FACTORS INFLUENCING THE LEVEL OF USER PARTICIPATION IN HUMAN CENTRED DESIGN PROJECTS: AN EXPLORATORY STUDY

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ABSTRACT

BACKGROUND: Human Centred Design (HCD) is an approach to designing products and systems that places end-users' needs centrally. HCD encases a broad selection of design methods that focus on end-users. These methods differ in the extent of end-user participation with the design team. Two major HCD methods are 1) User Centred Design (UCD), which refers to a design situation in which end-users are visualised and empirical measurement does not occur, and 2) Participatory Design (PD), which encompasses designing using empirical measurement, and in cooperation with actual end-users.

OBJECTIVES: The factors that influence practitioners to adopt a UCD or PD method, besides practical matters such as time and monetary constraints, are scarcely covered in current literature. Further, practitioners' views on these factors are not known. This study identifies the influencing factors that motivate practitioners to adopt either a UCD or a PD method, and explores which practitioner views exist on the choice for adopting either a UCD or PD method, based on these factors.

METHOD: In order to explore practitioners' views regarding the influencing factors for adopting UCD or PD, Q-methodology, which is a card-sorting method, has been carried out among a participant sample of 26 Dutch HCD-practitioners. Participants sorted a set of 34 statements (i.e. influencing factors) on a continuum approximating a Normal distribution and ranging from UCD to PD. Additionally, both pre- and post-sorting interviews were conducted; the former to identify participants' organisational environment and the latter to gain insights into the reasoning behind the sorting.

RESULTS: 34 factors influencing practitioners' choice to adopt either UCD or PD were found. Further, 5 unique practitioner views on choosing a UCD or PD method, based on the 34 factors, were found. Practitioners tend to focus on 1) understanding usability requirements, 2) understanding contexts, 3) understanding the market, 4) understanding users, and 5) understanding resources.

CONCLUSION: This study shows that practitioners' motivation considering the extent of user participation in HCD projects is dependent on a multitude of factors, which often, contradictory to academic literature, move beyond practical matters. Further, practitioners' have highly divergent views on the factors: 5 views were found, in which different factors contribute to either adopting UCD or PD. Moreover, influencing factors motivate some practitioners towards UCD, while motivating other practitioners towards PD.

Keywords: Human Centred Design, User Centred Design, Participatory Design, User Participation

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1. INTRODUCTION

Since the early 1980s, a view developed among designers that, in order to create products and systems that are perceived by end-users as being simple to use, intuitive, and enjoyable, end-user input should, in some way, be incorporated into the design process. This general view on designing is embodied in Human Centred Design (HCD). HCD is an approach to designing systems and products that places the needs and capabilities of end-users centrally. It is believed that taking end-users into consideration when designing a system is beneficial for the usability of that system (e.g. Gould & Lewis, 1985; Maguire, 2001; Wallach & Scholz, 2012), and usability is considered to be "critical to the success of an interactive system or product" (Maguire, 2001, p. 587). Maguire (2001) writes that unusable systems can lead to lower user satisfaction, underuse and misuse. In contrast, he mentions five benefits of usable systems: 1) a more effective use of the system, 2) a decrease in human error-making, 3) a decrease in the need for training and support, 4) an increase in system acceptance and trust, and 5) an enhanced company image.

However, HCD is not a fixed work method. Rather, HCD is a "group of methods and principles aimed at supporting the design of useful, usable, pleasurable and meaningful products or services for people" (Van der Bijl-Brouwer & Dorst, 2017, p. 2). In other words: HCD is aimed towards placing people, and not, for example, product features, centrally. There are multiple ways of placing end-users centrally when designing a product or system. Two major approaches in HCD, that differ in terms of empirical measurement, are implemented through 1) visualising end-users, without involving them in the actual design process, and 2) actively incorporating end-users in the design process. In this paper, the two approaches will be referred to as 1) User Centred Design (UCD), and 2) Participatory Design (PD).

There is ample literature concerning UCD and PD, and their drawbacks and benefits. However, current literature often focuses on either of the two methods. Academic literature comparing UCD methods to PD methods is scarce. A recent study by Mirri, Rocetti, and Salomoni (2018) compared UCD and PD methods when designing mobile applications for students. In this study, user reports showed that users were satisfied with both apps – regardless of whether a UCD or PD approach was taken during development. This finding shows that perhaps not the design method in itself should be the main influencing factor for choosing a particular HCD approach, but rather the context in which the design process is carried out. For some part, this topic has been covered by Karlsson, Holgersson, Söderström, and Hedström in 2012. They evaluated to what extent, among others, UCD and PD can aid in achieving strategic e-service goals in public e-service development. In the study, Karlsson et al. identified three challenges or considerations which should be taken into account when choosing among HCD methods:

1) determining a clear user segment with which to perform HCD, 2) determining users' motivation for participating in an HCD process, and 3) determining which knowledge and skills can be expected from users. However, these findings are focused specifically on public e-service. Further, they are focused primarily on users and not on the context in which designers perform HCD. This study's first aim is to identify more generally the factors that drive HCD project members towards adopting either a user centred or a participatory design approach. As portrayed in the study's first research question:

RQ1: Which are the factors that influence HCD practitioners to adopt either a UCD or a PD approach?

Second, practitioners' views on these factors are explored. As stated in the second research question:

RQ2: Which views regarding the choice for adopting either a UCD or PD approach, based on the influencing factors, exist among HCD practitioners?

The relevance of this study is found in the exploration of views considering HCD practices. HCD practices and measurements vary greatly among practitioners (Lewis, 2014; Putnam et al., 2016). What is needed to streamline these conceptions and perhaps make HCD practice more comprehensible, is insights in the way HCD practitioners do their job, and the effectiveness of their operations. As Lewis (2014) states: "I want to end with a call to action. Specifically, I encourage practitioners as well as researchers to look for opportunities in their day-to-day work to study and compare different methods and, most important, to publish the findings." This study aims to, at least partly, answer Lewis' call. It does so in two ways. First, it provides a more complete overview – one that moves beyond mere practical grounds – of factors that influence practitioners' inclination towards PD or UCD. Second, the study provides insights in practitioners' views on adopting either a UCD or PD strategy.

In the next section of this report, the key concepts of this study will be further elaborated. Additionally, the knowledge gap that this study aims to bridge – insights in choosing an HCD method from a practitioners' viewpoint – is discussed.

2. THEORETICAL FRAMEWORK

2.1 HUMAN CENTRED DESIGN AND USABILITY

Human Centred Design (HCD) is an approach to designing systems and products that places the needs and capabilities of end-users centrally. Gould and Lewis (1985), while laying the foundations of HCD, stated that “any system designed for people to use should be easy to learn (and remember), useful, that is, contain functions people really need in their work, and be easy and pleasant to use” (p. 300). The notion of a human centred approach to designing developed in the mid-1980s. In 1985, Gould and Lewis published their paper “Designing for Usability: Key Principles and What Designers Think”, thereby capturing the groundwork of HCD. Gould and Lewis address three basic principles of HCD: 1) early focus on users and tasks, 2) empirical measurement, and 3) iterative design. While often readdressed (e.g. Norman & Draper, 1986; Maguire, 2001), these three principles still are widely accepted as imperative preconditions of HCD.

What Gould and Lewis were aiming at improving through HCD is the usability of products and systems. Usability is defined in the ISO EN 9241-11 as the “Extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use”. Given the similarities in Gould and Lewis’ foundations of HCD, and the definition of usability in the ISO EN 9241-11, one could say that usability is the essence of a good product, and thus forms the heart of HCD (Wallach & Scholz, 2012).

In 2014, Lewis published an article named “Usability: Lessons Learned... and Yet to Be Learned.” The goal of this article was to review the evolution of usability over the past 30 years – since Gould and Lewis published their first paper regarding usability. Further, Lewis (2014) reviewed existing debates in the field of usability and formulated several lessons to learn and be learned. Among others, Lewis described the importance to distinguish between summative and formative usability. Put simply, the former is usability based on metrics: for example, achieving specified goals with effectiveness, efficiency and satisfaction, as described in the ISO definition of usability. The latter is based on problem diagnostics, i.e. “the presence of usability depends on the absence of usability problems” (Lewis, 2014, p. 665). Thus, two forms of usability exist. Using both forms in an iterative design process while employing qualitative and quantitative methods would be an ideal HCD process (Lewis, 2014). Such a process could follow five phases: 1) planning, 2) determining the context of use, 3) determining user and organisational requirements, 4) designing, and 5) evaluating designs (Maguire, 2001). A visual representation of this iterative HCD process is given in figure 2.1.

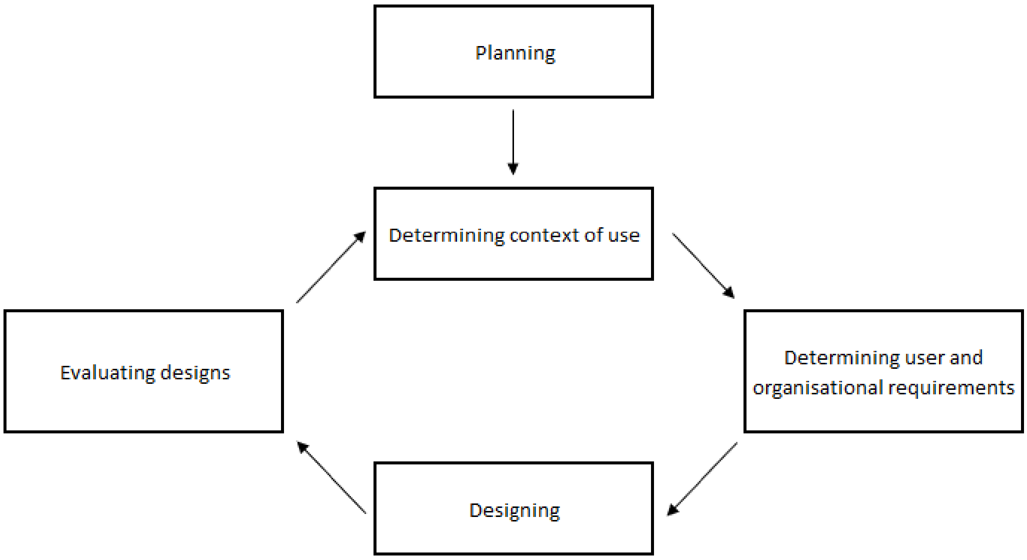


Figure 2.1: The 5 phases of a continual HCD process

Like Lewis (2014), Putnam et al. (2016) review and continue on Gould and Lewis (1985) almost 30 years after the publication of "Designing for Usability: Key Principles and What Designers Think" to revisit practitioners' perspectives on usability. Putnam et al. distinguish 4 job groups in HCD work: researcher, designer, researcher & designer, and manager. What they found, is that HCD conceptions diverged considerably among job groups. Further, the extent of 'human centredness' differed among job groups and conceptions regarding usability and HCD varied considerably among HCD practitioners. This implicates that, although thoroughly reviewed in academic literature, in practice, HCD and usability still are ambiguous topics. A possible explanation for this might be the fact that a great assortment of HCD methods exists, each specialised for particular situations. Further, the fact that HCD has evolved greatly towards a specialised field with a distinct focus on interactions between users (Van der Bijl-Brouwer & Dorst, 2017) could have an influence. Considering the divergence in HCD conceptions, it is important to properly define the key concepts regarding HCD that are used in this study. This is done in the following section.

2.2 KEY CONCEPTS

Human Centred Design is often considered to be an "umbrella term" (Cruickshank & Trivedi, 2017, p. 562) for an assortment of design methods that place end-users' needs centrally. In this study, three key concepts regarding HCD are mentioned: 1) Human Centred Design (HCD), 2) User Centred Design (UCD), and 3) Participatory Design (PD). From this point forward, HDC, UCD, and PD will be regarded as follows:

- HCD: an umbrella term for all design methods that focus on users, in whatever way (which includes both UCD and PD);
- UCD: design processes in which end-users' needs are taken into consideration, but where end-users are not necessarily empirically involved in the actual design process, e.g. users can be envisioned using personas or other forms of virtualisation (Mirri et al., 2018);
- PD: design processes in which end-users are empirically involved in the design process, for example through working together with software engineers (Mirri et al., 2018).

HCD, UCD and PD are commonly used concepts within HCD literature. However, there is a discussion based on the terminology of HCD vs. UCD. Some scholars favour the term HCD, because UCD, in focusing on "users" and not actual people (i.e. humans), is dehumanizing (e.g. Steen, 2011). Further, the concepts HCD, UCD, and PD are often treated as being interchangeable. For example, both the terms HCD (e.g. Maguire, 2001) and UCD (e.g. Wallach & Scholz, 2012) have been known to describe design methods that, in this article, would be referred to as Participatory Design. Given the fact that the walls between UCD and PD research are becoming increasingly permeable (Karlsson et al., 2012), it can be expected that terminology regarding HCD concepts becomes increasingly ambiguous as well.

One should note, however, that in this article HCD refers to a totality of design methods that revolve around end-users, whereas UCD and PD refer to sets of specific design methods within the totality of HCD. In this study, the main distinction between UCD and PD is empirical measurement. This distinction is based on Gould and Lewis (1985), who stress the importance of empirical measurement when designing for usability, and would therefore, in this study, be regarded as advocates of PD. HCD can be seen as a continuum of design methods that increasingly incorporate empirical measurement, often through user participation. At one extreme of the continuum, where empirical measurement is not incorporated in the design method, one finds UCD. On the other extreme, one finds PD, where empirical measurement is considered crucial. This is illustrated in Figure 2.2.

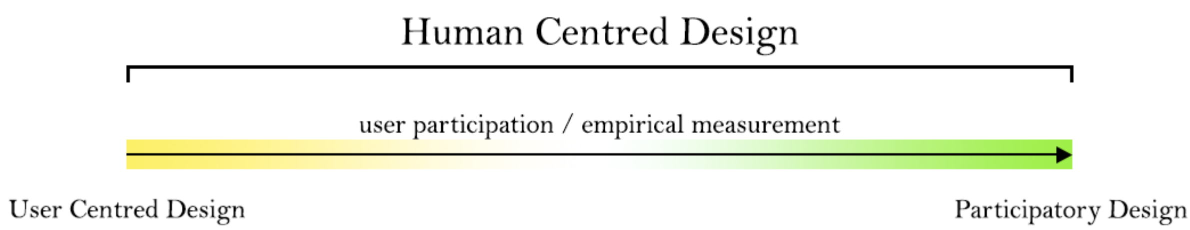


Figure 2.2: The User Participation Continuum in HCD

Karlsson et al. (2012) note a second distinction between UCD and PD, which is the role of the designer. In UCD, designer and user are not equal; designers alone are responsible for the actual creation of a product. With PD, however, user and designer are equal; both users and designers have an actual influence in the design process and creation of the product.

2.2.1 User Centred Design

User Centred Design is a form of HCD based on "designing and developing applications or products where a team of designers focuses on users' needs in an iterative way" (Mirri et al., 2018, p. 2). Arguably, user personas are the most distinct UCD method available. A user persona "represents a group of users who share common goals, attitudes, and behaviors in relationship to a particular product or service" (Putnam et al., 2016, p. 449). Personas aid designers by directing their focus on users and their needs, communicate about users, make design choices regarding product characteristics, comprehend and empathize with users, and avoid designing based on user assumptions (Nielsen, Nielsen, Stage, & Billestrup, 2013; Putnam et al., 2016).

In this study, empirical measurement of users is not present when applying a UCD method. However, many organisations and academics believe that empirical measurement is crucial for the creation of a successful product (Steen, 2011). Returning to the UCD-typical example of user personas, many scholars argue that empirical measurement is critical for the creation of a good user persona (e.g. Chang, Lim, & Stolterman, 2008; Nielsen et al., 2013; Putnam et al., 2016). However, in his book "The Inmates are Running the Asylum", Alan Cooper (2004), who introduced the concept of user personas, quite rigorously states the exact opposite (p. 100), illustrating the validity of a UCD method:

> "The most obvious approach—to find the actual user and ask *him*—doesn't work for a number of reasons, but the main one is that merely being the victim of a particular problem doesn't automatically bestow on one the power to see its solution. […] The actual method that works sounds trivial, but it is tremendously powerful and effective in every case: We make up pretend users and design for *them*. We call these pretend users *personas*, and they are the necessary foundation of good interaction design."

The discussion whether UCD or PD design methods yield better results is lively, with scholars from both sides actively and passionately defending their standpoints. Arguments in favour of UCD often focus on efficiency, for example regarding time, monetary resources, and personnel. However, such arguments tend to serve more as disputes against PD, rather than for UCD. Indeed, many studies showcasing PD mention high expenditure as a significant drawback, even when the effectiveness of the PD approach is considered satisfactory (e.g. Delikostidis, Van Elzakker, & Kraak, 2016; Siebenhandl, Schreder, Smuc, Mayr, & Nagl, 2013; Tolkamp, Huijben, Mourik, Verbong, & Bouwknegt, 2018).

Additionally, Bellamy et al. (2007) present two challenges in PD. First, people have different needs. In other words, when dealing with a user group in the design process, it is impossible for designers to create a product that satisfies the needs of all involved users. This is confirmed in a comprehensive case study by Siebenhandl et al. (2013), who comprehensively described the implication of a PD process for the design of self-service ticket vending machines. They found that when applying a PD approach to a large target group, user input is often contradictory due to differences within the target group. Furthermore, they mentioned that "actual design ideas contributed by the (potential) users were of limited use" (p. 156). Focusing more on commercial environments, Tolkamp et al. (2018) state that "[user-]generated ideas can be of low value to the firm or unfeasible" (p. 760-761).

Second, Bellamy et al. mention that user needs are not static, but rather evolve over time. More specifically, the needs of a user group evolve – even when the design of a product is completed. Therefore, even if a designer manages to create a product perfectly adapted to all user needs, those needs will change, inevitably rendering all PD data, and thus the designed product, outdated. Similarly, Norman (2005), who designed some of the "fundamental principles" (Cruickshank & Trivedi, 2017, p. 563), of designing for users in the early 1980s, claims that focussing on exceedingly specific end-users during the design process might decrease the product usefulness for larger groups.

More methodological concerns on user input are expressed by Sullivan et al. (2017). They state that "researchers are sceptical about the effectiveness of these one-off encounters for shaping engineering priorities" (p. 494). A possible explanation for this could be that users are unable or unwilling to voice their opinion to designers (Van Kleef, Van Trijp, & Luning, 2005). On the other hand, designers may develop a user bias regarding user needs when dealing with end users frequently (Panne, Van Beers, & Kleinknecht, 2003). Further, concerns regarding user input draw on the fact that many of today's most influential and successful technologies (e.g. clocks, vehicles, and musical instruments) were not inspired by user input (e.g. Norman, 2005; Sullivan et al, 2017), possibly demonstrating that the input of end-users is not essential to the creation of good products and systems. Steen (2011) and Stewart & Williams (2005) continue this thought, stating that focussing too much on the expressed needs of a particular, involved user group might diminish the agency and creativity of designers. As stated by Steen (2011): "HCD practitioners need to combine and balance their own knowledge and ideas with users' knowledge and ideas; they will have to decide when and how, and to what extent, to be human-centred" (p. 47).

Last, an argument in favour of UCD poses that PD might not be appreciated by end-users (Carpentier, 2009). In an article with the appropriate name "Participation is not enough", Carpentier illustrates just that: for successful cooperation with users, participation alone is not enough. There needs to be professional quality in the cooperation and social relevance for the audience as well; aspects which are often forgotten in PD research.

2.2.2 PARTICIPATORY DESIGN

Participatory design is "an approach towards computer systems design in which the people destined to use the system play a critical role in designing it' (Schuler & Namioka, 1993, p. xi). Although this definition is based on PD in computer systems design, while PD has since evolved to being practised in other types of products and systems as well, the definition still captures the essence of PD: end-users are *participating* in the design process and have an actual influence on the creation of the product. PD is particularly effective in cases where user tasks are not clear, or when the user populations are unconventional (Karlsson et al., 2012). In contrast to a beforementioned statement made by Cooper (2004), who poses that end-users are not necessarily able to solve a problem, merely because they experience it, PD relies on the exact opposite: the best solutions for a problem will most likely come from those who are experiencing it (Miller, 1993).

Adequately summarised by Karlsson et al. (2012) are the general benefits of PD:

> "Existing research shows that user participation results in a more complete and accurate definition of requirements (Maiden & Rugg, 1996), improvement of work organization and industrial democracy (Cherry & Macredie, 1999), improved user interfaces (Smith & Dunckley, 2002), decreased user resistance to change (Bjerknes & Bratteteig, 1995), and greater user commitment to the implemented system (Markus, 1983)" (p. 159).

There are different levels of user participation in PD projects. Mumford (1983), distinguishes three. First and least extensive, users are brought in as consultants to help make distinct design decisions. Second, users can be strategically selected to help make design decisions. Last, designers can strive towards a consensus situation, where all involved participating users are in agreement with one another.

Gould and Lewis (1985), strong proponents of involving actual end-users in the design process, argue that user ideas are the most valuable form of input because they explain not only the problem itself, but also the reason behind it. Elaborating on this subject, Spinuzzi (2005) states that PD approaches offer great value because of the method's ability to uncover tacit knowledge. Tacit knowledge is "what people know without being able to articulate" (p. 165). Tacit knowledge can only be uncovered or learned through experience (Zuboff, 1988), which is why, when carrying out UCD, practitioners will likely be unable to uncover tacit knowledge. In other words, interactively and empirically involving end-users in the design process, and thus carrying out PD, is necessary to uncover tacit knowledge.

Building on this, Spinuzzi argues that when tacit knowledge remains undiscovered, system designers are at risk of oversimplifying user tasks, resulting in inadequate system design solutions. One should note, however, that Spinuzzi defines PD as an extensive collaboration with end-users. Less intense forms of PD, such as in-depth interviews, assumedly will not uncover tacit knowledge.

An additional argument in favour of PD is presented by Van der Bijl-Brouwer and Dorst (2017), who argue that HCD is "now at a point where there is an opportunity for HCD to be adopted outside the traditional design field in strategic innovation processes" (p. 7). In order to achieve innovative products, deeper insights in users are needed, "such as human values and meanings" (p. 8). These insights cannot be obtained through UCD, since they should come from the user group directly, i.e. empirically. Thus, in order to design strategic, innovative products, designers should adopt a PD approach.

Potential ethical benefits of PD are expressed by Rose (2016), who states that, next to providing useful information to designers, the increasing popularity of incorporating empirical measurement in the design process creates a "unique opportunity to advocate for inclusion of a social justice perspective in design conversations with developers, organizations, and policymakers" (p. 442), implying that designers, while interacting with actual end-users, should include vulnerable populations such as minorities, the underprivileged and the disabled. This way, technologies can be designed for the inclusion of people from all social statues and aim at bridging societal disparities.

Continuing on ethical benefits of PD, Spinuzzi (2005) suggests that, in organisational settings, PD approaches improve end-users' position in terms of empowerment, stating:

> Participatory design is meant to improve workers' quality of life both in terms of democratic empowerment (that is, workers' control over their own work organization, tools, and processes) and functional empowerment (that is, workers' ability to perform their given tasks with ease) (p. 169-170).

Last, Wallach and Scholz (2012) conclude their article on "Why and How to Put Users First in Software Development" with the following statement, perhaps summarising the general attitude of PD advocates:

> "The necessity of a user-centered [in this study: participatory design] approach in software development is, in our opinion, beyond dispute and due to the abundance of digital interfaces in our daily lives even more crucial for sustainable differentiation than ever. User-centered design [in this study: participatory design] offers a great set of different tools that

can easily be adjusted to fit any combination of project type, scope, timeline, budget and team setup" (p. 36-37).

2.3 Choosing HCD methods

As portrayed in the previous section, both UCD and PD methods offer several benefits and drawbacks. Further, HCD methods are abundant: there is a wide array of different available methods, varying in the time they take to complete, the required personnel and knowledge, monetary expenses, the design phase in which they should be used, and so forth. Deciding which design method to apply, for practitioners, can therefore be a difficult job. However, scholars have written books, guidelines, and even software to enable practitioners to better make decisions regarding which design method they should use. For example, Bevan et al. (2002) created the EC UsabilityNet project, which is a website created "to provide usability professionals with an authoritative website of resources, including recommended methods for user centred design" (Bevan, 2003, p. 436). Further, Bevan (2009) wrote an extensive HCD selection procedure existing of 2 basic steps: first, identifying which categories of human-system best practice activities can increase business benefits or reduce project risks, and second, choosing the most appropriate methods, based on the extent to which the method will achieve best practices and is cost-effective. However, this procedure is quite elaborate and, as mentioned in Bevan's article, requires skilled, experienced, and knowledgeable HCD practitioners.

A last example of guidelines to help practitioners choose fitting HCD methods is provided by Maguire (2001). In an elaborate article "Methods to support human-centred design", Maguire provides a framework and explanation of many possible HCD methods, categorised by the 5 phases of HCD, as illustrated in Figure 2.1.

Summarised, there is ample scholarly literature on differing HCD methods and the methods that might fit best in different situations. However, it seems that this literature often takes a *method perspective*, rather than a *practitioner's perspective*. In other words, the current existing body of knowledge on choosing HCD methods often compares different methods with one another and decides for practitioners which methods fit best in particular situations. What is not yet represented in academic literature on the subject, is knowledge about what motivates practitioners to adopt a certain HCD method – other than constraining factors such as monetary resources, personnel, and time, which are incorporated in virtually all examined scholarly works. However, such knowledge might prove valuable. For instance, in a study by Mirri et al. (2018), comparing the effectiveness of UCD versus PD by following the process of developing two similar mobile application, user reports showed that users were satisfied with both apps, regardless of the design approach that was used during development. Considering this finding, it could be suggested that one's focus, when considering either a UCD or PD approach for the design of a product of system, should be on determining the best fit with one's current organisational context and personal preferences, instead of the used design approach.

Further, existing literature, such as the mentioned article by Maguire (2001), often treats HCD as a single compilation of methods, without distinguishing in the level of user participation. However, as detailed previously in this chapter, the distinction of the level of user participation in the design trajectory can have major practical and organisational implications in the design process, and should therefore be incorporated in literature regarding the decision-making in HCD methods. Currently, research comparing UCD and PD is scarce. A study by Hi Chun, Harty, and Schweber (2015) compared four types of HCD research, including UCD and PD, providing valuable insights in the similarities and dissimilarities between those methods of designing. However, the study does not recommend which design approaches fit best to particular organisational environments. Additionally, Hi Chun, et al.'s paper focuses specifically on designing and constructing within the built environment. Therefore, their conclusions are difficult to apply to other organisational contexts. Mirri et al. (2018) give recommendations regarding UCD and PD towards the "optimal" design practice in terms of user satisfaction and congruence with user's expectations. However, they too do not consider the context in which organisations are placed. In other words, these results might be context specific, rendering them less useful when applied to other organisations. Further, their research was aimed more towards the successfulness of different design methods, rather than motivating factors for choosing such methods.

Last, the existing literature on the subject of choosing HCD methods is often based largely or even entirely on theoretical information and desk research. Because of this, the literature might serve more as a guideline to practitioners than as an explanation for scholars about the choices that practitioners make. This study analyses the subject matter – choosing an HCD approach – from a practitioners' viewpoint. To be more specific: the main goal of this study is to find out which factors are of importance to practitioners, when choosing a particular style of HCD, which, in this study, can be either UCD or PD. This might provide scholars with a more honest outlook on the topic.

3. METHOD

This study aims to determine the factors that influence HCD practitioners' choices in the level of user participation in HCD projects. Specifically, influencing factors for adopting either a UCD or PD approach will be identified. Further, it will be researched whether specific influencing factors are more important, and whether their importance depends on organisational context. The main research method in this study is Q-methodology. Q-methodology is a card-sorting method combining both qualitative and quantitative research methods. As Brown (1993) stated, "the focus is on quality rather than quantity, and yet some of the most powerful statistical mechanics are in the background, but sufficiently so as to go relatively unnoticed by those users of Q who are disinterested in its mathematical substructure" (p. 94). The method was introduced by William Stephenson in 1935 through a paper with the fitting title "Correlating Persons Instead of Tests". Q-methodology is a researched method designed specifically for systematically analysing subjectivity (Brown, 1993). Q-methodology is most appropriate for exploratory research (Watts & Stenner, 2005), such as this study.

Unique to Q-methodology is that it allows one to "capture the essence of what the participants feel about a topic from collective voices, while at the same time identifying subtle differences between some of these voices" (Coogan & Herrington, 2011, p. 27). In other words, Q-methodology allows researchers to collect the sentiment of participants surrounding a particular topic, along with categorising comparable participant sentiment groups. In Q-methodology, participants are given a sample of cards, often containing statements about a topic: the Q-set. Participants then rank the Q-set, which is called Q-sorting. Q-sorting is done in what is called the Q-grid: a pyramid-shaped array of boxes in which the cards are sorted. During the Q-sorting, participants place the statements along a continuum on the X-axis of the pyramid. The continuum usually ranges from "most disagree" to "most agree". However, in this study, it ranges from "most fitting to UCD" to "most fitting to PD", since participants inclinations towards UCD and PD is investigated, and not participants' agreement with a given topic. It is because of the assigning of the statements on a continuum that participants' subjectivity surrounding the research topic becomes clear (Coogan & Herrington, 2011). Further, there exists no wrong way of sorting the cards, since participants' own opinions are the topic of research (Brown, 1993).

The data-collection for this research has been carried out in 5 steps, closely resembling the Q-methodology framework provided by Van Exel and De Graaf (2005). First, the subject concourse is defined. Second, a set of statements is created. Third, participants are selected. Fourth, Q-sorts are performed. Last, Q-sort data is analysed. In this chapter, all steps will be elaborated on.

3.1 PRELIMINARY RESEARCH

Before conducting the actual Q-sorts, a preliminary study was carried out. During this preliminary study, the subject concourse was defined. Further, the Q-set was created. Ultimately, the preliminary study resulted in a set of 34 cards, containing statements that describe situations (i.e. motivating factors) that have an influence on practitioners' choice for UCD or PD. These cards would later be used during the actual Q-sorting.

Step 1: defining the concourse

As Brown (1993) states, the concourse is "the very stuff of life" (p. 95). Put simply, the concourse is all communication surrounding a topic. Therefore, the concourse need not be restricted to spoken and written words. Brown mentions examples of Q-samples that included, among others, audio files, video files, and artworks. Perhaps a most practical definition of the concourse is given by Van Exel and De Graaf (2005), who state that "the concourse is a technical concept […] much used in Q methodology for the collection of all the possible statements the respondents can make about the subject at hand" (p. 4).

Defining the concourse may be done in a large number of ways. Ultimately, the manner of defining the concourse is of little importance, as long as the content of the concourse covers most of the subject at hand (e.g. Watts & Stenner, 2005; Van Exel & De Graaf, 2005). In this study, the concourse has been defined by carrying out both a literature study and semi-structured interviews. In total, 4 participants have been interviewed. All participants had several years of experience working with HCD methods. The interviews were recorded, transcribed, and analysed. This will be elaborated in the next section. To verify a complete coverage of the concourse, the information gathered from the interviews was compared and supplemented with information that was discovered gathered in the literature review.

Step 2: creating the Q-set

The Q-set refers to a sub-set of statements, originating from the concourse. The Q-set is the final set of statements that will be presented to participants during the actual Q-sort (Van Exel & De Graaf, 2005). Creating the Q-set is often one of the most challenging and time-consuming phases of Q-methodology (Watts & Stenner, 2005), and it is often seen as more of an art or craft than a scientific expertise (e.g. Van Exel & De Graaf, 2005; Curt, 1994). It is important to have a high-quality Q-set, since the Q-set will impact "the essence of the subjectivity that will later emerge from the sorting of statements by the participants" (Coogan & Herrington, 2011, p. 24). Again, quality is measured mostly by coverage of the subject.

In this study, the Q-set was created by physically printing the transcribed interviews and highlighting all statements participants made about factors influencing their decision making process regarding HCD methods. During this process, the statements were categorised. After gathering statements from all interviews, the categories were refined and finalised. The categorisation has no purpose other than to verify whether all facets of the research topic have been addressed (Coogan & Herrington, 2011).

In total, 65 statements were discerned from the interviews and literature study. After merging similar statements and discarding statements that were mentioned only rarely, a final Q-set of 34 statements remained. Next, the Q-deck was designed. The Q-deck is the physical set of cards (Van Exel & De Graaf, 2005). Each card consisted out of a statement and a short explanatory example (see also Appendix 1). To verify the comprehensibility and ambiguity of the Q-deck, a pilot study was carried out among 3 participants. The participants were asked to complete a Q-sort while thinking out loud. After carrying out the Q-sort, interviews were conducted to confirm whether participants understood the Q-sorting process and the Q-deck, and to verify observed Q-sorting complications. Several changes to the Q-deck were made based on feedback from the participants. First, the initial rendition of the Q-deck contained explanatory examples. These examples were removed in the second rendition of the Q-deck. Participants were found to be puzzled by the examples, confusing them with the actual statements instead of viewing them as supplementary explanations to the statements. Also, participants mentioned that the examples were inconsistent and distracted them from the main statements. Second, a problem that occurred was that participants often did not fully understand how to perform a Q-sort, sorting the Q-deck oppositely to their attitude towards the statements. During post-sorting interviews it became clear that this problem occurred due to the phrasing of the statements presented in the Q-deck. Therefore, the phrasing of the statements was altered in the second version of the Q-deck. In the first rendition of the Q-deck, statements were phrased as static definitions of the motivating factor they portrayed, for example: “the accessibility of the end-user”. In the second rendition, however, the statements were phrased to support participants in the sorting process: “the easier end-users are accessible, the more I am inclined towards…”. Examples of both rendition 1 and rendition 2 of the Q-deck are illustrated in Figure 3.1. The entire, final Q-deck is included in Appendix 1. Simultaneously with the Q-set, the Q-grid was designed (Appendix 2). The Q-grid generally approximates a Normal distribution. However, when performing Q-methodology on “highly controversial” (p. 200) topics, a more flattened Q-grid is often favoured, since such a Q-grid allows participants to sort more statements in the extremes of the grid, and less statements at the centre (Brown, 1980). However, since HCD methods was not expected to be a controversial topic, a Normal distribution Q-grid was adopted.

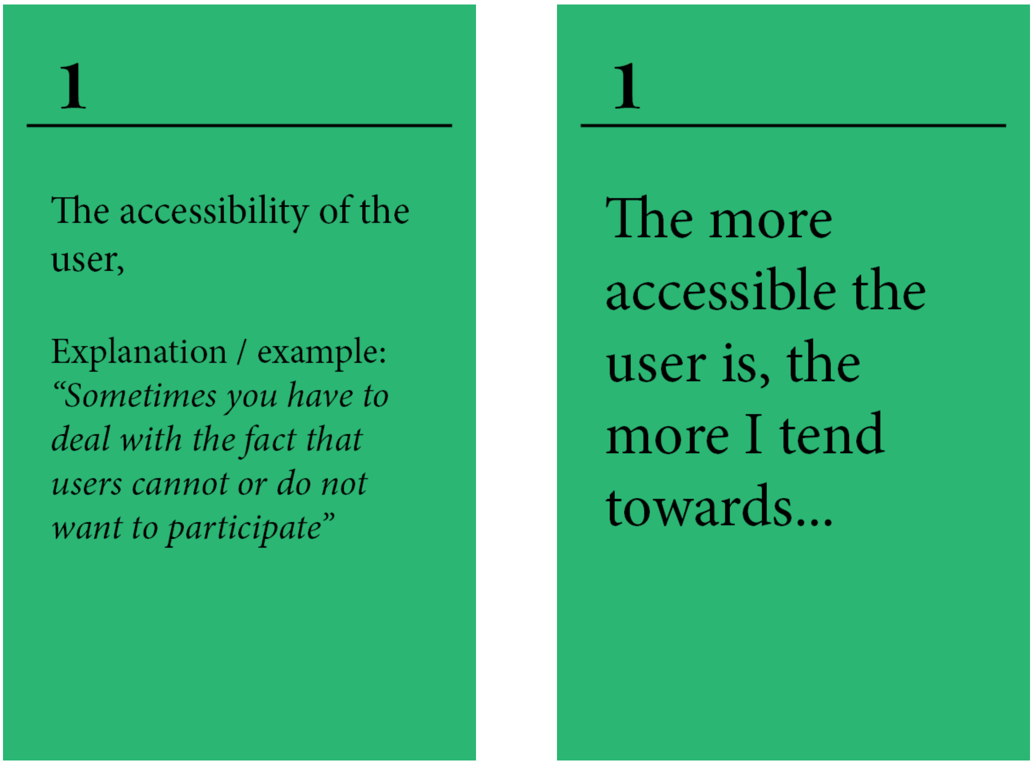


Figure 3.1: Translated examples of rendition 1 (left) and 2 (right) of the first card from the Q-deck. Original language: Dutch.

3.2 CONDUCTING Q-METHODOLOGY

The main part of this study consisted of conducting the actual Q-methodology. First, a participant group was selected. Then, Q-sorting was carried out. Additionally, both pre- and post-sorting interviews were conducted.

Step 3: Selecting participants

The P-set is the group of respondents that are participating in the Q-sort. It is difficult to find a consensus among scholars on how many participants are needed for carrying out a Q-sort. For example, Brown (1980) suggests, rather vaguely, that "only a few subjects are required" (p. 191). According to Brown, the number of participants is large enough as soon as factors can be discerned from the data. Watts and Stenner (2005), however, advocate a P-set consisting of 40 to 60 participants. However, Watts and Stenner further mention that "highly effective Q studies can be carried out with far fewer participants" (p. 79), which makes determining an exact satisfactory number of participants difficult. In this study, a guideline provided by Van Exel and De Graaf (2005) has been adopted. They write that "the aim is to have four or five persons defining each anticipated viewpoint [i.e. factor], which are often two to four, and rarely more than six" (p. 6). Following this guideline and accounting for 4 participants per factor and 6 factors, the aim was to have 24 participants in this study. However, ultimately, a total of 26 participants has been included in this study.

The P-set need not be a random sample. In fact, one should strategically select participants who's viewpoints are not only relevant to the concourse, but also manifest and deliberate (Van Exel & De Graaf, 2005; Watts & Stenner, 2005). In this study, a convenience sample of 26 participants was used. Participants were reached out to through LinkedIn, e-mail, the researcher's social network, and snowball sampling. Participants were selected based on their experience with HCD methods.

As illustrated in Table 3.2, participant information on 1) job type, 2) product physicality, 3) product completeness, 4) gender, and 5) age has been collected. Job type is a dichotomous variable which refers to participants' main job activities, which can be either developing products or managing design activities. Job type was divided equally among participants: 50% engaged primarily in developing, and 50% in managing. Regarding product physicality, participants design either physical, tangible products or non-physical products, i.e. software or services. Further, products can be either finished or semi-finished. Finished products are usually created for actual end-users and can be sold immediately after development. Semi-finished products, however, are usually not intended for actual end-users. Rather, they are typically sold to manufacturers, who then use these semi-finished goods to create a whole product, intended for sales.

Additionally, demographic participant information was collected. Table 3.2 shows that the majority of participants (69%) is male. Participants' mean age is approximately 36 years (SD = 12.26, N = 22). Roughly 75% of participants lives and works in Overijssel.

Table 3.2
Participant information

Job type	Frequency	Valid Percent	Cumulative Percent
Developing	13	50.00	50.00
Managing	13	50.00	100.00
Total	26	100.00	
Product physicality	Frequency	Valid Percent	Cumulative Percent
Physical products	12	46.15	46.15
Non-physical products	14	53.85	100.00
Total	26	100.00	
Product completeness	Frequency	Valid Percent	Cumulative Percent
Finished products	20	76.92	76.92
Semi-finished products	6	23.08	100.00
Total	26	100.00	
Gender	Frequency	Valid Percent	Cumulative Percent
Male	18	69.23	69.23
Female	8	30.77	100.00
Total	26	100.00	
Age	M	SD	N
	36.18	12.26	22

Step 4: Executing Q-sorts

The Q-sorts were carried out during face-to-face meetings. Examples of the Q-deck and the Q-grid that were used can be found in Appendices 1 and 2. Prior to the Q- sorting, semi-structured interviews were conducted. During these interviews, participants were asked to elaborate on their organisational environment, knowledge of HCD and experience with HCD. Then, information was given about the context of the study, the key concepts in the study (HCD, UCD, and PD), and on how to perform Q-sorting. When all was understood by the participants, the sorting began.

Participants were allowed to sort the cards in any way they wanted, as long as each card was placed in one of the designated boxes on the Q-grid. In this study, participants were asked to sort all 34 cards onto the Q-grid. Sorting the complete Q-deck is not always necessary, for Q-sort analysis can be carried out even with incomplete Q-sort entries (Watts & Stenner, 2005). However, during the pilot study it became clear that specifically during the sorting of the last handful of cards, participants began thinking very consciously about their sorting, elaborated more on their thought process, and, consequently, often completely changed their sort. Therefore, participants were requested to complete a full Q-sort, in which all 26 participants succeeded. During the sorting, participants were allowed to shuffle the deck until they were completely satisfied with their response. Participants were asked to think-aloud during the sorting and if permission was granted by the participants, they were recorded during the sorting.

After the sorting, a second interview was conducted. Participants were asked to elaborate on the most-left (best suiting UCD) and most-right (best suiting PD) cards on the Q-grid. Further, they were asked to elaborate on cards they deemed notable. Last, they were asked if they deemed any cards unnecessary or if they would add certain statements if they were given that option.

3.3 ANALYSING Q-SORT DATA

After 26 participants had completed the Q-sort, the final step, which is analysing the Q-sort data, was performed. This was done using the programs SPSS and PQMethod. While the former, SPSS, is a well-known statistical analysis tool, PQMethod is lesser known. However, PQMethod is recommended for analysing Q-methodology by several academics (e.q. Coogan & Herrington, 2001; Van Exel & De Graaf, 2005; Watts & Stenner, 2005). PQMethod is a free-to-use program, developed by Peter Schmolck. The program is specifically made for the analysis of Q-sorts.

Step 5: Data-analysis

Using PQMethod, all collected Q-sort data was digitalised. Then, a Principal Components factor analysis (PCA) was performed. Using the results of the PCA, the number of factors to be considered in this study was identified. This was done conforming to three rules: 1) the factor's eigenvalue should be > 1, 2) the factor should explain at least 5% of the variance, and 3) the total explained variance of all factors combined should be at least 60%.

Table 3.3

Principal Components factor Analysis (PCA) results

Factor	Eigenvalue	As Percentage	Cumulative Percentage
1	8.26	31.77	31.77
2	2.71	10.44	42.21
3	2.31	8.88	51.09
4	1.85	7.12	58.20
5	1.72	6.62	64.82

Drawing upon the results from the PCA and following the beforementioned rules, it was determined that, in this study, a total of 5 factors will be analysed. In total, they account for 64.82 percent of the data variance. PCA results for these 5 factors are shown in Table 3.3. The complete PCA results can be found in APPENDIX 3.

Next, the factors were rotated using PQMethod. The program allows for two types of rotating: 1) manual rotating and 2) an automized varimax rotation of the factors. In this study, a varimax rotation was carried out. Then, factors were flagged. Like the rotation of the factors, the flagging of the factors can be done both manually or automatically. In this study, the flagging was done automatically.

After flagging the factors, the Q-sort results were generated using PQMethod. These results will be presented and elaborated on in the next section of this report: Results.

4. RESULTS

In this chapter, the five extracted factors are described in detail. Further, the consensus statements, which are the statements that do not distinguish significantly between any pair of factors, are presented and elaborated on.

In total, 24 out of the 26 participants from this study loaded onto a factor. As shown in Table 4.1, nine participants loaded onto factor 1, three participants loaded onto factor 2, five participants loaded onto factor 3, two participants loaded onto factor 4, and five participants loaded onto factor 5. Further, as illustrated in Table 4.1, composite reliability scores for all factors are well beyond 0.7, which is the threshold for indicating construct internal consistency (Fornell & Larcker, 1981).

Table 4.1
Factor characteristics

	Factor				
	1	2	3	4	5
№ of defining variables	9	3	5	2	5
Average Rel. Coef.	0.80	0.80	0.80	0.80	0.80
Composite reliability	0.97	0.92	0.95	0.89	0.95
S.E. of Factor Z-Scores	0.16	0.28	0.22	0.33	0.22

Using PQMethod, factor arrays for the five factors have been generated (See also Table 4.2). Factor arrays show the position, i.e. the Q-sort value (Q-SV) of each of the 34 statements in the Q-grid as characterised by the corresponding factor. The factor arrays give insight into which influencing factors are important to UCD (Q-SV = negative) or PD (Q-SV = positive) methods, and which factors are equally important or irrelevant (Q-SV = 0) to the choice for one of the two design methods. For each factor, information about both the participant group who fits that factor, and the Q-sort statements that significantly describe the factor are given.

4.1 Factor results

4.1.1 Factor comparison

Table 4.2 shows all 34 statements, along with their Q-SV correspondent with the 5 extracted factors in this study. Further, statement categories are shown. In total, the statements can be subdivided into 8 different categories, involving: 1) the design team, 2) HCD methods, 3) the market in which the organisation operates, 4) monetary resources, 5) the organisation, 6) the product, 7) time, and 8) the end-users of the product.

Table 4.2

Aggregated factor arrays with corresponding statements and categories

Category	Brief description	Factor arrays					Statement №
		1	2	3	4	5	
Design team	Desire for convenience in design team	-5	0	3	3	-4	11
Design team	Extent of non-supported user knowledge	0	1	3	5	-5	12
Design team	Diversity within design team	-1	0	2	0	0	13
HCD methods	Clearness of issue	-3	0	-5	-5	-5	8
HCD methods	Extent of available end-user information	-4	-5	-4	-5	-4	9
HCD methods	Insights in HCD methods	0	-1	-4	1	1	10
HCD-methods	Visibility of HCD impact	1	-3	-1	1	4	18
Market	Focus on B2B	-2	-3	5	-2	-3	15
Market	Focus on B2C	0	4	-3	4	1	16
Market	Organisation's market share	-1	-2	-2	-3	0	21
Market	Organisation operates nationally	-2	-1	-1	2	-1	23
Market	Organisation operates internationally	-2	-1	4	-3	1	24
Market	Extent of competitivity	3	1	2	0	-2	26
Money	Extent of monetary resources	1	0	0	0	5	6
Money	Expected HCD return	2	2	-3	-4	5	7
Organisation	Extent of HCD alternatives	-1	-3	-2	-1	-3	14
Organisation	Openness towards innovation	0	3	-2	-1	2	17
Organisation	Organisational trust in HCD	1	0	0	1	4	19
Organisation	Organisational focus on HCD	1	-2	-1	1	3	20
Organisation	Influence of organisational values	-3	1	2	0	0	22
Organisation	Organisational agility	0	2	-1	-2	-1	25
Product	Newness of product	3	3	5	-2	-1	27
Product	Product complexity	5	-5	4	-1	3	28
Product	Importance of product innovation	3	5	1	0	0	29
Product	Physical products	4	3	0	2	0	30
Product	Software-based products	2	-1	0	0	-2	31
Product	Extent of third-party regulations	-3	-4	3	-1	2	32
Time	Amount of time for design activities	2	0	1	4	3	33
Time	Available fte for design trajectory	-1	-4	1	3	1	34
Users	User accessibility	4	4	-3	5	0	1
Users	User understanding of product	0	1	-5	2	-2	2
Users	Designing for users	5	5	0	-3	2	3
Users	Designing for purchasers	-4	-2	1	3	-1	4
Users	Homogeneity user group	-5	2	0	-4	-3	5

Note. Green box: significant at $P < 0.05$ for PD. Red box: significant at $P < 0.05$ for UCD. Grey box: significantly neutral at $P < 0.05$.

When studying the aggregated statement and factor information in Table 4.2, several elements stand out. First, one statement, which is product complexity (statement 28), is represented in all factors. Notable is that this statement is rather equally represented in both design methods; it has been sorted twice with UCD, and thrice with PD. This finding implicates that product complexity is highly relevant to practitioners' decision between UCD and PD, but is also highly dependent on the context in which the design is carried out, and personal preferences of practitioners.

Second, multiple statements did not prove to have a significant effect on participants' choice to carry out either UCD or PD. These are the following statements:

5 – homogeneity of the user group;
9 – the extent of already available end-user information;
13 – diversity within design team
14 – the extent of available HCD alternatives
17 – openness towards innovation
18 – visibility of HCD impact
19 – organisational trust in HCD
20 – organisational focus on HCD
21 – organisation's market share
23 – organisation operates nationally
26 – the extent of competitivity in the market
30 – physical products
31 – software-based products
32 – the extent of third-party regulations
33 – the amount of planned time for design activities

An interesting finding that can be deducted from this list, is that product type (physical vs. software-based products) has no significant influence on participants' design method choice. In fact, most participants were relatively indifferent about product type, stating matters such as "Well, if it is software or hardware… That does not really matter, I think." Other participants even discarded the product type cards entirely, while expressing thoughts like "This just totally not applies to my design choice", and then moving on to the next card, while sorting both product type cards to a Q-SV of 0. However, one participant provided a more elaborate reasoning, stating the following: "[Product type] does not really matter. It is always important to verify. […] And, well, both ways [UCD and PD] could fit." Further, it seems that a national base of operations has no influence on the participants decision for a design method, while having an international base of operations matters significantly in factor 3. This could be due to the fact that national operations can be seen as the usual or conventional situation in which HCD work is carried out. Therefore, designers might not be markedly affected by this statement. Having to carry out international HCD work, however, could be perceived as irregular or unconventional, and therefore affect practitioners' decision-making regarding which HCD method to choose more.

4.1.2 CONSENSUS STATEMENTS

Consensus statements are the statements that are statistically non-significant and have similar scores for all extracted factors. In this study, three consensus statements emerged. These statements are presented in Table 4.3.

Table 4.3
Consensus statements

Statement	Brief description	Factors				
		1	2	3	4	5
		Q-SV	Q-SV	Q-SV	Q-SV	Q-SV
9*	Extent of available end-user information	-4	-5	-4	-5	-4
14*	Extent of HCD alternatives	-1	-3	-2	-1	-3
33	Amount of time for design activities	2	0	1	4	3

Q-SV: Q-sort value; statement placement in Q-grid
Note. All listed statements are non-significant at P > .01, and those flagged with an * are also non-significant at P > .05.

Out of the three consensus statements, two were mainly attributed to UCD. These were the extent of already available end-user information (statement 9), and the extend of HCD alternatives (statement 14). First, participants mentioned that having more end-user data available simply allows one to more easily create personas and other UCD methods. In other words, having quality data available allows practitioners to do their job without having to perform PD. In this sense, statement 9 seems to be related to the desire for convenience in the design team (statement 11, which is not a consensus statement). For example, a participant explained that "having more data already available, means that it is easier for me to both create and use personas" and "already having the data means that I won't have to talk to users as much." However, using available information for UCD activities also comes with drawbacks. For example, participants mentioned that it matters where the data came from (e.g. previous PD research, website traffic data, etc.). Furthermore, several participants stated that often, already available end-user information only informs practitioners about what user groups are doing, feeling, experiencing, and so forth. It generally is unable to answer any *why-questions*.

Second, as shown in Table 4.8, the extent of HCD alternatives (statement 14) is less important to UCD than the amount of already available user information. However, the two statements seem to be related. For example, one participant stated: "I am reading this as having, for example, customer journeys already available, made by third parties. That is why I am placing it more towards UCD."

Participants stated that having more HCD alternatives available, pressures them to move towards more time- and cost-effective design methods, which they find primarily in UCD. In other words: when there are more HCD-alternatives available, participants find that less time and money is set aside for actual HCD work.

The last consensus statement, the amount of scheduled time for the design activities (statement 33), is attributed moderately towards PD (Q-SV = 2, 0, 1, 4, 3). The main reasoning behind this, which imaginably might not come as a surprise, is that PD is more time-consuming than UCD. Further, participants expressed arguments such as "If I have enough time, I will always perform PD. In principle, PD is always preferred. UCD is more like a shortcut you take to be able to work faster."

4.1.3 Factor 1: Understanding usability requirements

Factor 1 has an eigenvalue of 8.26 and explains 31.77% of the study variance. As shown in Table 4.4, factor 1 is characterised by 4 distinguishing statements. Three factor categories are influential in this factor: product, organisation, and users. Participants in this factor tend to choose an HCD method based on product complexity and the importance of product innovation. Further, the influence of organisational values in the design process plays a role. Unique to this factor, however, is the relevance of the statement "designing for purchasers". It seems that only in factor 1, participants' choice for an HCD method is influenced when participants are designing increasingly for a purchaser (i.e. not a user). What stands out in this factor, is that there seems to be a trade-off situation for designers in regard to the necessary usability requirements of their products. As will be elaborated in the next section, designers decide whether there is a need for users to be able to work with products effectively, efficiently and with satisfaction, or whether usability of the product is less important. Consequently, practitioners who fit this factor are concerned with *"Understanding usability requirements"*.

Table 4.4

Distinguishing statements factor 1

Statement	Brief description	Factor					Category
		1	2	3	4	5	
		Q-SV	Q-SV	Q-SV	Q-SV	Q-SV	
28	Product complexity	5*	-5	4	-1	3	Product
29	Importance of product innovation	3*	5	1	0	0	Product
22	Influence of organisational values	-3**	1	2	0	0	Organisation
4	Designing for purchasers	-4**	-2	1	3	-1	Users

* P < .05

** P < .01

Q-SV: Q-sort value; statement placement in Q-grid

Note. Negative Q-SV signifies importance for UCD. Positive Q-SV signifies importance for PD. Q-SV = 0 signifies equal or no importance for both methods.

In this factor, the statements "product complexity" and "importance of product innovation" were attributed to best fit PD. Participants stated that performing PD when dealing with complex products is especially important, because you never truly know your users. For example, participants stated that it is extremely challenging to predict the difficulties that users will experience with complex products. Building on this, most participants in this category design non-physical products, which generally insinuates that they are designing software. One participant stated the following: "Software is just very complicated. […] And when I actually meet people, I get a better understanding of how they think. And for me, that really is the crux." In other words, when designing complex products, it is important to understand how users think, and, for participants in factor 1, that will be better accomplished when performing PD compared to UCD. For the latter, participants mentioned that the importance of product innovation is crucial to PD because that design method allows one to observe, with great detail, very specific user problems and ways of handling a product. Contrastingly, UCD provides one with more generalised data, which will only reveal general problems that users might have. However, when designing innovative products, what designers in factor 1 need is input on very specific user problems, tailored to the specific innovative elements of the product.

Statements attributed to UCD are "designing for purchasers" and "influence of organisational values". One participant mentioned that, when designing for purchasers, often it is of less importance that a user group is able to efficiently use a product. For example, he mentioned that designing for purchasers is often done in a business-to-business (B2B) context. In such case, users, which are employees, often have more time and motivation to learn how to use a product, partly because they have no choice in the matter. Therefore, it is of less importance to identify specific user needs. Consequently, carrying out UCD is satisfactory, even when it yields generalised input.

Concerning organisational values, UCD is a good fit because organisational values are more easily incorporated in UCD than in PD. For example, user personas and customer journeys, which are typical UCD methods, often portray organisational values well, whereas this is harder to do in, for example, in-depth interviews and co-creation sessions, which are typical PD methods.

Participant characteristics

Out of the 9 participants who load onto this factor, 6 are male, and 3 are female. Their mean age is 33.75 years (SD = 10.65, n = 8). In this factor, the majority of participants' main job activity is developing (78%). The dominant product created in this factor is non-physical (67%), and almost all participants in this factor design finished products (89%).

4.1.4 Factor 2: Understanding contexts

Factor 2 has an eigenvalue of 2.71 and explains 10.44% of the study variance. As shown in Table 4.5, factor 2 is characterised by 6 distinguishing statements. What is most interesting about this factor, is that it does not focus on a particular statement category. In other words, participants in this factor tend to take into account a wide array of possible influencing statements, rather than to let one or several categories influence their choice in design methods more dominantly. Practitioners who fit in this category, will likely feel the need to extensively examine the situation in which they are designing a product, looking at different elements from varying categories such as the product they are designing, the organisation and design team in which they are designing, and the available fte for the project. Interestingly, a category that is not taken into account is "users" – a category that *is* represented in all other factors. Thus, it seems that user characteristics are not important to practitioners in factor 2, when it comes to the manner in which they design their products, even though humans stand at the centre of their design methods (since they adopt an HCD approach). Further, this factor is unique in that it significantly marks a statement from the "time" category as relevant. Practitioners who fit this factor are concerned with *"Understanding contexts"*: they tend to look at their design situation extensively, before deciding whether to adopt a UCD or PD approach.

Table 4.5

Distinguishing statements factor 2

Statement	Brief description	Factor					Category
		1	2	3	4	5	
		Q-SV	Q-SV	Q-SV	Q-SV	Q-SV	
29	Importance of product innovation	3	5**	1	0	0	Product
25	Organisational agility	0	2*	-1	-2	-1	Organisation
11	Desire for convenience in design team	-5	0*	3	3	-4	Design team
8	Clearness of issue	-3	0**	-5	-5	-5	HCD methods
34	Available fte in design trajectory	-1	-4**	1	3	1	Time
28	Product complexity	5	-5**	4	-1	3	Product

* P < .05

** P < .01

Q-SV: Q-sort value; statement placement in Q-grid

Note. Negative Q-SV signifies importance for UCD. Positive Q-SV signifies importance for PD. Q-SV = 0 signifies equal or no importance for both methods.

In this factor, the statements “importance of product innovation” and “organisational agility” were attributed to best fit PD. Participants in this factor did not hesitate to sort product innovation with PD. On the contrary, one participant explained: “Look, if the card says ‘innovation’, it moves to the right [PD]. Immediately.” Participants mentioned that, when doing UCD, designing is based more on assumptions. This means that, when using this type of design method, there is more uncertainty about the way in which users eventually will appreciate with the product – which is something designers in this factor wish to avoid, especially when designing innovative products. Therefore, the designers in this factor would rather collect more reliable data directly from actual end-users.

Statements attributed to UCD are “product complexity” and “available fte in the design trajectory”. Remarkably, in this factor, product complexity was sorted opposite to factor 1. Whereas in factor 1, product complexity was seen as ideal for PD, in this factor, it was matched to UCD. A reason for this, as stated by a participant, is that when one is designing complex products, one would need the knowledge of specialists who know the user group and can assess what that user group needs. Further, they stated that specialists might even know user needs better than users themselves. Additionally, PD is often done with a small sample of users. A participant explained: “When you are designing a complex product, then the input of a single person is less valuable. Therefore, I would want to do UCD.”

Last, two statements were significantly characterised as neutral (Q-SV = 0): desire for convenience, and clearness of the issue.

Participant characteristics

All 3 participants who load onto this factor are male. Their mean age is 35.00 years (SD = 13.00, n = 3). In this factor, predominantly, participants' main job activity is developing (67%). Participants in this factor exclusively design finished products, and two-thirds of these participants are involved with creating non-physical products.

4.1.5 Factor 3: Understanding the market

Factor 3 has an eigenvalue of 2.31 and explains 8.88% of the study variance. As shown in Table 4.6, factor 3 is characterised by 8 distinguishing statements. What stands out in this factor, is the number of statements from the category "market". Not only is "market" the highest represented category in this factor, the factor also contains half of all existing "market" statements in this study. Participants who fit this factor, tend to choose a design method primarily based on the market in which the product will be used. For example, the data shows that it makes a significant difference, for participants in this factor, if the product is intended for a business-to-business (B2B) market, in which case participants favour a PD approach, or a business-to-consumer (B2C) market, in which case participants favour a UCD approach. Consequently, practitioners who fit this factor are concerned with *"Understanding the market"*.

Table 4.6
Distinguishing statements factor 3

Statement	Brief description	Factor					Category
		1	2	3	4	5	
		Q-SV	Q-SV	Q-SV	Q-SV	Q-SV	
27	Newness of product	3	3	5**	-2	-1	Product
15	Focus on B2B	-2	-3	5**	-2	-3	Market
24	Organisation operates internationally	-2	-1	4**	-3	1	Market
28	Product complexity	5	-5	4*	-1	3	Product
1	User accessibility	4	4	-3**	5	0	Users
16	Focus on B2C	0	4	-3**	4	1	Market
10	Insights in HCD methods	0	-1	-4**	1	1	HCD methods
2	User understanding of product	0	1	-5**	2	-2	Users

* P < .05

** P < .01

Q-SV: Q-sort value; statement placement in Q-grid

Note. Negative Q-SV signifies importance for UCD. Positive Q-SV signifies importance for PD. Q-SV = 0 signifies equal or no importance for both methods.

In this factor, the statements "newness of a product", "focus on business-to-business markets", "international business operations", and "product complexity" were attributed to best fit PD. A focus on B2B markets was deemed important for PD by participants within factor 3, because in B2B markets, having organisational knowledge, like the hierarchy and logistics chain, is important when designing products. This information is hard to gather using UCD, and therefore, PD is a better suited design method. Further, a participant stated that often, designers have trouble envisioning organisational needs. This makes UCD more difficult to carry out, and therefore, they would preferably carry out PD. A similar reasoning lies behind the sorting of international business operations. Put simply, there are more differences between designers and foreign user groups than there are between designers and user groups from their home country. Therefore, designers have a harder time understanding international user groups, which increases the need to reach out to them and actively incorporate them in the design process.

Statements attributed to UCD are "user understanding of the product", "designers' insights in HCD methods", "focus on business-to-consumer markets", and "user accessibility". Participants did not mention specific reasons for their sorting regarding these factors.

Participant characteristics

Out of the 5 participants who load onto this factor, 2 were male, and 3 were female. Their mean age is 45.50 years (SD = 5.80, n = 4). All participants' main job activity was managing. Almost all (80%) participants in this factor design physical products. Regarding product completeness, participants are rather equally divided among finished (40%) and semi-finished (60%) products.

4.1.6 Factor 4: Understanding users

Factor 4 has an eigenvalue of 1.85 and explains 7.12% of the study variance. In this factor, participants' focus is on the abilities of users. As shown in Table 4.7, factor 4 is defined by 2 distinguishing statements, both portraying UCD. The two represented statements are product complexity (statement 28), and designing for users (statement 3). Put simply, practitioners believe that the employed design method should not be too demanding for end-users, and therefore they generally tend towards UCD. Additionally, in this factor, it is believed that UCD yields more generalisable data, ultimately resulting in products that are useful for larger user groups. User abilities are primarily taken into consideration by practitioners who fit this factor, and thus, practitioners who fit this factor are concerned with *"Understanding users"*.

Table 4.7

Distinguishing statements factor 4

Statement	Brief description	Factor					Category
		1	2	3	4	5	
		Q-SV	Q-SV	Q-SV	Q-SV	Q-SV	
28	Product complexity	5	-5	4	-1*	3	Product
3	Designing for users	5	5	0	-3**	2	Users

* P < .05

** P < .01

Q-SV: Q-sort value; statement placement in Q-grid

Note. Negative Q-SV signifies importance for UCD. Positive Q-SV signifies importance for PD. Q-SV = 0 signifies equal or no importance for both methods.

In this factor, both statements "designing for users" and "product complexity" were attributed to UCD. A participant stated that complex products are better suited for UCD methods, because, for users, it is often difficult to comprehend what is needed from them during PD research. According to that participant, this leads to having to spend a significant amount of extra time on the design process, when carrying out PD. Coincidentally, the "scheduled amount of time for design activities" (statement 33) was attributed highly, although not significantly (P > 0.05) to PD in this factor. In other words, when there is enough scheduled time for HCD, participants in this factor tend to carry out PD. When time is more of a constraining factor in the project, participants from factor 4 favour UCD methods. Further, users' knowledge of complex products themselves is often insufficient for PD methods. Last, according to a participant, UCD is more objective than PD. Thus, one has a greater chance of satisfying a larger group of users when doing UCD work. Especially when designing a complex product, because with those, user problems might become rather specific. In regard to designing for users, one participant articulated the following:

> "[When adopting a PD method] you have to explain, clarify, tailor, and inform them [users] a lot. In that case, PD is just a lot less useful. So, UCD is also more objective. With PD, you only speak with one person. What if that person just does not know his stuff? Then maybe, you will have satisfied one person, but not the other 30 or so from your target group."

Although it is debatable whether or not one would just speak with one user during PD, this participants' point is made clear: when designing for actual end-users, they aim for user information that says something about the whole user group. Information obtained from a relatively small number of participants, as is usually the case when carrying out PD, is, to them, less desirable. Therefore, they tend more towards UCD, when increasingly designing for actual end-users.

Participant characteristics

Out of the 2 participants who load onto this factor, 1 is male, and 1 is female. Unfortunately, information about participants' age has only been collected for one participant, making this data unworkable. All participants' main job activity in this factor is managing. One participant was involved in designing physical products, and the other was involved in designing non-physical products. Both participants in this factor create finished products.

4.1.7 Factor 5: Understanding resources

Factor 5 has an eigenvalue of 1.72 and explains 6.62% of the study variance. As shown in Table 4.8, factor 5 is significantly characterised by 5 distinguishing statements. What sets this factor apart from the others, is that the category "money" is represented. Moreover, both statements from that category are significantly important to participants who fit this factor, at P < 0.01. It seems that the choice for a PD or UCD method is based primarily on the extent of monetary resources: when they are sufficient, PD methods will be adopted. Besides monetary reasons, participants take into account statements from the categories "product", "users", and "design team". It seems that, in this factor, the only statement that might persuade participants to adopt a UCD method over a PD method, is when non-supported user knowledge (i.e. a gut-feeling) is strongly present. Practitioners who fit this factor are primarily looking at the available monetary resources, when choosing an HCD method. Consequently, practitioners who fit this factor are concerned with *"Understanding resources"*.

Table 4.8
Distinguishing statements factor 5

Statement	Brief description	Factor					Category
		1	2	3	4	5	
		Q-SV	Q-SV	Q-SV	Q-SV	Q-SV	
7	Expected HCD return	2	2	-3	-4	5**	Money
6	Extent of monetary resources	1	0	0	0	5**	Money
28	Product complexity	5	-5	4	-1	3*	Product
1	User accessibility	4	4	-3	5	0**	Users
12	Extent of non-supported user knowledge	0	1	3	5	-5**	Design team

* P < .05
** P < .01
Q-SV: Q-sort value; statement placement in Q-grid
Note. Negative Q-SV signifies importance for UCD. Positive Q-SV signifies importance for PD. Q-SV = 0 signifies equal or no importance for both methods.

In this factor, PD is defined by the statements "expected HCD return", "extent of monetary resources", and "product complexity". Participants in this factor were straightforward as to why monetary statements were important for PD: according to them PD is the more extensive, and thus expensive design method and can therefore only be used when there is enough money available. One participant metaphorically explained this as follows:

> "It is like a Maslow's pyramid. At the bottom, there are technical requirements. [Products] have to be developed and they should work properly. Going up, there are visual aspects; the client wants to see something. Only then comes the user. And the further you go up, the more budget is required."

PD is fit for complex products, because these products usually have more functionality. Therefore, users have to know more about the product and be able to do more with it. Further, one participant mentioned that with complex products, often there is a highly specialised target group. Such a target group must be continuously informed about the progress of the product design, because their input is crucial to the success of the product.

The single statement in this factor attributed to UCD is "extent of non-supported user knowledge". Participants stated that user input (and therefore PD) is not always reliable; what people say that they do, and what they actually do, often differs. Therefore, participants from this factor value developing a *gut-feeling* as to what users' needs are, based on findings from UCD research. However, it should be mentioned that most participants later stated that, optimally, they would perform PD in a later stage of the design process to validate this gut-feeling. Further, in this situation, being able to do UCD to develop a gut-feeling was often seen as a cost- and time effective alternative for PD. A second, unrelated, but notable reason to adopt a UCD method, that was mentioned by one of the participants in this factor, was confidentiality. It was mentioned that, sometimes, a UCD method was favoured because the organisation did not trust end-users enough to let them in on sensitive product information regarding, for example, innovative inventions. This participant stated: "you should treasure the competitive position of your organisation. Especially with new, innovative products, you do not want to give away to much. So, you do not want to reveal too much to end-users."

Further, one statement was significantly characterised as neutral: user accessibility.

Participant characteristics

Out of the 5 participants who load onto this factor, 4 are male, and 1 is female. Their mean age is 42.25 years (SD = 17.15, n = 4). In this factor, participants' main job activity is fairly equally divided: 2 participants focus on developing (40%), and 3 focus on managing (60%). Both product physicality and product completeness were divided equally among the participants who fit in this factor. Regarding product physicality, 40% of participants designs physical products, and 60% designs non-physical products. Regarding product completeness, 60% of participants designs finished products and 40% designs semi-finished products.

5. DISCUSSION

5.1 MAIN FINDINGS

In this study, two research questions have been formulated. Drawing upon the data gathered in this study, the research questions will now be answered. The research questions in this study are as follows:

RQ1: Which are the factors that influence HCD practitioners to adopt either a UCD or a PD approach?

RQ2: Which views regarding the choice for adopting either a UCD or PD approach, based on the influencing factors, exist among HCD practitioners?

In total, 34 factors that motivate HCD practitioners to adopt an HCD approach have been identified. Within the entire participant group, 5 unique practitioner views on choosing a UCD or PD method, based on the 34 factors, were uncovered. Practitioners were found to focus on 1) understanding usability requirements, 2) understanding contexts, 3) understanding the market, 4) understanding users, and 5) understanding resources.

Second, it has been shown that, in each participant view, different factors are of significant importance when deciding whether to adopt a UCD or PD approach. Further, an influencing factor might steer some practitioners towards UCD, while, in other organisational contexts and practitioner groups, steer other practitioners towards PD. Additionally, not all subgroups are influenced by an equal number of factors. One factor has been found to significantly influence all subgroups: product complexity (statement 28). Product complexity has been found to steer practitioners towards both a UCD or PD method, depending on practitioners' view on HCD and their organisational context.

Third, 3 consensus statements, which are factors that influence all participants similarly, have been found: the extent of available end-user information (statement 9), the extent of available HCD alternatives (statement 14), and the amount of time for design activities (statement 33). Regarding the first two statements, participants were found to favour a UCD approach when more user information or HCD alternatives were available. More scheduled time for the design activities generally motivated participants to adopt a PD approach.

5.2 THEORETICAL CONTRIBUTIONS

In this study, influential factors for choosing the level of user participation in HCD projects have been researched. A set of 34 motivating factors, which are influential to practitioners' choice to carry out either a UCD or a PD strategy, has been drafted. The set of 34 factors shows that there are many factors to consider, when motivating the adoption of a particular HCD method. Current academic works that mention influencing factors for choosing an HCD method, which often are case studies (e.g. Delikostidis et al., 2016; Mirri et al., 2018; Siebenhandl et al., 2013; Tolkamp et al., 2018), and, on rare occasions, academic studies (e.g. Bevan, 2009) focus, to the author's best knowledge, almost exclusively on practical factors like time-constraints, monetary resources, and accessibility of the user group. However, the current study shows that other, for example situational and motivational factors, such as a focus on users vs. a focus on purchasers, a desire for convenience in the design team, and organisational trust in HCD, also play a role in the HCD method decision-making process. In other words, it has been shown that many factors influence practitioners when choosing a particular HCD approach, and that this choice is not entirely based on practical motives like the available amount of time, money, and fte. In fact, design contexts have been discerned in which practical motives were not significantly important at all. For example, in factor 1, practitioners decide on which design methods to adopt primarily based on the nature of the product they are designing and on organisational factors.

In general, it seems that academics typically view PD as the ideal design method. In consequence, UCD is often viewed as an inferior method, only to be performed when design resources are insufficient for a carrying out a proper PD trajectory. For example, Gould and Lewis (1985) repeatedly emphasize the need for designers to interact with users, in order to understand them, stating "We recommend bringing the design team into *direct contact* with potential users, as opposed to hearing or reading about them through human intermediaries, or through an 'examination of user profiles'" (p. 301). Continuing on this, Wallach and Scholz (2012) quite uncompromisingly mention that it is "cognitively impossible" (p. 13) for members of a design team to identify with users. Further, in a study comparing UCD and PD methods, Mirri et al. (2018) state that PD creates products which better meet user expectations, and therefore is a preferable option in relation to UCD.

Certainly, drawbacks of PD are mentioned in academic literature as well. For example, high costs and efforts (e.g. Delikostidis et al., 2016; Siebenhandl et al., 2013; Tolkamp et al., 2018) and limited value of user input (e.g. Bellamy et al., 2007; Siebenhandl et al., 2013; Tolkamp et al., 2018; Van der Bijl-Brouwer & Dorst, 2017) are often mentioned as drawbacks of PD. Further, Carpentier (2009) shows that, although PD can be used effectively, implementation of PD methods often inadequately provide quality and relevance to users, resulting in dissatisfied users. A last obstacle in PD methods is presented by Hornbæk (2006), who argues that usability measures, such as the ISO standards effectiveness, efficiency, and satisfaction, are often not of equal importance to all involved stakeholders (e.g. designers and end-users), making a consensus on a "usable" product hard to reach.

It seems that current literature in favour of UCD often focuses on the beforementioned drawbacks of PD, and not on actual benefits of UCD. However, the current research has shown that in many contexts, UCD might be seen as a preferable option *in itself*, and not because of drawbacks of PD. For example, participants have been shown to favour UCD over PD in situations where organisational values and a focus on product purchasers are important (factor 1), or when there is ample manpower and designers are dealing with complex products (factor 2). Moreover, participants in one of the extracted factors in this study, factor 4, preferably rely solely on UCD. In this factor, no statistically significant motives for adopting a PD strategy could be found.

It becomes clear that PD is not always the preferred design method – even in a world where time, money, and personnel would be unlimitedly available. Situations exist in which UCD is, according to practitioners, a better suitable and preferred option. Reasons for this include confidentiality: a participant in factor 5 revealed that, in some cases, users were intentionally not involved in the design process because the product that was being designed was highly confidential. In such cases, organisations did not want to risk an information leak and therefore avoided communicating sensitive information to third parties such as end-users.

Another example is that some designers tend to adopt a UCD strategy when their user group understands the product well. One participant even took it a step further, and stated, "I would turn it around: it matters only if I understand the goal." When asked if that meant that it does not matter if a user does not understand the product goal, they answered: "Well, if that is the case, then I have made something that does not make sense to begin with." In other words, it seems that some designers adopt a, perhaps fittingly arrogant, attitude – thinking that, in some situations, it is best to think *for* users, and not *with* them.

Last, motives for PD often focus on the type of information that is gathered; information acquired through PD would be more comprehensive and therefore of more value, for example, because it provides an explanation regarding usability problems (Gould and Lewis, 1985) and uncovers information that users find difficult to express (Spinuzzi, 2005). In this study, similar results have been found. Participant were often seen favouring a PD approach when the design situation became exceptional: for instance, when designers were dealing with complex or highly innovative products, or when the user group was situated in a foreign country. Through the conducted qualitative interviews, it became clear that, in such situations, practitioners favoured PD because they did not feel adequately equipped to “assume” user preferences or characteristics. In other words, when a design situation is exceptional, the user group too is exceptional, and designers often do not feel well-enough equipped to deal with such user groups without the implementation of empirical research.

5.3 Practical Implications

The current study shows that there is a considerable and diverse set of motivating factors that influences practitioners’ inclination towards adopting a UCD or PD method. What can be taken from this in future HCD research, for example in studies comparing diverse HCD methods or studies investigating the implementation of HCD methods in organisations, is that factors beyond practical matters such as time and monetary resources should be taken into account, for those factors might greatly steer HCD practitioners towards a particular direction. Factors to be considered, as implemented in this study, should encompass 1) the design team, 2) HCD methods, 3) market, 4) money, 5) organisation, 6) product, 7) time, and 8) users.

Further, this study presents the idea that practitioners’ views on choosing a certain degree of user participation in HCD projects, differ greatly. Up until now, the questions if, when, and why practitioners choose for either a UCD or PD approach, based on organisational context, have been an untouched topic in the academic body of knowledge surrounding HCD. Organisational context in relation to HCD methods has been studied by several academics. However, these studies often focus on the HCD methods, and not on practitioners’ views. For example, Van der Bijl-Brouwer and Dorst (2017) state that “There is a large variety of HCD methods, each having their own specific purpose within a specific design context” (p. 2). Summarised, Van der Bijl-Brouwer and Dorst argue that varying HCD methods yield different types of knowledge, which means that the choice for a particular method should be made deliberately and elaborately. Focussing more on usability, a key result of HCD, Hornbæk (2006) argues that the meaning of usability depends on the design context. Continuing on this topic, Winter, Rönkkö, and Rissanen (2014) mention that “views of what usability actually is in this context, and its importance, were found to be varied. […] Different stakeholders have their own ideas of what the root of a problem is, and what the solution must be” (pp. 58-59).

In line with Hornbæk and Winter et al., the current study focuses on practitioner views instead of HCD method characteristics, and that practitioners’ motivation to adopt either a UCD or a PD strategy is influenced differently by varying factors. In this study, 5 practitioner views on the choice for a UCD or PD strategy have been found. These views show that different factors influence practitioners, depending on their personal preferences and organisational context. Further, it cannot be said that influencing factors have an identical influence on practitioners’ motivation for a design strategy, but rather that practitioners' motivation can be influenced differently by the same factors, conditional to the design context. For example, in some contexts, factors influence practitioners oppositely. In factor 1, for example, increasing product complexity motivates practitioners to adopt a PD strategy, where in factor 2, increasing product complexity motivates practitioners to adopt a UCD strategy. Further, statements that are of great importance in a certain context might not influence practitioners at all in a second context. For example, factor 1, consisting of 4 influencing statements, shares but one statement with factor 3, which consist out of 8 influencing statements. In this example, the shared statement is product complexity; which is significant in all factors.

Implications for practitioners are that they should be aware of the context in which they perform HCD and make deliberate design choices based on the most salient aspects of that context. The results from the current study can aid practitioners in recognising 1) the salient aspects of their context (i.e. the factor that best fits their organisational context), and 2) the design orientation (UCD or PD) that fits best, based on the importance of different motivating factors within that context. For academics, this study shows that there are different views among HCD practitioners regarding the choice for carrying out UCD or PD. This means that future theoretical models aiding practitioners in deciding which HCD method to adopt, should take into account that there are varying groups of designers who require unique help in their decisions, since influencing factors can have different and even opposite effects on designer's HCD preference. Additionally, the idea that varying practitioner views on choosing different levels of user participation in HCD projects exist, implicates that statements regarding, for example, the optimal design method, the optimal way of implementing HCD, or the weight of drawbacks and benefits regarding HCD methods, is situational and should therefore always be relativized to organisational contexts and personal preferences of practitioners.

A last, important contribution that this study makes, is the suggestion that UCD is a valid and, on various occasions, a favourable design method as compared to PD. Perhaps it is time for both academics and designers to, when fitting, validate UCD for what it is: a perfectly good design method that, when the context is right, yields the data that is needed, in the way it is wanted. UCD should, at least, not be defaulted as the second-class alternative to PD, only to be performed when budget does not allow for PD. On the contrary, both academics and practitioners should recognise the benefits of UCD. Certainly, the advantages of PD, such as its ability to uncover rich, qualitative explanations behind user problems (Gould and Lewis, 1985), are valid and should not be disregarded. However, perhaps in some cases, these advantages of PD are outweighed by the unique advantages that UCD offers, and which move beyond budgetary benefits.

5.4 LIMITATIONS

While this study provides several important additions to the current body of knowledge regarding HCD, and more specifically, practitioners' choices regarding the level of user participation in HCD projects, limitations to this study which should be addressed, exist.

A dominant limitation in this study is the participant sample. First, the sample size of the study was low. Although, as elaborated on in the Methods section of this report, the sample size, which was 26 in this study, was sufficient, perhaps more substantiated results could have been documented with a larger sample size. As stated by Watts and Stenner (2005), Q-methodology is most effective "when the participant group contains between 40 and 60 individuals" (p. 79). One reason for this, is that when the participant group is larger, more participants will be sorted into a factor – providing more generalisable data and more qualitative data to substantiate the quantitative findings. In the current study, 2 factors existed in which a particularly low number of participants was sorted: 1) factor 2, in which 3 participants were sorted, and 2) factor 4, in which 2 participants were sorted. However, since a factor on which 2 participants are loaded is still considered satisfactory (Watts & Stenner, 2005), no changes were made to the number of extracted factors.

Further, in this study, participants were approached through the researchers' social network, 3rd degree contacts and snowball sampling. However, in Q-methodology, it can be wise to strategically select participants, based on their experience with and anticipated viewpoints on the subject matter (Van Exel & De Graaf, 2005; Watts & Stenner, 2005). Further, because of the implementation of a convenience sample in this study, demographic participant data was not balanced. In other words, participant data was significantly unequally divided among the participant sample. Therefore, this data could not be used reliably to indicate attributes of the participant groups that would generally be sorted with each factor.

Last, according to Van Exel and De Graaf (2005), "the most important type of reliability for Q is replicability" (p. 7). In other words: will the same results be found when the study is replicated? According to Brown (1980), replicability, and thus reliability, is sufficient when the most prominent viewpoints of the concourse, which are not more than several, are revealed. This will be the case when the Q-set comprises of a broad range of opinions on the subject matter. In contrast, according to Watts and Stenner (2005), what is important is less the Q-set itself, and more the manner in which participants interact with the Q-set. However, according to both studies, these risks of Q-methodology should be tackled through the implementation of a participant group which contains a broad range of perspectives on the subject matter. Due to the use of a convenience sample during the interviews used to create the Q-set in this study, it is unclear whether a broad enough range of opinions has been incorporated in the Q-set. However, a literature review was incorporated during the constructing of the Q-set to broaden the scope of opinions in the Q-set, resulting in what is, to the researcher's best knowledge, an adequately complete Q-set. Further, it should be noted that an absolute, complete Q-set, containing all perspectives on a subject, cannot exist (Watts & Stenner, 2005), as "there is always 'something else' that might potentially be said" (p. 75).

Considering the limitations of this study, directions for future research are focused on researching which type of practitioner (e.g. experienced vs. inexperienced) and organisation (e.g. national vs. international; whole products vs. half products) fit with each organisational context. Such research could further aid practitioners in deciding which design method to implement in their particular context. Second, further research might incorporate a larger and more generalisable participant group, to verify whether the results found in this study are applicable to a broader participant group.

5.5 CONCLUSIONS

In conclusion, this study shows that practitioners' motivation considering the extent of user participation in HCD projects is dependent on a multitude of factors, which often, contradictory to academic literature, move beyond practical matters. Further, practitioners' views on the choice for conducting UCD or PD are divergent: 5 practitioner views have been found, in which different factors contribute to either adopting UCD or PD. Moreover, dependent on the design context and practitioner preferences, influencing factors might in some cases motivate practitioners towards UCD, while in other scenarios motivate practitioners to carry out PD.

REFERENCES

Bellamy, R. K., Richards, J., Rosenbaum, R., Erickson, T., Kellogg, W. A., Thomas, J., ... & Swart, C. (2007). Common & particular needs: A challenge to participatory design. *Proceedings of CHI'07 Extended Abstracts on Human Factors in Computing Systems*, 1697-1702. doi:10.1145/1240866.1240886

Bevan, N. (2003). UsabilityNet methods for user centred design. *Human-Computer Interaction: Theory and Practice*, *1*, 434-438.

Bevan, N. (2009). *Criteria for Selecting Methods in User Centred Design*. Retrieved from https://www.researchgate.net/profile/Nigel_Bevan/publication/221508484_Criteria_for_Selecting_Methods_in_User_Centred_Design/links/54d641270cf2970e4e69f824.pdf

Bevan, N., Claridge, N., Fröhlich, P., Granlund, Å., Kirakowski, J., & Tscheligi, M. (2002). *UsabilityNet: Usability support network*. Retrieved from http://www.usabilitynet.org/

Bjerknes, G., & Bratteteig, T. (1995). User participation and democracy: A discussion of Scandinavian research on system development. *Scandinavian Journal of Information Systems, 7(1)*, 73–98.

Brown, S. R. (1980). *Political subjectivity: Applications of Q methodology in political science*. Yale University Press.

Brown, S. R. (1993). A primer on Q methodology. *Operant Subjectivity*, *16*(3/4), 91-138.

Carpentier, N. (2009). Participation is not enough: The conditions of possibility of mediated participatory practices. *European Journal of Communication*, *24*(4), 407-420.

Chang, Y. N., Lim, Y. K., & Stolterman, E. (2008). Personas: from theory to practices. *Proceedings of the 5th Nordic Conference on Human-computer Interaction: Building Bridges*, 439-442. doi:10.1145/1463160.1463214

Cherry, C., & Macredie, R. D. (1999). The importance of context in information system design: An assessment of participatory design. *Requirements Engineering, 4(2),* 103–114.

Coogan, J., & Herrington, N. (2011). Q methodology: an overview. *Research in Secondary Teacher Education*, *1*(2), 24-28.

Cooper, A. (2004). *The inmates are running the asylum: Why high-tech products drive us crazy and how to restore the sanity* (Vol. 2). Indianapolis, IN: Sams.

Cruickshank, L., & Trivedi, N. (2017). Beyond human-centred design: Supporting a new materiality in the internet of things, or how to design when a toaster is one of your users. *The Design Journal*, 20(5), 561-576.

Curt, B. (1994). *Textuality and tectonics: Troubling social and psychological science*. Buckingham: Open University Press.

Delikostidis, I., Van Elzakker, C. P., & Kraak, M. J. (2016). Overcoming challenges in developing more usable pedestrian navigation systems. *Cartography and Geographic Information Science*, 43(3), 189-207.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39-50.

Gould, J. D., & Lewis, C. (1985). Designing for usability: Key principles and what designers think. *Communications of the ACM*, 28(3), 300-311.

Hi Chun, M. I., Harty, C., & Schweber, L. (2015). Comparative study of user-centred design approaches. *Proceedings of the 31st Annual ARCOM Conference,* 7-9.

Hornbæk, K. (2006). Current practice in measuring usability: Challenges to usability studies and research. *International Journal of Human-Computer Studies*, *64*(2), 79-102.

Karlsson, F., Holgersson, J., Söderström, E., & Hedström, K. (2012). Exploring user participation approaches in public e-service development. *Government Information Quarterly*, *29*(2), 158-168.

Lewis, J. R. (2014). Usability: lessons learned… and yet to be learned. *International Journal of Human-Computer Interaction*, *30*(9), 663-684.

Maguire, M. (2001). Methods to support human-centred design. *International Journal of Human-Computer Studies*, 55(4), 587-634.

Maiden, N. A. M., & Rugg, G. (1996). ACRE: Selecting methods for requirements acquisition. *Software Engineering Journal, 11(3)*, 183–192.

Markus, M. L. (1983). Power, politics and MIS implementation. *Communications of the ACM, 26(6)*, 430–444.

Miller, S. E. (1993). From system design to democracy. *Communications of the ACM, 36(4)*, 38.

Mirri, S., Roccetti, M., & Salomoni, P. (2018). Collaborative design of software applications: The role of users. *Human-centric Computing and Information Sciences*, 8(1), 6.

Mumford, E. (1983). *Designing participatively.* Manchester: Manchester Business School.

Nielsen, L., Nielsen, K. S., Stage, J., & Billestrup, J. (2013). Going global with personas. *IFIP Conference on Human-Computer Interaction*, 350-357. Springer, Berlin, Heidelberg.

Norman, D. A. (2005). Human-centered design considered harmful. *Interactions*, 12(4), 14-19.

Norman, D. A., & Draper, S. W. (1986). *User centered system design: New perspectives on human-computer interaction*. Boca Raton: CRC Press.

Panne, G.V.D., Van Beers, C., & Kleinknecht, A. (2003). Success and failure of innovation: A literature review. *International Journal of Innovation Management*, 7 (3), 309–338.

Rose, E. J. (2016). Design as advocacy: Using a human-centered approach to investigate the needs of vulnerable populations. *Journal of Technical Writing and Communication*, 46(4), 427-445.

Schuler, D., & Namioka, A. (Eds.). (1993). *Participatory design: Principles and practices*. CRC Press.

Siebenhandl, K., Schreder, G., Smuc, M., Mayr, E., & Nagl, M. (2013). A user-centered design approach to self-service ticket vending machines. *IEEE Transactions on Professional Communication*, 56(2), 138-159.

Smith, A., & Dunckley, L. (2002). Prototype evaluation and redesign: Structuring the design space through contextual techniques. *Interacting with Computers, 14(6)*, 821–843.

Spinuzzi, C. (2005). The methodology of participatory design. *Technical Communication*, 52(2), 163-174.

Steen, M. (2011). Tensions in human-centred design. *CoDesign*, *7*(1), 45-60.

Stephenson, W. (1935). Correlating persons instead of tests. *Journal of Personality*, *4*(1), 17-24.

Stewart, J., & Williams, R. (2005). The wrong trousers? Beyond the design fallacy: social learning and the user. *User Involvement in Innovation Processes. Strategies and Limitations from a Socio-Technical Perspective*, H Rohracher (ed.), 39–71. Munich: Profil-Verlag.

Sullivan, L. S., Klein, E., Brown, T., Sample, M., Pham, M., Tubig, P., ... & Goering, S. (2017). Keeping disability in mind: A case study in implantable brain–computer interface research. *Science and Engineering Ethics*, 24, 479-504.

Tolkamp, J., Huijben, J. C. C. M., Mourik, R. M., Verbong, G. P. J., & Bouwknegt, R. (2018). User-centred sustainable business model design: The case of energy efficiency services in the Netherlands. *Journal of Cleaner Production*, 182, 755-764.

Van der Bijl-Brouwer, M., & Dorst, K. (2017). Advancing the strategic impact of human-centred design. *Design Studies*, *53*, 1-23.

Van Exel, J., & De Graaf, G. (2005). *Q methodology: A sneak preview*. Retrieved from http://www.jobvanexel.nl/.

Van Kleef, E., Van Trijp, H.C.M., & Luning, P. (2005). Consumer research in the early stages of new product development: A critical review of methods and techniques. *Food Quality and Preference*, 16 (3), 181–201.

Wallach, D., & Scholz, S. C. (2012). User-centered design: Why and how to put users first in software development. *Software for People,* 11-38. Springer, Berlin, Heidelberg.

Watts, S., & Stenner, P. (2005). Doing Q methodology: Theory, method and interpretation. *Qualitative Research in Psychology*, *2*(1), 67-91.

Winter, J., Rönkkö, K., & Rissanen, M. (2014). Identifying organizational barriers – A case study of usability work when developing software in the automation industry. *Journal of Systems and Software*, *88*, 54-73.

Zuboff, S. (1988). *In the age of the smart machine: The future of work and power.* New York. NY: Basic Books.

Appendix 1: Final Q-deck

1 Hoe gemakkelijker de eindgebruiker bereikbaar is, hoe meer ik neig naar …	**2** Hoe meer de eindgebruiker het doel van het product begrijpt, hoe meer ik neig naar …	**3** Hoe meer focus er ligt op ontwerpen voor echte eindgebruikers van het product, hoe meer ik neig naar …
4 Hoe meer focus er ligt op ontwerpen voor de betalers van het product, hoe meer ik neig naar …	**5** Hoe meer homogeen de doelgroep is, hoe meer ik neig naar …	**6** Hoe meer geld er beschikbaar is voor het ontwerpproces, hoe meer ik neig naar …

7 Hoe hoger het verwachte rendement van de HCD-inspanningen is, hoe meer ik neig naar ...	**8** Hoe meer afgebakend en duidelijk het vraagstuk is, hoe meer ik neig naar ...	**9** Hoe meer data er reeds beschikbaar is over de doelgroep, hoe meer ik neig naar ...
10 Hoe meer kennis van en inzicht in beschikbare HCD methoden het ontwerpteam heeft, hoe meer ik neig naar ...	**11** Hoe meer behoefte er is aan gemak binnen het ontwerpteam, hoe meer ik neig naar ...	**12** Hoe meer niet-onderbouwde kennis het ontwerpteam zelf heeft van de klant, hoe meer ik neig naar ...
13 Hoe diverser de samenstelling van het ontwerpteam is, hoe meer ik neig naar ...	**14** Hoe meer alternatieven de organisatie heeft voor HCD, hoe meer ik neig naar ...	**15** Hoe meer de organisatie focust op de B2B markt, hoe meer ik neig naar ...

16

Hoe meer de organisatie focust op de B2C markt, hoe meer ik neig naar ...

17

Hoe meer de organisatie open staat voor innovatie, hoe meer ik neig naar ...

18

Hoe meer zichtbaar het effect van HCD is in de organisatie, hoe meer ik neig naar ...

19

Hoe meer vertrouwen in HCD er is vanuit de organisatie, hoe meer ik neig naar ...

20

Hoe meer focus er is op HCD binnen de organisatie, hoe meer ik neig naar ...

21

Hoe meer marktaandeel de organisatie heeft, hoe meer ik neig naar ...

22

Hoe meer invloed de organisatiemissie / -visie / -doelen hebben in het ontwerpproces, hoe meer ik neig naar ...

23

Hoe meer de organisatie focust op nationale bedrijfsvoering, hoe meer ik neig naar ...

24

Hoe meer de organisatie focust op internationale bedrijfsvoering, hoe meer ik neig naar ...

25

Hoe wendbaarder de organisatie is, hoe meer ik neig naar ...

26

Hoe feller de concurrentie van de organisatie is, hoe meer ik neig naar ...

27

Hoe nieuwer het product is, hoe meer ik neig naar ...

28

Hoe complexer het product is, hoe meer ik neig naar ...

29

Hoe groter het belang van innovatie is voor het product, hoe meer ik neig naar ...

30

Als het product fysiek is, dan neig ik meer naar ...

31

Als het product software is, dan neig ik meer naar …

32

Hoe meer rekening er moet worden gehouden met regulering vanuit de overheid en andere derde partijen, hoe meer ik neig naar …

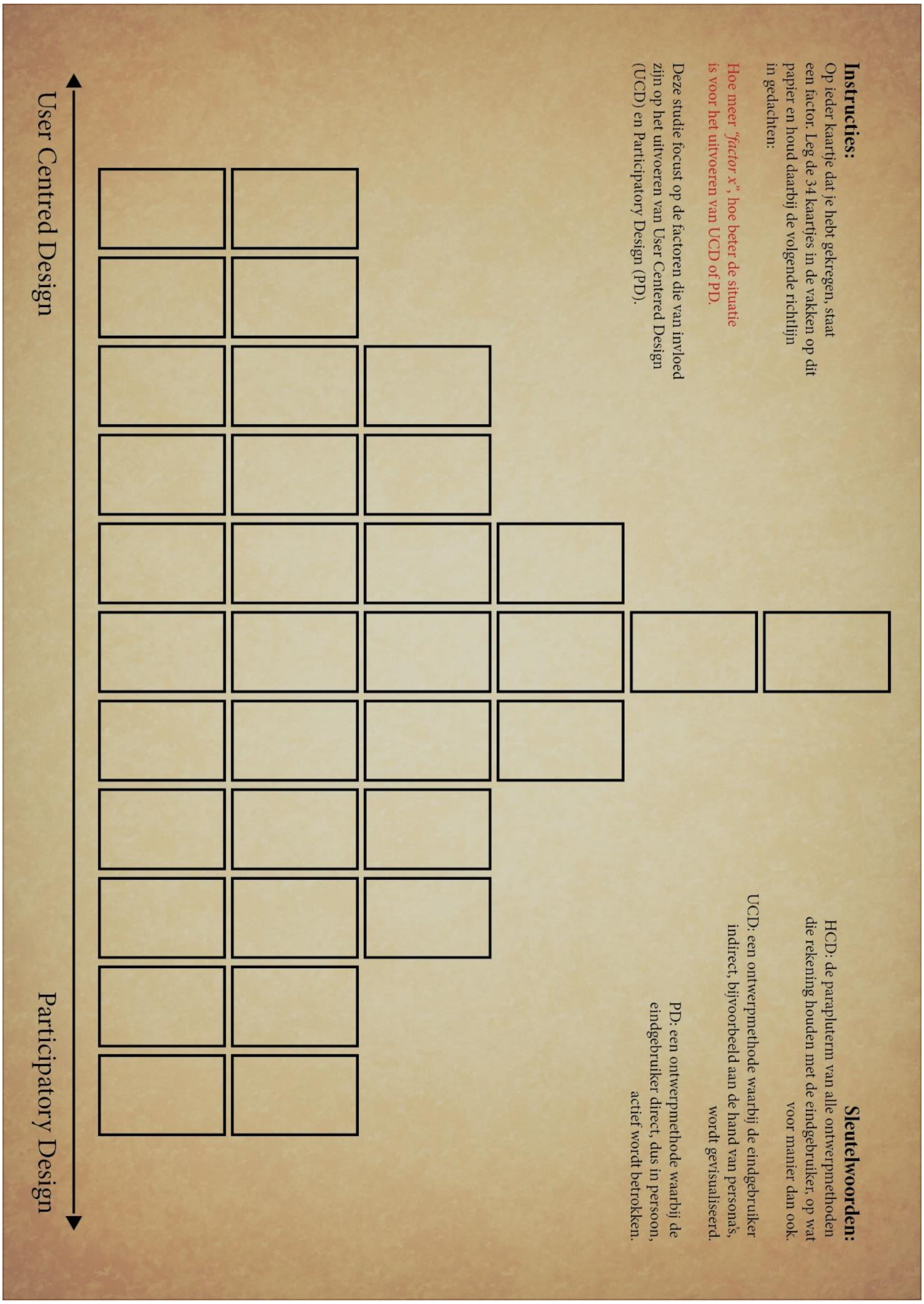
33

Hoe meer tijd er is ingepland voor het ontwerptraject, hoe meer ik neig naar …

34

Hoe meer fte er beschikbaar is gemaakt voor het ontwerptraject, hoe meer ik neig naar …

Appendix 2: Final Q-grid



APPENDIX 3: COMPLETE PCA RESULTS

Principal Components factor Analysis (PCA) results

Factor	Eigenvalue	As Percentage	Cumulative Percentage
1	8.26	31.77	31.77
2	2.71	10.44	42.21
3	2.31	8.88	51.09
4	1.85	7.12	58.20
5	1.72	6.62	64.82
6	1.30	4.99	69.81
7	1.18	4.52	74.33
8	1.05	4.05	78.38
9	0.89	3.43	81.81
10	0.81	3.13	84.95
11	0.69	2.64	87.59
12	0.64	2.48	90.06
13	0.53	2.03	92.09
14	0.47	1.81	93.90
15	0.40	1.53	95.43
16	0.30	1.16	96.58
17	0.22	0.85	97.44
18	0.21	0.80	98.24
19	0.14	0.54	98.78
20	0.12	0.46	99.23
21	0.08	0.32	99.56
22	0.04	0.16	99.72
23	0.04	0.14	99.86
24	0.03	0.10	99.96
25	0.01	0.04	100.00
26	0.00	0.00	100.00