance. Journal of Product Innovation
Management 29, 878–895.

## D

Danneels, E., 2002. The Dynamics of
Product Innovation and Firm Competences.
Strategic Management Journal 23, 1095–1121.

Danneels, E., Kleinschmidt, E.J., 2001. Product
Innovativeness From the Firm's Perspective:
Its Dimensions and Their Relation With Project
Selection and Performance. Journal of Product
Innovation Management 18, 357–373.

De Mozota, B.B., Kim, B.Y., 2009. Managing
Design as a Core Competency: Lessons from
Korea. Design Management Review 20, 66–76.

Dell'Era, C., Verganti, R., 2009.
The Impact of International Designers on
Firm Innovation Capability and Consumer
Interest. International Journal of Operations
& Production Management 29, 870–893.

Dell'Era, C., Verganti, R., 2010.
Collaborative Strategies in Design-intensive
Industries: Knowledge Diversity and
Innovation. Long Range Planning 43, 123–141.

Dewar, R.D., Whetten, D.A., Boje, D., 1980.
An Examination of the Reliability and Validity
of the Aiken and Hage Scales of Centralization,
Formalization and Task Routineness.
Administrative Science Quarterly 25, 120–128.

Duck, K., 2012. Executing Strategy:
What Designers Can Teach Project Managers.
Design Management Review 23, 28–36.

## E

Eling, K., Langerak, F., Griffin, A., 2013.
A Stage-Wise Approach to Exploring
Performance Effects of Cycle Time Reduction.
Journal of Product Innovation Management 30,
626–641.

Evanschitzky, H., Eisend, M., Calantone, R.J.,
Jiang, Y., 2012. Success Factors of Product
Innovation: An Updated Meta-Analysis. Journal
of Product Innovation Management 29, 21–37.

## F

Fitzsimmons, J.A., Kouvelis, P., Mallick, D.N.,
1991. Design Strategy and Its Interface With
Manufacturing and Marketing: A Conceptual
Framework. Journal of Operations
Management 10, 398–415.

Fixson, S.K., Read, J.M., 2012.
Creating Innovation Leaders: Why We Need
to Blend Business and Design Education.
Design Management Review 23, 4–12.

Fleiss, J. L., (1986) The Design and Analysis
of Clinical Experiments. John Wiley & Sons,
New York, NY.

Flyvbjerg, B., 2006.
Five Misunderstandings About Case-Study
Research. Qualitative Inquiry 12, 219–245.

Fornell, C., Larcker, D.F., 1981.
Evaluating Structural Equation Models with
Unobservable Variables and Measurement
Error. Journal of Marketing Research 18, 39–50.

## G

Garcia, R., Calantone, R., 2002.
A Critical Look at Technological Innovation
Typology and Innovativeness Terminology:
A Literature Review. Journal of Product
Innovation Management 19, 110–132.

Geisser, S., 1975. The Predictive Sample
Reuse Method with Applications. Journal of the
American Statistical Association 70, 320–328.

Gemser, G., Candi, M., van den Ende, J., 2011.
How Design Can Improve Firm Performance.
Design Management Review 22, 72–77.

Gemser, G., Leenders, M.A.A.M., 2001.
How Integrating Industrial Design in the
Product Development Process Impacts on
Company Performance. Journal of Product
Innovation Management 18, 28–38.

Gillespie, B., 2014. Walking the Walk:
Putting Design at the Heart of Business
By Paul Gardien and Ferdy Gilsing.
Design Management Review 25, 75–88.

Goffin, K., Micheli, P., 2010.
Maximizing the Value of Industrial Design
in New Product Development. Research-
Technology Management 53, 29–37.

Golsby-Smith, T., 2007. The Second Road of
Thought: How Design Offers Strategy a New
Toolkit. Journal of Business Strategy 28, 22–29.

Griffin, A., Page, A.L., 1993.
An Interim Report on Measuring Product
Development Success and Failure. Journal of
Product Innovation Management 10, 291–308.

Gupta, A.K., Smith, K.G., Shalley, C.E., 2006.
The Interplay between Exploration and
Exploitation. The Academy of Management
Journal 49, 693–706.

## H

Hair, J.F., Black, W.C., Babin, B.J.,
Anderson, R.E., 2010. Multivariate Data
Analysis. Prentice Hall, Englewood Cliffs.

Hair, J.F., Ringle, C.M., Sarstedt, M., 2011.
PLS-SEM: Indeed a Silver Bullet. Journal of
Marketing Theory and Practice 19, 139–151.

Hair, J.F., Sarstedt, M., Ringle, C.M., Mena, J.A.,
2012. An Assessment of the Use of Partial Least
Squares Structural Equation Modeling in
Marketing Research. Journal of the Academy
of Marketing Science 40, 414–433.

Hakatie, A., Ryynänen, T., 2007.
Managing Creativity: A Gap Analysis Approach
to Identifying Challenges for Industrial Design
Consultancy Services. Design Issues 23, 28–46.

Han, J.Y., Bromilow, D., 2010.
Graphic Designers Win the Leadership Game.
Design Management Journal 5, 20–31.

Hassi, L., Laakso, M., 2011. Design Thinking in the Management Discourse: Defining the Elements of the Concept, International Product Development Management Conference, Delft University of Technology, The Netherlands.

Hayes, J., Allinson, C., 1998. Cognitive Style and the Theory and Practice of Individual and Collective Learning in Organizations. Human Relations 51, 847–871.

Hayes, J., Allinson, C.W., 1994. Cognitive Style and its Relevance for Management Practive. British Journal of Management 5, 51–71.

He, Z.-L., Wong, P.-K., 2004. Exploration vs. Exploitation: An Empirical Test of the Ambidexterity Hypothesis. Organization Science 15, 481–494.

Hekkert, P.P.M., Van Dijk, M.B., 2011. Vision in Design: A Guidebook for Innovators. BIS Publishers, Amsterdam.

Henard, D.H., Szymanski, v., 2001. Why Some New Products Are More Successful Than Others. Journal of Marketing Research 38, 362–375.

Hertenstein, J.H., Platt, M.B., 1997. Developing a Strategic Design Culture. Design Management Journal (Former Series) 8, 10–19.

Hertenstein, J.H., Platt, M.B., Veryzer, R.W., 2005. The Impact of Industrial Design Effectiveness on Corporate Financial Performance*. Journal of Product Innovation Management 22, 3–21.

Hise, R.T., O'Neal, L., McNeal, J.U., Parasuraman, A., 1989. The Effect of Product Design Activities on Commercial Success Levels of New Industrial Products. Journal of Product Innovation Management 6, 43–50.

Huang, J.-W., Li, Y.-H., 2012. Slack Resources in Team Learning and Project Performance. Journal of Business Research 65, 381–388.

Hulland, J., 1999. Use of Partial Least Squares (PLS) in Strategic Management Research: A Review of Four Recent studies. Strategic Management Journal 20, 195–204.

Hultink, E.J., Robben, H.S.J., 1995. Measuring New Product Success: The Difference that Time Perspective Makes. Journal of Product Innovation Management 12, 392–405.

## K

Kammeyer-Mueller, J.D., Schilpzand, P., Rubenstein, A.L., 2012. Dyadic Fit and the Process of Organizational Socialization, Organizational Fit. John Wiley & Sons, Ltd, pp. 50–73.

Kang, H.-J., Chung, K.-w., Nam, K.Y., 2015. A Competence Model for Design Managers: A Case Study of Middle Managers in Korea. International Journal of Design 9, 109–127.

Kaplan, S., Brooks-Shesler, L., King, E.B., Zaccaro, S., 2009. Thinking Inside the Box: How Conformity Promotes Creativity and Innovation, in: Goncalo, J.A., Mannix, E.A., Neale, M.A. (Eds.), Research on Managing Groups and Teams: Creativity in Groups. Emerald Group, Bradford, U.K., pp. 229–265.

Kembaren, P., Simatupang, T.M., Larso, D., Wiyancoko, D., 2014. Design Driven Innovation Practices in Design-Preneur Led Creative Industry. Journal of Technology Management & Innovation v9, 91–105.

Kim, N., Atuahene-Gima, K., 2010. Using Exploratory and Exploitative Market Learning for New Product Development. Journal of Product Innovation Management 27, 519–536.

Kirton, De Ciantis, S., 1986. Cognitive Style and Personality: The Kirton Adaption-Innovation and Cattell's Sixteen Personality Factor Inventories. Personality and Individual Differences 7, 141–146.

Kirton, M., 1976. Adaptors and Innovators: A Description and Measure. Journal of Applied Psychology 61, 622–629.

Korenok, O., Hoffer, G.E., Millner, E.L., 2010. Non-price Determinants of Automotive Demand: Restyling Matters Most. Journal of Business Research 63, 1282–1289.

Kristof-Brown, A.L., Zimmerman, R.D., Johnson, E.C., 2005. Consequences of Individuals' Fit at Work: A Meta-Analysis of Person-Job, Person-Organization, Person-Group, and Person-Supervisor Fit. Personnel Psychology 58, 281–342.

Kyriakopoulos, K., Moorman, C., 2004. Tradeoffs in Marketing Exploitation and Exploration Strategies: The Overlooked Role of Market orientation. International Journal of Research in Marketing 21, 219–240.

## L

Landwehr, J.R., Wentzel, D., Herrmann, A., 2013. Product Design for the Long Run: Consumer Responses to Typical and Atypical Designs at Different Stages of Exposure. Journal of Marketing 77, 92–107.

Langerak, F., Griffin, A., Hultink, E.J., 2010. Balancing Development Costs and Sales to Optimize the Development Time of Product Line Additions*. Journal of Product Innovation Management 27, 336–348.

Langerak, F., Hultink, E.J., Griffin, A., 2008. Exploring Mediating and Moderating Influences on the Links among Cycle Time, Proficiency in Entry Timing, and New Product Profitability. Journal of Product Innovation Management 25, 370–385.

Levinthal, D.A., March, J.G., 1993. The Myopia of Learning. Strategic Management Journal 14, 95–112.

Lew, Y.K., Sinkovics, R.R., 2013. Crossing Borders and Industry Sectors: Behavioral Governance in Strategic Alliances and Product Innovation for Competitive Advantage. Long Range Planning 46, 13–38.

Li, 2013. Disentangling the Effect of Exploratory Learning and Exploitative Learning in Product Innovation Process. Canadian Journal of Administrative Sciences / Revue Canadienne des Sciences de l'Administration 30, 101–114.

Li, Chu, C.P., Lin, C.J., 2010. The Contingent Value of Exploratory and Exploitative Learning for New Product Development Performance. Industrial Marketing Management 39, 1186–1197.

Li, Vanhaverbeke, W., Schoenmakers, W., 2008. Exploration and Exploitation in Innovation: Reframing the Interpretation. Creativity and Innovation Management 17, 107–126.

Liedtka, J., 2010. Business Strategy and Design: Can this Marriage Be Saved? Design Management Review 21, 6–11.

Liedtka, J., 2015. Perspective: Linking Design Thinking with Innovation Outcomes through Cognitive Bias Reduction. Journal of Product Innovation Management 32, 925–938.

Lockwood, T., 2010. Design Thinking in Business: An Interview with Gianfranco Zaccai. Design Management Review 21, 16–24.

Lohman, D. F., 2001. Issues in the Definition and Measurement of Abilities, Intelligence and Personality: Bridging the Gap in Theory and Measurement. Erlbaum, New York.

Lohmoller, J.-B., 1989. Latent Variable Path Modeling with Partial Least Squares. Physica, Heidelberg.

Lorenz, C., 1994. Harnessing Design as a Strategic Resource. Long Range Planning 27, 73–84.

## M

Maciver, F., 2012.
Diversity, Polarity, Inclusivity: Finding Balance in Design Leadership. Design Management Review 23, 22–29.

March, J.G., 1991.
Exploration and Exploitation in Organizational Learning. Organization Science 2, 71–87.

Marion, T.J., Meyer, M.H., 2011.
Applying Industrial Design and Cost Engineering to New Product Development in Early-Stage Firms. Journal of Product Innovation Management 28, 773–786.

McNally, R.C., Cavusgil, E., Calantone, R.J., 2010. Product Innovativeness Dimensions and Their Relationships with Product Advantage, Product Financial performance, and Project Protocol. Journal of Product Innovation Management 27, 991–1006.

Micheli, P., Jaina, J., Goffin, K., Lemke, F., Verganti, R., 2012. Perceptions of Industrial Design: The “Means” and the “Ends”. Journal of Product Innovation Management 29, 687–704.

Michlewski, K., 2008. Uncovering Design Attitude: Inside the Culture of Designers. Organization Studies 29, 373–392.

Miles, M.B., Huberman, A.M., 1994. Qualitative Data Analysis: An Expanded Sourcebook, 2nd ed. Sage Publications, Thousand Oaks, CA.

Miller, K., Moultrie, J., 2013.
Understanding the Skills of Design Leaders. Design Management Journal 8, 35–51.

Miron-Spektor, E., Erez, M., Naveh, E., 2011.
The Effect of Conformist and Attentive-To-Detail Members on Team Innovation: Reconciling The Innovation Paradox. Academy of Management Journal 54, 740–760.

Miron, E., Erez, M., Naveh, E., 2004.
Do Personal Characteristics and Cultural Values that Promote Innovation, Quality, and Efficiency Compete or Complement Each Other? Journal of Organizational Behavior 25, 175–199.

Moenaert, R.K., Robben, H., Antioco, M., De Schamphelaere, V., Roks, E., 2010.
Strategic Innovation Decisions: What You Foresee Is Not What You Get*. Journal of Product Innovation Management 27, 840–855.

Molina-Castillo, F.-J., Jimenez-Jimenez, D., Munuera-Aleman, J.-L., 2011.
Product Competence Exploitation and Exploration Strategies: The Impact on New Product Performance Through Quality and Innovativeness. Industrial Marketing Management 40, 1172–1182.

Mom, T.J.M., Van Den Bosch, F.A.J., Volberda, H.W., 2007. Investigating Managers’ Exploration and Exploitation Activities: The Influence of Top-Down, Bottom-Up, and Horizontal Knowledge Inflows*. Journal of Management Studies 44, 910–931.

## N

Nemeth, C., Goncalo, J.A., 2005.
Influence and Persuation in Small Groups, in: Brock, T.C., Green, M.C. (Eds.), Persuasion: Psychological Insight and Perspectives. Sage, London, pp. 171–194.

Nerdalize: Cloud Heater, 2015, October 12.
Retrieved from: http://npk.nl/project/nerdalize/

npk Insight: Design Strategy, 2015, December 16
Retrieved from https://vimeo.com/101596046

Norman, D., Verganti, R., 2014.
Incremental and Radical Innovation: Design Research vs. Technology and Meaning Change. Design Issues 30, 78–96.

## O

O’Cass, A., Heirati, N., Ngo, L.V., 2014.
Achieving New Product Success via the Synchronization of Exploration and Exploitation across Multiple Levels and Functional Areas. Industrial Marketing Management 43, 862–872.

O’Reilly, C.A., Tushman, M.L., 2013.
Organizational Ambidexterity: Past, Present, and Future. The Academy of Management Perspectives 27, 324–338.

## P

Pahl, G., Beitz, W., 1996. Engineering Design: A Systematic Approach, Second Edition ed. Springer, London, United Kingdom.

Pattikawa, L.H., Verwaal, E., Commandeur, H.R., 2006. Understanding New Product Project Performance. European Journal of Marketing 40, 1178–1193.

Payne, R., 1987. Individual Differences and Performance Amongst R and D Personnel: Some Implications for Management Development. R&D Management 17, 153–161.

Perks, H., Cooper, R., Jones, C., 2005.
Characterizing the Role of Design in New Product Development: An Empirically Derived Taxonomy*. Journal of Product Innovation Management 22, 111–127.

Person, O., Schoormans, J., Snelders, D., Karjalainen, T.-M., 2008. Should New Products look Similar or Different? The Influence of the Market Environment on Strategic Product Styling. Design Studies 29, 30–48.

Peters, J., 2012. Educating Designers to a T. Design Management Review 23, 62–70.

Pinto, M.B., Pinto, J.K., 1990.
Project Team Communication and Cross-Functional Cooperation in New Program Development. Journal of Product Innovation Management 7, 200–212.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y., Podsakoff, N.P., 2003. Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies. Journal of Applied Psychology 88, 879–903.

Podsakoff, P.M., Organ, D.W., 1986.
Self-Reports in Organizational Research: Problems and Prospects.
Journal of Management 12, 531–544.

## R

Raisch, S., Birkinshaw, J., 2008.
Organizational Ambidexterity: Antecedents, Outcomes and Moderators. Journal of Management 34, 375–409.

Raisch, S., Birkinshaw, J., Probst, G., Tushman, M.L., 2009. Organizational Ambidexterity: Balancing Exploitation and Exploration for Sustained Performance. Organization Science 20, 685–695.

Ravasi, D., Lojacono, G., 2005.
Managing Design and Designers for Strategic Renewal. Long Range Planning 38, 51–77.

Reckwitz, A., 2002.
Toward a Theory of Social Practices: A Development in Culturalist Theorizing. European Journal of Social Theory 5, 243–263.

Rijsdijk, S.A., Langerak, F., Jan Hultink, E., 2011. Understanding a Two-Sided Coin: Antecedents and Consequences of a Decomposed Product Advantage*. Journal of Product Innovation Management 28, 33–47.

Ringle, C.M., Wende, S., Will, A., 2005. SmartPLS 2.0 (beta). Hamburg: SmartPLS.

Roozenburg, N.F.M., Eekels, J., 1995. Product Design: Fundamentals and Methods. John Wiley & Sons, Chichester.

Roy, R., Potter, S., 1993. The Commercial Impacts of Investment in Design. Design Studies 14, 171–193.

Roy, R., Riedel, J.C.k.h., 1997. Design and Innovation in Successful Product Competition. Technovation 17, 537–594.

Rubera, G., Droge, C., 2013. Technology versus Design Innovation's Effects on Sales and Tobin's Q: The Moderating Role of Branding Strategy. Journal of Product Innovation Management 30, 448–464.

## S

Saldana, J., 2009. The Coding Manual for Qualitative Researchers. Sage, Thousand Oaks, CA.

Scheer, M., 2012. Are Emotions A Kind Of Practice (And Is That What Makes Them Have A History)? A Bourdieuian Approach To Understanding Emotion. History and Theory 51, 193–220.

Seawright, J., Gerring, J., 2008. Case Selection Techniques in Case Study Research: A Menu of Qualitative and Quantitative Options. Political Research Quarterly 61, 294–308.

Seidel, V.P., Fixson, S.K., 2013. Adopting Design Thinking in Novice Multidisciplinary Teams: The Application and Limits of Design Methods and Reflexive Practices. Journal of Product Innovation Management 30, 19–33.

Simoni, M., Cautela, C., Zurlo, F., 2014. Product Design Strategies in Technological Shifts: An Explorative Study of Italian Design-Driven Companies. Technovation 34, 702–715.

SKS Germany: Fietspompen. Leading the Way A New Direction for a Focused Brand. 2015, October 12. Retrieved from: http://npk.nl/project/sks-germany-pompen/

Sok, P., O'Cass, A., 2015. Examining the New Product Innovation – Performance Relationship: Optimizing the Role of Individual-level Creativity and Attention-to-detail. Industrial Marketing Management 47, 156–165.

Song, M., Im, S., Bij, H.v.d., Song, L.Z., 2011. Does Strategic Planning Enhance or Impede Innovation and Firm Performance? Journal of Product Innovation Management 28, 503–520.

Stevens, J., Moultrie, J., 2011. Aligning Strategy and Design Perspectives: A Framework of Design's Strategic Contributions. The Design Journal 14, 475–500.

Stigliani, I., Fayard, A., 2010. Designing New Customer Experiences: A Study of Socio-Material Practices in Service Design. Imperial Collage Business School, London.

Stone, M., 1974. Cross-Validatory Choice and Assessment of Statistical Predictions. Journal of the Royal Statistical Society. Series B (Methodological) 36, 111–147.

Storey, C., Cankurtaran, P., Papastathopoulou, P., Hultink, E.J., 2016. Success Factors for Service Innovation: A Meta-Analysis. Journal of Product Innovation Management, n/a-n/a.

Swan, K.S., Kotabe, M., Allred, B.B., 2005. Exploring Robust Design Capabilities, Their Role in Creating Global Products, and Their Relationship to Firm Performance*. Journal of Product Innovation Management 22, 144–164.



Szymanski, D.M., Kroff, M.W., Troy, L.C., 2007. Innovativeness and New Product Success: Insights from the Cumulitative Evidence. Journal of the Academy of Marketing Science, 35, 35–52.

## T

Talke, K., Salomo, S., Wieringa, J.E., Lutz, A., 2009. What about Design Newness? Investigating the Relevance of a Neglected Dimension of Product Innovativeness. Journal of Product Innovation Management 26, 601–615.

Trueman, D.M., Jobber, P.D., 1998. Competing Through Design. Long Range Planning 31, 594–605.

Tsai, M.-T., Huang, Y.-C., 2008. Exploratory Learning and New Product Performance: The Moderating Role of Cognitive Skills and Environmental Uncertainty. The Journal of High Technology Management Research 19, 83–93.

Turner, R., 2000. Design and Business Who Calls the Shots? Design Management Journal (Former Series) 11, 42–47.

## V

Valencia, A., Person, O., Snelders, D., 2013. An In-Depth Case Study on the Role of Industrial Design in a Business-to-Business Company. Journal of Engineering and Technology Management 30, 363–383.

Verganti, R., 2003. Design as Brokering of Languages: Innovation Strategies in Italian Firms. Design Management Journal (Former Series) 14, 34–42.

Verganti, R., 2008a. Design Driven Innovation. Harvard Business School Press, Boston, MA.

Verganti, R., 2008b. Design, Meanings, and Radical Innovation: A Metamodel and a Research Agenda. Journal of Product Innovation Management 25, 436–456.

Verganti, R., 2011. Radical Design and Technology Epiphanies: A New Focus for Research on Design Management. Journal of Product Inovation Management 28, 384–388.

Von Stamm, B., 2004. Innovation – What's Design Got to Do with It? Design Management Review 15, 10–19.

## W

Warde, A., 2005. Consumption and Theories of Practice. Journal of Consumer Culture 5, 131–153.

Wold, H., 1975. Path Models With Latent Variables: The NIPALS approach, in: Blablock, H.M., Aganbegian, A., Borodkin, F.M., Boudon, R., Capecchi, V. (Eds.), Quantitative Sociology: International Perspectives on Mathematical and Statistical Modeling. Academic, New York, pp. 307–357.

## Y

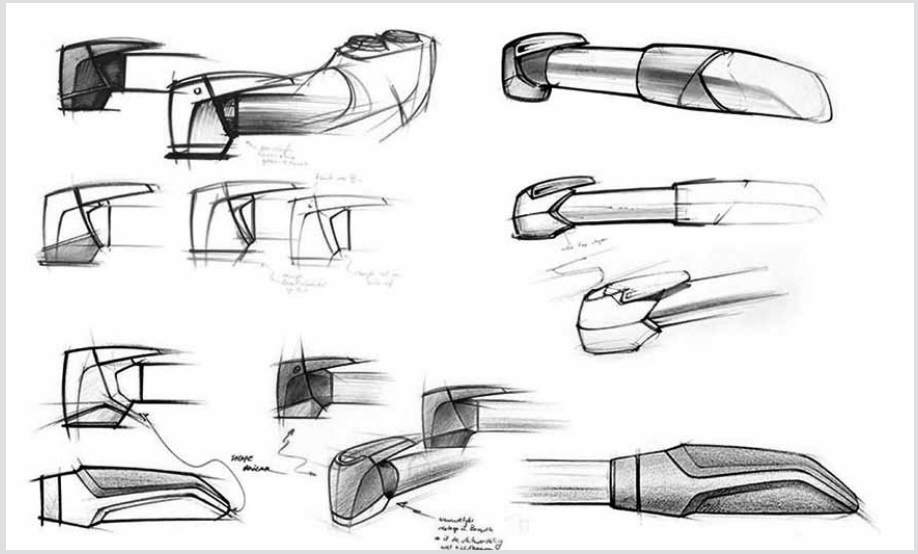
Yin, R.K., 2009. Case Study Research: Design and Methods. Sage, Thousand Oaks, CA.

## Z

Zomerdijk, L.G., Voss, C.A., 2011. NSD Processes and Practices in Experiential Services*. Journal of Product Innovation Management 28, 63–80

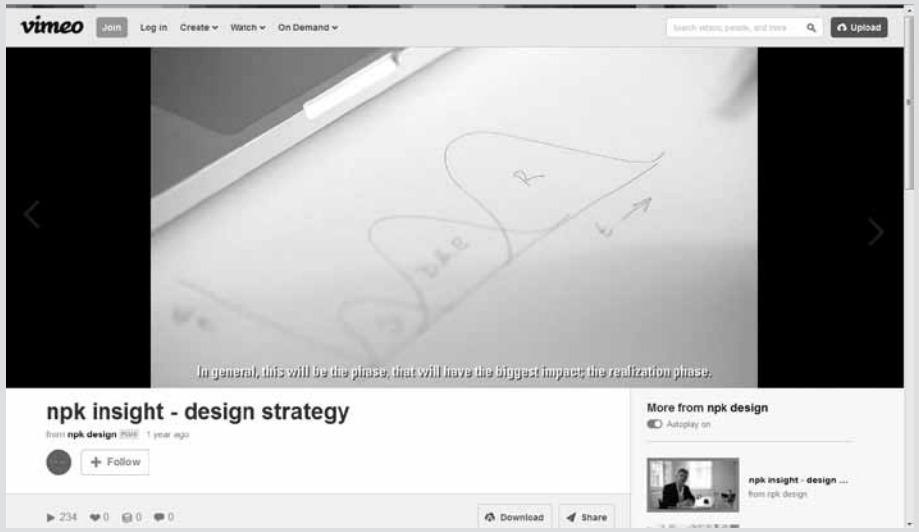
# Appendix

## APPENDIX 2 .1
## EXAMPLES OF PICTURES AND MOVIE STILLS FOR STUDY 1 – ‘DESIGNERS’ ROLE IN CREATING PROCESS UNDERSTANDING: PRACTICES AND ABILITIES FOR RADICAL AND INCREMENTAL INNOVATION PROJECTS’



Source: SKS Germany: Fietspompen.
Leading the way – a new direction for a focused brand (2015)

Source: Nerdalize: Cloud Heater (2015)




Source: npk Insight: Design Strategy (2015)

## APPENDIX 2 .2
## EXEMPLIFYING QUOTES FOR THE RELATIONS BETWEEN DESIGN PRACTICES AND ABILITIES FOR STUDY 1, 'DESIGNERS' ROLE IN CREATING PROCESS UNDERSTANDING: PRACTICES AND ABILITIES FOR RADICAL AND INCREMENTAL INNOVATION PROJECTS'

| PRACTICE AND ABILITY | EXEMPLIFYING QUOTES |
|---|---|
| Making the process accountable and overseeing the process | 'There are a lot of information streams in the structure of our organisation, but you have to be able to interpret them and tie them together. For example, which part of the budget is used in relation to the progress of the project.' |
| Making the process tangible and steering the process forward | 'You have to know what the next steps of the process are and at the same time make them tangible. Often you visualize and explain which steps you are going to take and why. Just having them in your head is not enough.' |
| Synchronizing designers' and clients' processes and adjusting the process iteratively | 'It is more than iterative. Iterative means you go back sometimes. But you also go forward. So you can see that something is not right and you go back. We also do the opposite, we take a big step forward, to get a look whether the direction we're heading is the right one.' |
| Creating ownership for the process and connecting with clients | 'What we try to do, what every designer tries to do, is to make the client the co-owner of what is happening. That he is partly responsible for the results that are being created in every phase. So you don't try to disconnect the designer from the client. There is a continuous focus that we do it together. That is why you build a relation with the client from the start. You do a lot of things together to see whether you can agree with each other. Because otherwise you lose the client somewhere in the process.' |
| Bringing the result of the process to life and telling a coherent and compelling story | 'The senior designer tells stories. He tells stories as regards to the concept. I noticed that this became much more important in the past couple of years. That you develop the content and the story in parallel. The communication that you need to sort of transfer the concept that you created to the client. There should be a fairy tale around it.' |
| Getting clients accustomed to designerly ways of working and creating client engagement | 'It should be fun for clients. When you are in a workshop.... The client has to experience it like a party to work on the project. It has to be fun. It is fun! If you can transfer that feeling of enthusiasm to the client, you can reach multiple goals. You get a better social connection within your team, you get credits from your clients, you get room to experiment, the client is happy.' |

## APPENDIX 2 .3
## EXEMPLIFYING QUOTES SHOWING THAT SOME PRACTICES AND ABILITIES ARE EMPHASIZED LESS IN INCREMENTAL VERSUS RADICAL INNOVATION PROJECTS FOR STUDY 1, 'DESIGNERS' ROLE IN CREATING PROCESS UNDERSTANDING: PRACTICES AND ABILITIES FOR RADICAL AND INCREMENTAL INNOVATION PROJECTS'

| PRACTICE AND ABILITY | INCREMENTAL: BIKE ACCESSORIES PORTFOLIO PROJECT FOR SKS GERMANY | RADICAL: CLOUD HEATER PROJECT FOR NERDALIZE |
|---|---|---|
| Making accountable and overseeing the process | 'In the beginning, we made a separate quote for every project, every pump. We made a document of 3 or 4 pages.' | 'This is the quote we sent to Nerdalize. You can see which phases we are going to go through in this document.' |
| Making tangible and steering the process forward | 'I explained who we are and what we have done in terms of bike projects and I told them what we had in mind. So I presented the idea of the workshops to check whether they like it to do it in this way. Is it useful?' | 'So we invited them to show them what we think should be done in the project and how we are going to do that. And then we gave a presentation about the [innovation] framework.' |
| Synchronizing designers' and clients' processes and adjusting the process iteratively | 'We did not adhere to it very strictly. Like, we agreed on this and this earlier so now we are going to.... We left the planning, the priorities to them: "You decide when something is going to be introduced and what the priorities are".' | 'Here you see things like a planning, and within a couple of days its updated. Here it goes on: a new planning.' |
| Creating ownership for the process and connecting with clients | 'What you see in this phase is that there is little effort to keep the client involved. Because they know it. They feel like: "You know what, we have to make a pump. If you send us the first phase in three weeks, it will be OK".' | 'We send drawings back and forth. You can explode them, all components so they can go into the details. To create that ownership. They know every corner, screw, thing...' |
| Bringing the result of the process to life and telling a coherent and compelling story | 'The products that they have in their portfolio, they known them inside out. It was more about positioning them better in the market.' | 'With Nerdalize the question was: "How is this thing going to work?". The basic principle was known, that you heat [houses] by using calculating power, by crunching data. But how and when and what the interaction with the user would be, that was not known.' |
| Getting clients accustomed to designerly ways of working and creating client engagement | 'No, they didn't come with suggestions [for new products]. They have a lot of knowledge about technology and they know what they like, but they can't...' | 'At a certain moment they were standing in front of [the stakeholder map] and we could just sit down.' |

## APPENDIX 3 .1
## RELIABILITY AND VALIDITY OF MEASURES FOR STUDY 2 – 'DO DESIGNERS AND MANAGERS COMPLEMENT EACH OTHER? THE INFLUENCE OF COGNITIVE STYLE ON FINANCIAL PERFORMANCE'

| CONSTRUCT | MEASUREMENT | MEAN | S.D. | LOADING |
|---|---|---|---|---|
| Financial performance (CR =0.92, AVE=0.78) | - The product attained its profitability goals. | 4.84 | 1.44 | 0.92 |
| | - The product attained its margin goals. | 4.61 | 1.46 | 0.85 |
| | - The product attained its ROI goals. | 4.50 | 1.41 | 0.89 |
| Product advantage (CR =0.88, AVE= 0.71) | - The product quality was superior to that of competing products. | 5.57 | 0.99 | 0.88 |
| | - The product was superior to competing products in terms of meeting the customer's needs. | 5.62 | 0.92 | 0.91 |
| | - The product offered the customer unique attributes or performance characteristics that are not provided by competing products. | 5.86 | 1.08 | 0.73 |
| Designers' creativity (CR=0.85, AVE=0.66) | - I have a lot of creative ideas. | 5.92 | 0.93 | 0.75 |
| | - I prefer tasks that enable me to think creatively. | 6.08 | 1.02 | 0.84 |
| | - I like to be innovative. | 6.10 | 1.01 | 0.85 |
| | - I like to do things in an original way. [a] | | | |
| Designers' conformity (CR=0.77, AVE=0.64) | - I try not to oppose other members of a team to which I belong. | 3.87 | 1.71 | 0.57 |
| | - I adapt myself to the organizational system. | 4.42 | 1.39 | 0.97 |
| | - I adhere to accepted rules in my area of work. [a] | | | |
| | - I avoid cutting corners. [a] | | | |
| Designers' attention to details (CR=0.82, AVE=0.61) | - I like to address the small details that are needed to perform a task. | 4.94 | 1.38 | 0.95 |
| | - I can perform a task accurately over a long period of time. | 5.14 | 1.51 | 0.51 |
| | - I am good in tasks that require dealing with details. | 5.23 | 1.43 | 0.82 |
| | - I am thorough when solving problems. [a] | | | |
| Managers' creativity (CR=0.88, AVE=0.72) | - I have a lot of creative ideas. | 5.80 | 1.16 | 0.94 |
| | - I prefer tasks that enable me to think creatively. | 5.98 | 1.00 | 0.77 |
| | - I like to be innovative. | 6.16 | 0.99 | 0.82 |
| | - I like to do things in an original way. [a] | | | |
| Managers' conformity (CR=0.94, AVE=0.56) | - I try not to oppose other members of a team to which I belong. | 3.82 | 1.59 | 0.55 |
| | - I adapt myself to the organizational system. | 4.24 | 1.43 | 0.91 |
| | - I adhere to accepted rules in my area of work. [a] | | | |
| | - I avoid cutting corners. [a] | | | |
| Managers' attention to details (CR=0.93, AVE=0.82) | - I like to address the small details that are needed to perform a task. | 4.51 | 1.72 | 0.86 |
| | - I can perform a task accurately over a long period of time. | 4.70 | 1.79 | 0.90 |
| | - I am good in tasks that require dealing with details. | 4.52 | 1.75 | 0.95 |
| | - I am thorough when solving problems. [a] | | | |

[a] We deleted these items in the scale purification process.

## APPENDIX 4 .1
## RELIABILITY AND VALIDITY OF MEASURES FOR STUDY 3 – 'EXPLORATION AND EXPLOITATION ACTIVITIES IN DESIGN INNOVATION'

| CONSTRUCT | MEASUREMENT | MEAN | S.D. | LOADING |
|---|---|---|---|---|
| Market performance (CR=0.90, AVE=0.74) | - The product attained its unit sales goals. | 4.51 | 1.38 | 0.77 |
| | - The product achieved a high level of customer satisfaction. | 5.63 | 1.04 | 0.90 |
| | - The product achieved a high level of customer acceptance. | 5.56 | 1.17 | 0.91 |
| Process performance (CR=0.81, AVE=0.59) | - The development costs of the product stayed within the budget. | 4.35 | 1.74 | 0.79 |
| | - The product was launched on time. | 4.32 | 1.88 | 0.88 |
| | - The product had a short 'time-to-market'. | 4.09 | 1.89 | 0.62 |
| Design innovativeness (CR=0.91, AVE=0.76) | - The appearance of the product represented something new or different in the industry of my firm. | 5.19 | 1.34 | 0.85 |
| | - The product evoked new or different emotions from customers, emotions that had never before been evoked by products in the industry of my firm. | 4.75 | 1.40 | 0.93 |
| | - The product provided customers with a new or different way to express their identity, a way that had never before been provided by products in the industry of my firm. | 4.18 | 1.59 | 0.84 |
| Exploration activities (CR=0.90, AVE=0.64) | - Activities in which the products or processes of my firm were strongly renewed. | 5.27 | 1.14 | 0.62 |
| | - Activities that required a degree of adaptability from my firm. | 4.96 | 1.33 | 0.88 |
| | - Activities that included the acquiring of new knowledge or skills for my firm. | 5.08 | 1.26 | 0.87 |
| | - Activities that were not clearly existing company practice for my firm. | 5.02 | 1.26 | 0.90 |
| | - Activities that involved searching for new possibilities with respect to the products, processes or markets of my firm. | 4.76 | 1.40 | 0.70 |
| Exploitation activities (CR=0.93, AVE=0.72) | - Activities that could be carried out as routine by my firm. | 4.32 | 1.35 | 0.92 |
| | - Activities in which my firm has accumulated a great deal of experience. | 3.58 | 1.26 | 0.87 |
| | - Activities that my firm clearly knew how to conduct. | 4.23 | 1.33 | 0.82 |
| | - Activities that could be properly conducted by using the present knowledge of my firm. | 4.27 | 1.25 | 0.85 |
| | - Activities that clearly fitted into the existing company policy of my firm. | 4.72 | 1.21 | 0.79 |
| Designers' decision freedom (CR=0.85, AVE=0.58) | - I needed to get permission from the project manager every time I wanted to do anything. [a] | 4.92 | 1.17 | 0.83 |
| | - The project manager strongly discouraged me from making my own decisions. [a] | 6.00 | 0.90 | 0.70 |
| | - Even small matters had to be referred to the project manager for a final answer. [a] | 5.25 | 1.27 | 0.83 |
| | - Any decision I made needed to be approved by the project manager. [a] | 4.58 | 1.27 | 0.69 |

[a] We reversed this item to reflect designer freedom.

# Summary (EN)

The overarching goal of this thesis is to investigate the antecedents and consequences of effective collaboration between designers and managers in innovation projects. It builds on findings from the design and innovation management literatures, which have suggested that the main antecedents of effective collaboration between designers and managers are their different ways of working and cognitive styles, as well as the management of these differences in terms of the decision freedom granted to designers. Moreover, the design and innovation management literatures have proposed that the main consequences of effective collaboration between designers and managers are higher levels of financial, market and process performance. This thesis extends the findings from the design and innovation management literatures by conducting three studies on these antecedents and consequences which fill the gaps in prior research.

The first study (presented in Chapter 2) investigates how designers can give managers insight in their way of working by creating process understanding. Namely, prior research has suggested that understanding about each other's way of working is important for effective collaboration between designers and managers, but it did not provide indications on how this understanding can be created. The first study aims to fill this gap in prior research by identifying the design practices and abilities that designers can use to explain their process to managers in the strategy, design and realization phases of radical and incremental innovation projects. Based on a case study of *npk design* and two innovation projects this Dutch design consultancy conducted for its clients, six design practices and six design abilities for process understanding are identified. The design practices that designers can use throughout the process of innovation projects are (although most are used in the strategy and design phases): *making the process accountable*, *making the process tangible*, *synchronizing designers' and clients' processes*, *creating ownership for the process*, *bringing the results of the process to life* and *getting clients accustomed to designerly ways of working*. The identified abilities that support the creation of process understanding are: *overseeing the process*, *steering the process forward*, *iteratively adjusting the process*, *connecting with clients*, *telling a coherent and compelling story* and *creating client engagement*. Lastly, the results from the first study show that designers put emphasis on two design practices and two design abilities in incremental innovation projects (the practices of *making the process accountable* and *making the process tangible* and *the abilities to oversee the process* and to *steer the process forward*), while they rely on all design practices and all design abilities in radical innovation projects.

The second study (presented in Chapter 3) investigates how designers' and managers' cognitive styles (in terms of creativity, conformity and attention to details) complement each other in achieving high levels of financial performance of innovation projects. This study contributes to prior research in two ways. First, it empirically test whether designers and managers complement each other in their cognitive styles, while prior research only *suggested* that this is the case. Secondly, it examines the influence of designers' and managers' cognitive styles on financial performance, which is important as prior research only investigated how integrating design or designers in innovation impacts this outcome. The results from an PLS-SEM analysis of 83 innovation projects (conducted by design consultancies and clients in The Netherlands) show that designers and managers complement each other in their creativity and conformity: while designers should be creative (and not conform to rules), managers should be conformist (and not creative). However, the results also suggest that designers and managers supplement (rather than complement) each other, as they should both be attentive to details to achieve higher levels of financial performance.

The third study (presented in Chapter 4) investigates the role of exploration and exploitation activities and of designers' decision freedom in design innovation. It contributes to prior research by investigating exploration and exploitation activities in design rather than technological innovation, which has been the focus of prior research. Moreover, it contributes to prior research by studying how the freedom granted to designers impacts design innovativeness and performance. Namely, prior research has suggested that the freedom granted to designers may increase innovativeness but it may decrease performance, but it did not empirically test this proposition. The results from this study (obtained through a PLS-SEM analysis of 83 innovation project conducted by Dutch design consultancies and their clients) show that exploration activities enhance design innovation, and that exploitation activities moderate the relationship between design innovation and process performance in such a way that this relationship is positive (negative) when high (low) levels of exploitation activities are completed in innovation projects. Moreover, the results show that when designers have high levels of decision freedom, the positive relationship between exploration activities and design innovation is enhanced. Last, the findings show that when designers are granted high (low) levels of decision freedom, the relationship between design innovation and market performance is negative (positive) while the relationship between design innovation and process performance is positive (negative).

This thesis ends with a discussion of the results in Chapter 5. First, the implications for research on the antecedents and consequences of effective collaboration between designers and managers are discussed, after which the practical implications of the findings are elaborated on. The findings from this thesis contribute to the research on the antecedents of effective collaboration between designers and managers by showing that the two should adopt each other's way of working and cognitive styles as well as cherish their differences, and by showing that there is a need for granting

designers the freedom to make decisions on their own as well for making decisions together with managers. In addition, the results from this thesis contribute to the research on the consequences of effective collaboration between designers and managers by showing that the two need each other's cognitive styles and they need to make decisions together to achieve high levels of financial and market performance, while designers can make decisions on their own to achieve process performance (both in terms of meeting budget and planning goals as well as achieving high product innovativeness). The practical implications of the findings are to be found in terms of improving the collaboration between designers and managers. More specifically, the results provide suggestions on how designers and managers can deal with their different ways of working and cognitive styles (by adapting to each other or by cherishing their differences), and how they can optimize decisions making. Overall, the results allow designers and managers to improve their collaboration to achieve higher levels of financial, market and process performance in their projects.

# Samenvatting (NL)

Dit proefschrift heeft als overkoepelend doel de antecedenten en consequenties van effectieve samenwerking tussen ontwerpers en managers in innovatieprojecten te onderzoeken. Het bouwt voort op bevindingen uit de design en innovatie management literatuur, die heeft gesuggereerd dat de belangrijkste antecedenten van de samenwerking tussen ontwerpers en managers hun verschillende manieren van werken en cognitieve stijlen zijn, evenals het management van deze verschillen in termen van de beslissingsvrijheid die wordt toegekend aan ontwerpers. De consequenties van de effectieve samenwerking tussen ontwerpers en managers (ook gesuggereerd door de design en innovatie management literatuur) zijn financieel, markt en processucces. Dit proefschrift breidt de bevindingen uit de design en innovatie management literatuur uit door drie studies naar deze antecedenten en consequenties uit te voeren welke een aantal leemtes in eerder onderzoek vullen.

De eerste studie (gepresenteerd in Hoofdstuk 2) onderzoekt hoe ontwerpers aan managers inzicht kunnen geven in hun manier van werken door het creëren van proces begrip. Eerder onderzoek heeft namelijk gesuggereerd dat het begrijpen van elkaars manieren van werken van belang is voor een effectieve samenwerking tussen ontwerpers en managers, maar het heeft geen richtlijnen gegeven voor het creëren van dit begrip. De eerste studie is bedoeld om een bijdrage te leveren eerder onderzoek door werkwijzen en vaardigheden te identificeren die ontwerpers kunnen gebruiken om hun proces aan managers uit te leggen in de strategie, ontwerp en de realisatie fases van radicale en incrementele innovatieprojecten. Op basis van een case studie van *npk design* en twee innovatieprojecten die dit Nederlandse ontwerpbureau heeft uitgevoerd voor zijn opdrachtgevers zijn zes werkwijzen en zes vaardigheden voor het creëren van procesbegrip geïdentificeerd. De werkwijzen die ontwerpers gedurende het proces van innovatieprojecten gebruiken zijn (hoewel de meeste tijdens de strategie en het ontwerp fases worden gebruikt): *het verantwoording afleggen over het proces*, *het tastbaar maken van het proces*, *het synchroniseren van het proces van ontwerpers en opdrachtgevers*, *het creëren van een gevoel van eigendom voor het proces*, *het tot leven brengen van de resultaten van het proces* en *het laten wennen van opdrachtgevers aan een ontwerpende manier van werken*. De geïdentificeerde vaardigheden voor het creëren van procesbegrip zijn: *het overzien van het gehele proces*, *het vooruit sturen van het proces*, *het iteratief aanpassen van het proces*, *het creëren van verbinding met opdrachtgevers*, *het vertellen van een coherent en overtuigend verhaal* en *het creëren van betrokkenheid bij opdrachtgevers*. Tot slot laten de resultaten van deze studie zien dat ontwerpers de nadruk leggen op twee werkwijzen en twee vaardigheden in incrementele innovatie projecten (de werkwijzen van *het verantwoording afleggen over het proces* en *het tastbaar maken van het proces* en *de vaardigheden van het gehele proces overzien* en *het proces vooruitsturen*), terwijl ze een beroep doen op alle werkwijzen en alle vaardigheden in radicale innovatieprojecten.



De tweede studie (gepresenteerd in Hoofdstuk 3) onderzoekt of ontwerpers en managers complementair zijn in hun cognitieve stijlen (in termen van creativiteit, conformisme en aandacht voor details) voor het bereiken van hoge financiële prestaties van innovatieprojecten. Deze studie draagt op twee manieren bij aan eerder onderzoek. Ten eerste test deze studie op een empirische wijze of ontwerpers en managers complementair zijn in hun cognitieve stijlen, terwijl eerder onderzoek alleen heeft *gesuggereerd* dat dit het geval is. In de tweede plaats onderzoekt deze studie de invloed van de cognitieve stijlen van ontwerpers en managers op de financiële prestaties van innovatieprojecten, wat belangrijk is omdat eerder onderzoek alleen heeft onderzocht hoe het gebruik ontwerp methodes of van het betrekken van ontwerpers in innovatie een effect heeft op dit soort uitkomsten. De resultaten van een PLS-SEM analyse van 83 innovatieprojecten (uitgevoerd door ontwerpbureaus en opdrachtgevers uit Nederland) laten zien dat ontwerpers en managers complementair zijn in hun creativiteit en conformisme: ontwerpers moeten creatief zijn (en niet conformistisch) terwijl managers conformistisch moeten zijn (en niet creatief). De resultaten suggereren echter ook dat de cognitieve stijlen van ontwerpers en managers supplementair zijn (in tegenstelling tot complementair), aangezien ze beide aandacht voor details moeten hebben om hogere niveaus van financieel succes te behalen.

De derde studie (gepresenteerd in Hoofdstuk 4) onderzoekt de rol van exploratie en exploitatie activiteiten en van de beslissingsvrijheid die wordt toegekend aan ontwerpers in projecten die gericht zijn op het bereiken van innovatief design. Deze studie draagt bij aan eerder onderzoek door de rol van exploratie en exploitatie activiteiten bestuderen in projecten die gericht zijn op het bereiken van innovatief design in plaats van in projecten die gericht zijn op het bereiken van innovatieve technologie, wat de focus van eerder onderzoek is geweest. Ook onderzoekt deze studie hoe de vrijheid die managers toekennen aan ontwerpers een effect heeft op het bereiken van innovatief en van succesvol design. Eerder onderzoek heeft namelijk gesuggereerd het niveau van innovatie van uitkomsten toeneemt maar dat het succes van uitkomsten afneemt als ontwerpers de vrijheid hebben om zelf beslissingen te nemen. Deze studie test deze stelling op een empirische wijze. De resultaten van deze studie (verkregen via een PLS-SEM analyse van 83 innovatie projecten uitgevoerd door Nederlandse ontwerpbureaus en opdrachtgevers) laten zien dat exploratie activiteiten leiden tot hogere niveaus van innovatief design, en dat exploitatie activiteiten de relatie tussen innovatief design en processucces op zo'n wijze modereren dat deze relatie positief (negatief) is wanneer hoge (lage) niveaus van exploitatie activiteiten in innovatieprojecten worden uitgevoerd. Ook tonen de resultaten aan dat wanneer ontwerpers hoge niveaus van beslissingsvrijheid hebben, de positieve relatie tussen de exploratie activiteiten en innovatief design sterker is. Allerlaatst tonen de bevindingen

aan dat wanneer een hoog (laag) niveau van beslissingsvrijheid wordt toegekend aan ontwerpers, de relatie tussen innovatief design en marktsucces negatief (positief) is terwijl de relatie tussen innovatief design en processucces positief (negatief) is.

Dit proefschrift eindigt met een discussie van de resultaten in Hoofdstuk 5. Allereerst worden de implicaties van de resultaten voor onderzoek naar de antecedenten en consequenties van effectieve samenwerking tussen ontwerpers en managers besproken, waarna de praktische implicaties van de bevindingen worden uitgewerkt. De resultaten van dit proefschrift dragen bij aan eerder onderzoek naar de antecedenten van effectieve samenwerking tussen ontwerpers en managers door te laten zien dat de twee elkaars manieren van werken en cognitieve stijlen moeten aannemen maar dat ze ook hun verschillen moeten koesteren om effectief te kunnen samenwerken, en door aan te tonen dat er een behoefte is om ontwerpers de vrijheid te geven om zelf beslissingen te nemen en om beslissingen tezamen te nemen met managers. Daarnaast leveren de resultaten van dit proefschrift een bijdrage aan het onderzoek naar de consequenties van een effectieve samenwerking tussen ontwerpers en managers door te laten zien dat de twee elkaars cognitieve stijlen nodig hebben en dat ze samen beslissingen moeten nemen om hogere niveaus van financieel en marktsucces te behalen, terwijl ontwerpers zelf beslissingen kunnen nemen om hogere niveaus van processucces te behalen (zowel in termen van het behalen van begrotings- en planningsdoeleinden als in termen van creëren van innovatieve uitkomsten). De praktische implicaties van de bevindingen hebben betrekking op het verbeteren van de samenwerking tussen ontwerpers en managers. In het specifiek geven de resultaten suggesties over hoe ontwerpers en managers om moeten gaan met hun verschillen (door zich aan elkaar aan te passen of door verschillen te koesteren), en hoe zij op een effectieve wijze beslissingen kunnen nemen. Samenvattend stellen de resultaten ontwerpers en managers in staat om hun samenwerking te verbeteren om hogere niveaus van financieel, markt en processucces van hun innovatieprojecten te realiseren.

# Streszczenie (PL)

Nadrzędnym celem tej rozprawy jest zbadanie czynników warunkujących i efektów skutecznej współpracy między projektantami i menedżerami projektów innowacyjnych. Praca ta opiera się na literaturze z dziedziny projektowania i zarządzania innowacjami, która sugeruje, że głównymi czynnikami warunkującymi skuteczną współpracę pomiędzy projektantami i menedżerami projektów innowacyjnych są różnice w ich sposobach pracy i stylach poznawczych, a także zarządzanie tymi różnicami, związane głównie ze swobodą podejmowania decyzji udzielanej projektantom. Ponadto, literatura ta głosi, że głównymi efektami skutecznej współpracy pomiędzy projektantami i menedżerami są wyższy poziom wyników finansowych, oraz wydajności rynkowej i procesowej. Rozprawa niniejsza poszerza dyskusję na temat projektowania i zarządzania innowacjami poprzez zaprezentowanie trzech nowych badań na temat czynników warunkujących i efektów współpracy projektantów i menedżerów, które to badania wypełniają luki w istniejącej literaturze.

Badanie pierwsze (przedstawione w rozdziale 2) koncentruje się na zrozumieniu procesu wzorniczego, przez który projektanci dają wgląd menedżerom w projektancki sposób pracy. Wcześniejsze badania sugerują, że zrozumienie siebie nawzajem ma istotne znaczenie dla skutecznej współpracy między projektantami i menedżerami, ale nie dostarczają konkretnych wskazówek na temat jak zrozumienie takie może zostać wykreowane. Badanie pierwsze ma na celu wypełnienie tej luki poprzez określenie praktyk i umiejętności, ktore projektanci mogą wykorzystywać do wyjaśnienia menedżerom procesu wzorniczego stosowanego w planowaniu strategicznym, projektowaniu i realizacji projektów innowacyjnych. Poprzez analizę Agencji Doradztwa Projektowego *npk design* i dwóch projektów innowacyjnych przeprowadzonych przez tą agencję dla ich klientów, zostało zidentyfikowanych sześć praktyk projektowania i sześć zdolności poznawczych będących kluczem do zrozumienia procesu wzorniczego.

Praktyki projektowania, które mogą być wykorzystywane przez projektantów w całym procesie wzorniczym projektów innowacyjnych obejmują (choć najczęściej wykorzystywane są tylko w fazach planowania strategicznego i projektowania): *sprawianie że proces staje się konkretny i namacalny*, *że staje się on czyjąś odpowiedzialnością*, *a także czyjąś własnością*, *sprawianie że wyniki procesu są wdrażane w życie*, *procesy projektantów i klientów są zsynchronizowane*, oraz *że klientci przyzwyczajają się do projektanckiego sposobu pracy*.

Z kolei umiejętności, które wspierają tworzenie zrozumienia procesu wzorniczego obejmują: *nadzór nad całym procesem*, *sterowanie procesem*, *iteracyjnie korygowanie*, *dobrą łączność z klientem*, *dostarczanie klientowi spójnej i kompletnej historii procesu*, i *wytwarzanie zaangażowania klienta*. Wreszcie, wyniki pierwszego badania pokazują, że projektanci kładą nacisk na dwie praktyki projektowania i dwie umiejętności w projektach skupionych na polepszaniu istniejących produktów, tzn. na praktyki dzięki czemu proces *nabiera odpowiedzialności*, *staje się konkretny i namacalny*, i na umiejętności dzięki którym *nadzorowanie i sterowanie procesem stają się możliwe i łatwo wykonalne*. Opierają się oni na wszystkich praktykach projektowych i umiejętnościach zidentyfikowanych w tej rozprawie w projektach skupionych na projektowaniu nowych produktów.

Badanie drugie (rozdział 3) analizuje w jaki sposób style poznawcze projektantów i menedżerów uzupełniają się nawzajem w kwestiach kreatywności, zachowawczości i dbałości o szczegóły, i jaki ma to wpływ na osiąganie wysokiego poziomu wyników finansowych projektów innowacyjnych. Badanie drugie wzbogaca wcześniejszą literaturę na dwa sposoby. Po pierwsze, testuje ono empirycznie czy projektanci i menedżerowie rzeczywiście uzupełniają się wzajemnie w ich stylach poznawczych, tak jak sugerują opracowania już istniejące, czy też uzupełnianie to jest dziełem przypadku. Po drugie, badanie niniejsze testuje wpływ stylów poznawczych projektantów i menedżerów na wyniki finansowe projektów innowacyjnych, podczas gdy badania uprzednie testowały jedynie wpływ integracji projektowania lub projektantów na te wyniki. Wyniki analizy typu PLS-SEM dla 83 projektów innowacyjnych prowadzonych przez projektanckie firmy konsultingowe dla ich klientów w Holandii wykazują, że projektanci i menedżerowie rzeczywiście uzupełniają się nawzajem w kreatywności oraz zachowawczości. Podczas gdy projektanci powinni być głównie twórczy (zamiast zachowawczymi), menedżerowie powinni pozostawać konformistami (a nie działać twórczo). Jednakże wyniki niniejszej rozprawy sugerują również, że projektanci i menedżerowie nie tylko uzupełniają się wzajemnie lecz także poszerzają zakres swojego działania. Dzieje się tak ponieważ obie grupy zwracają uwagę na szczegóły w celu osiągnięcia wyższego poziomu wyników finansowych.

Badanie trzecie (rozdział 4) skupia się na roli działań poszukiwawczych i eksploatacyjnych oraz na swobodzie decyzji projektanckich w innowacyjności wzorniczej. Badanie niniejsze rozszerza literaturę przedmiotu poprzez skupianie się na aktywności poszukiwawczej i eksploatacyjnej projektantów w projektach skupionych na innowacjach wzorniczych, a nie na innowacjach technologicznych, które są przedmiotem wcześniejszych badań. Ponadto, studiowanie swobody przyznawanej projektantom w zakresie decyzji projektanckich i jej wpływu na innowacyjność wzorniczą oraz wydajność projektowania jest kolejnym nowatorstwem niniejszej rozprawy. Literatura przedmiotu sugerują, że swoboda przyznawana projektantom może zwiększyć innowacyjność, ale także obniżyć wydajność. Do tej pory teza ta nie była jednakże testowana empirycznie. Wyniki niniejszego badania (uzyskane poprzez analizę PLS-SEM wykonaną dla 83 projektów innowacyjnych wzorniczych firm konsultingowych w Holandii) pokazują, że

działania poszukiwawcze zwiększają innowacyjność wzorniczą, oraz że działania eksploatacyjne modyfikują zależnością pomiędzy innowacjami wzorniczymi oraz wydajnością procesu w taki sposób, że związek ten jest dodatni przy wysokich poziomach działalności eksploatacyjnej w projektach innowacyjnych, oraz ujemny przy poziomach niskich. Ponadto, wyniki pokazują, że wysoki poziom swobody decyzji przyznawany projektantom, wzmacnia pozytywny związek istniejący pomiędzy działaniami poszukiwawczymi i innowacjnością wzorniczą. Niniejsza rozprawa udawadnia także, że przy wysokim poziomie swobody decyzji projektantów, innowacyjność wzornicza jest negatywnie związana z wynikami rynkowymi, oraz dodatnio z wydajnością procesu. Przy niskim poziomie swobody, innowacyjność wzornicza związana jest pozytywnie z wynikami rynkowymi oraz negatywnie z wydajnością procesową.

Rozprawa niniejsza konczy się dyskusją uzyskanych wyników przedstawioną w rozdziale 5. Na pierwszym miejscu, rozdział 5 posumowuje ogólne implikacje niniejszej rozprawy dla badań nad czynnikami warunkującymi i efektami współpracy między projektantami i menedżerami projektów innowacyjnych. Następnie, przedstawiona jest w tym rozdziale dyskusja praktycznych konsekwencji uzyskanych wyników. Wyniki przedstawione w tej pracy przyczyniają się do dalszego postępu w badaniach nad czynnikami warukującymi efektywną współpracę projektantów i menedżerów, przez pokazanie że obie grupy mogą i powinny przejmować wzajemne style pracy oraz procesów poznawczych, a także pielęgnować swoje różnice.

Rozprawa niniejsze pokazuje także, że istnieje potrzeba udzielanie projektantom znaczącej swobody przy podejmowania decyzji wzorniczych, ale równie ważne jest podejmowanie decyzji przez projektantów wspólnie z menedżerami. Ponadto, wyniki tej pracy przyczyniają się do dalszego zaawansowania badań nad skutkami efektywnej współpracy projektantów i menedżerów, pokazując, że obie grupy potrzebują siebie nawzajem, w szczególności w kwestii stylów poznawczych, oraz wspólnego podejmowania decyzji, niezbędnych dla osiągnania wysokiego poziomu wyników finansowych i rynkowych. Niezależnie od działań wspólnych, projektanci mogą i powinni podejmować decyzje na własną rękę, aby osiągnąć wysoką wydajność procesu wzorniczego (zarówno pod względem realizacji celów budżetowych i planowania, a także osiągnięcia wysokiej innowacyjności produktów). Praktyczne implikacje wyników niniejszej rozprawy leżą w zakresie poprawy współpracy pomiędzy projektantami i menedżerów. Wyniki tej rozprawy dostarczają wielu sugestii na temat jak projektanci i menedżerowie mogą radzić sobie z różnicami w ich sposobach pracy i stylach poznawczych (poprzez dostosowanie się do siebie lub, zależnie od sytuacji, pielęgnowanie różnic), oraz jak powinni optymalizować podejmowanie decyzji. Ogólnie rzecz biorąc, rozprawa niniejsza pokazuje projektantom i menedżerom jak dążyć do poprawienia ich wzajemnej współpracy w celu osiągnięcia wyższego poziomu finansowego, wydajności rynkowej i procesowej w ich projektach.

# Acknowledge-ments

During my bachelor of Industrial Design Engineering I set out to do (and finish!) a Ph.D. This idea matured during my master, after which I found myself doing what I planned. And now the moment is here: the research is done, the thesis is written! I must say the process was far more interesting than I could have ever imagined! Along the way, many have been involved. Some stayed with me during the whole Ph.D., while others were only briefly part of my process. To all of you I am grateful! Of course, some of you I would like to mention by name.

First and foremost, I would like thank my supervisors. Gerda, under your supervision I have learned so much! I am grateful for your close involvement in my project, and that you took the time and effort to provide me with valuable feedback. I can sincerely say that because of you, I am a better researcher! Erik Jan: thank you for your continuous support (on matters large and small alike). With a supervisor like you, it is smooth sailing through a Ph.D., as you can solve any problem there is (or so it seems). Nachoem, it is great to have had a mind like yours in my team! Thank you for making sure that all the t's were crossed and for putting the dots on the i's! I would also like to thank my external committee members for providing me with valuable comments on the (almost!) last version of my thesis and for taking part in my doctoral defence. Thank you Prof. Dr. Gloria Barczak, Prof. Dr. Fred Langerak, Prof. Dr. Hans Berends, Prof, Dr. Jan Schoormans and Prof. Ir. Deborah Nas.

This research wouldn't have existed without CRISP, so my gratitude goes out to the Dutch ministry of Education, Culture and Science for making the project possible. Also many thanks to my CRISP colleagues, and the CASD team in particular, for making the four (five, ahum) years a great experience! A special thanks to the CASD companies, for dedicating their time and energy to participating in my research. Reframing Studio, Fabrique, Flex the INNOVATIONlab, Scope Design and Strategy, Zeeno, Studio Dumbar, Océ, Philips Design, KLM and Skyteam: thank you! A special thanks goes out to *npk design* and their two clients for sharing their insights about creating process understanding with me: thank you designers and managers! Jos, I've had a great time working with you: I hope we have the opportunity to collaborate again in the future. Also a big thank you to all other organizations, designers and managers that participated in my research. I can't mention you all by name, but without you my thesis wouldn't be there!

I've also had the pleasure to spend the five years of my Ph.D. at the Product Innovation Management department of the Faculty of Industrial Design Engineering (TU Delft). PIM colleagues: thank you for providing me with an inspiring place to work and grow as a researcher. Also a big thanks to the ladies from the secretariat! You are the quiet force that keeps the department going, and you've helped me out with many practical matters. A special thanks goes out to my 'frolegues' Lise, Robin, Nick and Eva, for all the good times in and outside of the office (Although I haven't been much of a socializer lately. I will make that up to you!). I also cannot forget the most awesome office-mates ever! Ana and Milene, what can I say... We have shared good and bad times, and you will be in my heart forever! You girls are true friends indeed!

As many Ph.D.'s before me have pointed out: there is life outside of research (sometimes I forget, so it's important to write this down!). Dear friends, thank you for being there to provide me with the much needed distraction from statistics, paper writing, assignment grading, well... from work. Christien, Carling, Franciska, Jasper, Diederik, Otmar, Anna: thank you guys! Wendelien: I love to exchange life- experiences with you. It is truly inspiring to talk to you about work, about being a creative professional, about life in general... But most importantly: I am happy to have you as a friend! Sas! Another milestone that we share! Throughout all these years our friendship only became stronger: I can't wait to play Rummikub with you whilst sitting behind the geraniums! Chris and Fink: I consider you my extended family and you remind me of what is most important in life. Thanks to all three of you for being my home away from home!

Kochana Rodzinko w Polsce! Babciu Krysiu, Babciu Aniu, Dziadku Zdziśku, Ciociu Danusiu, Wójku Waldku, Adasiu i Asiu, Ewo i Pawełku! Często nie umiałam Wam wytłumaczyć co ja właściwie robię. Udawało mi się to tylko częściowo, ale i tak byliście i jesteście ze mnie dumni! Bardzo dziękuje za wsparcie! Mom, dad, Jasiek and Lies: you were the closest to me throughout these five years, and I couldn't have wished for more support! Words cannot express how grateful I am for all that you have done and keep on doing for me (but food can, right? So don't forget that you're invited for dinner!).

Mark, you've only shared a small part of my process, but the most challenging part indeed. I hope you know how grateful I am for all that you've done during these past months (from cooking dinner night after night after night to listening and giving advice when I needed it)! I am truly happy that I've met you and that I'm sharing my life with you (and with the kitties! There. I've said it)! Let's see what the future brings (besides Dr. Tabeauns, I mean!).

# About the author

Kasia Tabeau was born in 1985 in Warsaw, Poland. She studied Industrial Design Engineering (BSc and MSc) at Delft University of Technology (The Netherlands). After graduating in 2011 (cum laude), she became a Ph.D. researcher in Strategic Design at the same university, pursuing her research career at the department of Product Innovation Management. Her Ph.D. research focuses on how designers can play a strategic role in innovation projects by more effectively collaborating with managers. Next to strategic design, Kasia's research interests include design management, design thinking, service design and user-centered design. Kasia presented her research at international conferences in marketing, management and innovation, such as: EIASM International Product Development Management Conference, Continuous Innovation Network Conference and the European Marketing Academy Conference. Her research was part of the Creative Industry Scientific Program (CRISP) which focused on stimulating the continuing growth of the Dutch Design Sector and Creative Industries. The CRISP program was sponsored by the Dutch Ministry of Education, Culture, and Science.



BOOK CHAPTERS

Tabeau, K., Gemser, G., Oberdorf, J. (Accepted: forthcoming in 2016)
"Designers' role in creating process understanding: practices and abilities for radical and incremental innovation projects", Strategic Design Practices for Competitive Advantage, BIS publishers: Amsterdam

JOURNAL PUBLICATIONS

Tabeau, K., Gemser, G., Hultink, E.J., & Wijnberg, N.M.
(Accepted: forthcoming in 2016) "Exploration and exploitation activities for design innovation", Journal of Marketing Management

CONFERENCE PUBLICATIONS

Tabeau, K., Gemser, G., & Hultink, E.J. & Wijnberg, N.M. (2015)
"Exploration and exploitation activities for design innovation", 39th Product Development and Management Conference, Anaheim, U.S., 7–8 November 2015

Tabeau, K., Gemser, G., Hultink, E.J., & Wijnberg, N.M. (2014)
"Do designers and managers complement each other? The influence of cognitive styles on product performance", 19th Academic Design Management Conference, London, United Kingdom, 2–4 September 2014

Tabeau, K., Gemser, G., Wijnberg, N.M., & Hultink, E.J. (2013)
"What is your experience? A study on collaborating NPD professionals and the effects of their dissimilar experiences on NPD outcomes", 20th International Product Development Management Conference (IPDMC), Paris, France, 23–25 June 2013

Tabeau, K., Gemser, G., Wijnberg, N.M., & Hultink, E.J. (2013)
"Mental model differences between external designers and their clients: the influence on project exploration, project exploitation and project performance", 42nd annual EMAC conference, Istanbul, Turkey, 4–7 June 2013

Tabeau, K., Gemser, G., Wijnberg, N.M., & Hultink, E.J., (2012)
"Ambidexterity in dyadic NPD relationships", 19th International Product Development Management Conference (IPDMC), Manchester, United Kingdom, June 17–19, 2012

Designers are increasingly playing a strategic role in innovation projects. They can do this, amongst others, by more effectively collaborating with the managers of these projects. This thesis investigates the antecedents and consequences of effective collaboration between designers and managers in innovation projects. It builds on findings from the design and innovation management literatures, which have suggested that the main antecedents of effective collaboration between designers and managers are their different ways of working and cognitive styles, as well as the management of these differences in terms of the decision freedom granted to designers. Moreover, the design and innovation management literatures have proposed that the main consequences of effective collaboration between designers and managers are higher levels of financial, market and process performance. This thesis extends the findings from the design and innovation management literatures by conducting three studies on these antecedents and consequences which fill the gaps in prior research. The findings from these three studies show that designers and managers should adopt each other's way of working and cognitive styles as well as cherish their differences to collaborate effectively, and they show that there is a need for granting designers the freedom to make decisions on their own as well for making decisions together with managers. In addition, the results from this thesis contribute to the research on the consequences of effective collaboration between designers and managers by proposing that the two need each other's cognitive styles and they need to make decisions together to achieve high levels of financial and market performance, while designers can make decisions on their own to achieve process performance (both in terms of meeting budget and planning goals as well as achieving high product innovativeness).