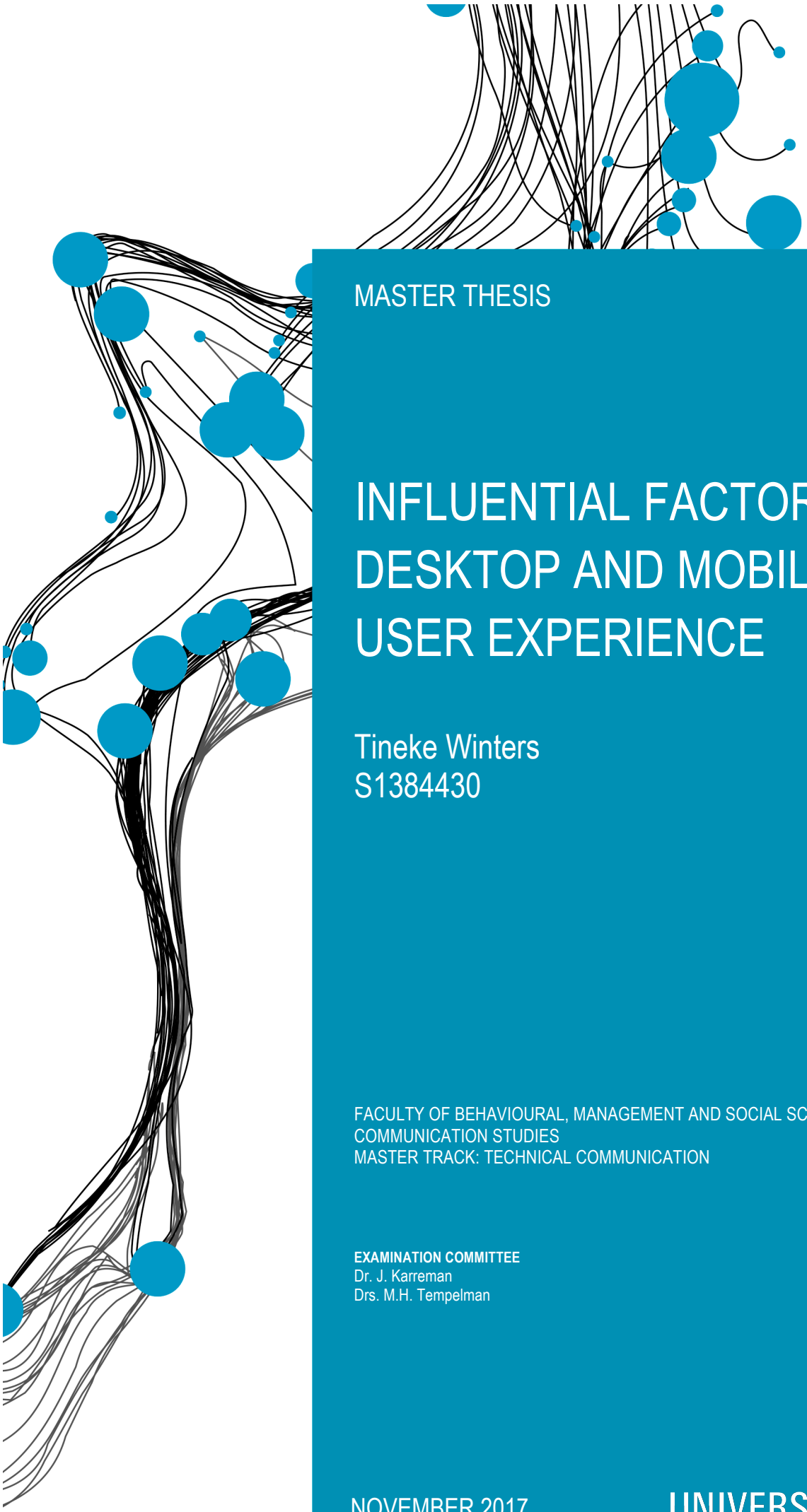

MASTER THESIS

INFLUENTIAL FACTORS OF DESKTOP AND MOBILE USER EXPERIENCE

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Abstract

Background: Nowadays it is common to use a desktop device, tablet device or a mobile device to surf on the Internet. The use of a specific device influences how a user experiences a website. The screen size, for example, is totally different on the different devices. An efficient and effective interaction with the website is what you want to deliver as an organization and what you want to experience as a user. However, not much is known about which factors influence the differences in experience on the different devices. **Aim:** The aim of this study is to better understand which factors influence desktop and mobile User Experience (UX). **Method:** The method consisted of interviews with experts in the UX field and an experiment with users. The interviews with five experts gave insight in how the experts think about desktop and mobile UX and how they deal with it within their organization. The experiment with 24 participants gave insight in how the users experience the differences between UX on desktop and mobile devices. **Results:** The experiment with the users indicates that the factors simplicity, directness, efficiency, informativeness, learnability, self-satisfaction, pleasure and customer needs are factors that influence UX on both devices. From this experiment is also obtained that flexibility is the main factor for differences on mobile and desktop devices. This research shows that experts struggle to chose a certain method for creating a website for different devices and that this often leads to trade off versions for one of the devices. From the user study is obtained that users seem to make a consideration on the expected difficulty of the task to choose a certain device. For simple tasks they prefer a mobile device and for more difficult tasks they prefer a desktop device. **Conclusion:** Flexibility is more relevant for mobile users because it needs to adjust to more elements than a desktop version. The struggle of the users for picking the right method can be less harsh if the experts keep in mind that some tasks are more preferred to perform at a mobile device and some tasks are more preferred at a desktop device and to focus on the UX and information need itself instead of limitations of a certain device. **Recommendations:** For creating the best possible UX further research is needed to find out which tasks are easy and preferred on mobile devices, and which tasks are difficult and preferred on desktop devices.

Keywords: *User experience, desktop user experience, mobile user experience, usability*

Table of content

1. Introduction

Since Internet is the main driver of success for many organizations the interaction of users with an organization's website on different devices is crucial. For users, it is important to have an efficient and effective interaction with the user interface (Pušnik, Ivanovski & Šumak, 2017).

Much has changed since the Internet came to existence two decades ago (Leiner, Cerf, Clark, Kahn, Kleinrock, Lynch & Wolff, 2009). It started with unattractive slow turnaround, low quality of pictures, terrible customer services, unreliable webhosting and not or very little search engine optimization (Gohel, 2014). Nowadays it is not only about reading information. It has become a mechanism for information dissemination, a worldwide broadcasting capability, a medium for collaboration and interaction between individuals and their computers without limitations for geographic location.

Not only the Internet has changed, also the use of the Internet has changed. Users were first only able to experience the Internet on a desktop device. Going on the Internet was a special activity, what was done by sitting down at the desk. Nowadays many users use the Internet on mobile phones, smart TVs, e-readers and tablets. Paternò and Santoro (2012) describe that it has become common that users perform their tasks on various devices. These devices range from the traditional stationary desktop platform to mobile devices. Paternò and Santoro (2012) call this "cross device task performing". Viewing a website on a desktop screen or a mobile device is quite different. Think about the location where people are surfing on the Internet, the difference in screen size, the availability or absence of a keyboard, using a mouse or your finger for navigation. This all has influence on the interaction of users with websites.

The interaction with a website can be described in different ways. Hassenzahl (2008) distinguishes the interaction with a website into a hedonic and a pragmatic quality. When the interaction focuses on the executing of activities, the pragmatic quality, the interaction is named usability and when the interaction focuses on the whole experience of the interaction, the hedonic quality, it is named User Experience (UX).

Keinänen (2011) states that further studies are needed to find out what the main distinctions are between UX on a desktop and UX on a mobile device and emphasizes the importance as

the share of mobile visitors increases worldwide. Since the literature misses a clear view of the actual differences on UX on desktop and mobile devices the aim of this research is to better understand this. It is unclear what the opinion of experts is and how they deal with these differences and how the users experience the differences.

To be able to study how users experience a website on different devices the website of the University of Twente is used. The website of the university is relevant because the University has to deal with a broad target group. The university wants to facilitate the employees, students and potential students. All these groups need to use the website of the university. The students are the biggest group and these are young and use different devices for surfing on the Internet. Most of the students have to travel a lot to the University or there houses, it is likely that they consult the website while they are on the go. Also from a practical view this is relevant, because the University of Twente has the goal to improve their UX.

The following research question and sub questions are proposed:
"Which factors influence the website User Experience according to experts and users?"

Sub questions:

Which factors influence the desktop and mobile User Experience according to experts?
Which factors influence the desktop and mobile User Experience according to users?

To answer the research questions expert interviews and a user experiment are executed. The theoretical framework is described in the second chapter. Next, in the third chapter the two different research methods are described. The results of the two research methods are presented in chapter four, followed by the conclusion and discussion in chapter five.

2. Theoretical framework

The theoretical framework is the foundation of this study. First the concepts usability and UX and their mutual relationship are described. Thereafter the UX on different devices is described, in particular the mobile UX. Next UX evaluation methods will be discussed. The chapter is concluded with the research questions.

2.1 Usability and User Experience

As described in the introduction usability focuses on the execution of activities. The ISO 9241 definition of usability is as follows: "The extent to which a product can be used by specific users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use". The definition of usability focuses on the pragmatic quality of interactive products. Hassenzahl (2008) assumes that people perceive interactive websites along two different dimensions. Hassenzahl (2008) distinguishes pragmatic quality and hedonic quality from each other. Pragmatic quality is about do-goals such as finding a book in an online-bookstore or making a telephone call. It is the product perceived ability to support the achievement of the goals. The hedonic quality also refers to the product perceived ability to support the achievement of goals. However, the goals of the hedonic quality are about "be goals" instead of "do goals". Examples of "be goals" are being special, being related to others or being competent. These goals are more related to human needs such as the need for novelty, self-expression and personal growth.

Usability and UX are two closely related terms. In the section before is explained that usability focuses on the pragmatic quality of a website. UX on the other hand focuses on the hedonic quality of a website. Hassenzahl (2003) already mentioned in 2003 that the HCI community seems to embrace the notion that functionality and usability is not enough and that they were far from having a coherent understanding of the actual meaning of UX. Hellweger and Wang (2015) cited Don Norman, the inventor of the term UX, a comment from the year 2000 that is still valid today:

"I invented the term because I thought human interface and usability were too narrow. I wanted to cover all aspects of the person's experience with the system including industrial design, graphics, the interface, the physical interaction, and the manual. Since then the term

has spread widely, so much so that it is starting to lose it's meaning… People use them often without having any idea why, what the word means, its origin, history, or what it's about."(p. 1).

Subsequent research defined UX from many different perspectives. According to Park, Han, Kim, Cho and Park (2013) UX concepts vary in terms of scope, objects, or elements. Some concepts focus on the temporality perspective of UX, or on co-experience by considering the social aspects of UX and others define UX as an outcome reflecting the user's internal state, the system's characteristic and the context of use. Bargas-Aila and Hornbæk (2011) stated that UX has emerged as an umbrella phrase for new ways of understanding and studying the quality-in-use of interactive products. Contrary to this perspective Park et al. (2013) defined UX as an overarching experience that consist of all aspects of users' interaction with a service or product. Usability and UX industry titans Jakob Nielsen and Don Norman, according to Mullins (2015), on the other hand describe UX as encompassing "all aspects of the end-user's interaction with the company, its services, and its products". In conclusion, the academic researchers and product developers have different opinions of what UX means (Park et al., 2013). Despite this, there is an immense interest in UX and it was speedily accepted in the Human-Computer Interaction (HCI) community and has been widely disseminated (Law, Roto, Hassenzahl, Vermeeren and Kort, 2009).

There are several reasons that explain why it is so difficult to get a universal definition of UX. Law et al. (2009) described the following three main reasons. The first reason is that UX is associated with a broad range of fuzzy and dynamic concepts. Mentioned variables of these concepts are: emotional, affective, experiential, hedonic and aesthetic. The inclusion and exclusion of particular variables seem arbitrary, depending on the author's background and interest. The second reason is that the unit of analysis for UX is too malleable. It can range from a single aspect of an individual end-user's interaction with a standalone application to all aspects of multiple end-users' interaction with the company and it's merging of services from multiples disciplines. The third reason plays around complications of the fragmented and complicated UX research field. There are diverse theoretical models with a focus on different aspects such as emotion, pragmatism, experience, affect, value, pleasure, hedonic quality and beauty.

This research adheres to the definition of Park et al. (2013): “All aspects of the end-user’s interaction with the company, its services, and its product”. This definition is used since it is dynamic, context-dependent and subjective. In addition, this definition also includes the perspective of not only focusing on the “do goals” but also on the “be goals”, as this is perceived as the main driver for good UX.

According to Hassenzahl (2008) the hedonic quality directly contributes to the core of positive experience and the pragmatic quality only indirectly contributes by making fulfillment more easily and likely. Hassenzahl (2008) believes that the fulfillment of “be goals” is the driver of UX. The lack of usability might be a barrier to the fulfillment of “be goals”, but it is in itself not desired. Hassenzahl (2008) also mentions that attributes such as being autonomous, being competent, being popular through technology use and being stimulated and related to others are required to fulfill the “be goals”. When people experience fulfillment of “do goals” through a product, they will attach pragmatic quality to it. This perceived pragmatic quality subsequently acts as an indicator for potential fulfillment of “be goals” by interaction with the product. Swallow, Blythe and Wright (2005) support this view by mentioning that good usability is the foundation for good UX.

Lárusdóttir, Cajander and Gulliksen (2012) mention that the ISO standardization of UX extends the concept of usability in several ways, because UX deals with much more than efficiency and effectiveness. They state that UX addresses satisfaction from the hedonic feelings about a product before it has been used. This goes far beyond the task oriented nature of usability.

To make a clear distinction between usability and UX Hassenzahl, Law and Hvannberg (2006) described the concepts "holistic", "subjective" and "positive outcome". The first concept of Hassenzahl et al. (2006) is holistic. Usability strongly focuses on the pragmatic side of the user-product relationship. The tasks of the users and their accomplishment are important as UX aims for a balance between pragmatic aspects and hedonic aspects. They view hedonic aspects as non-task related aspects of product possession and use, such as challenge, beauty, self-expression or stimulation. “Subjective” is the second concept that is described; it explains that a subjective approach is suitable for UX and that an objective approach is suitable for usability. Usability methods, like usability testing and eye tracking

primarily rests on observations when participants interact with a product. So it bases recommendations on observations rather than on mere user opinions. In contrast, UX augments the subjective, because it is more interested in the way people judge and experience the products they use. The objectivity of a product, how good it is, is important, but it must also be experienced subjectively to have impact, as the subjective constructions will guide future behavior of the individual and communication to others. The third and last concept is "positive outcome". Usability traditionally focuses on the reduction of problems, stress, frustrations, barriers and their removal. For product design the removal of negative aspects will always remain important. UX often stresses the importance of positive outcomes of technology possession or use. These positive emotions can be: excitements, joy, pride or simply "value". This does not mean that usability is unessential as bad conditions reduce satisfaction. However, good conditions also do not guarantee high levels of satisfaction. These high levels of satisfaction rather result from motivators such as recognition, growth or achievement. The best usability is probably not able to put a smile on users faces, because it only focuses on the removal of potential dissatisfaction. UX on the other hand focuses on equal footing dissatisfies and satisfiers.

2.2 UX on different devices

As described in the introduction it is nowadays common that users perform their tasks on different devices. According to Rowland, Goodman, Charlier, Light and Lui (2015) we are still figuring out the best ways to design for different devices and experiences. While users use different devices they encounter different usability issues, such as lack of coordination among tasks, poor adaptation to the context of use and inadequate support for seamless cross device task performance. These usability issues might have a negative influence on the UX. Websites can be displayed on many different ways and devices. In this subchapter the differences between the UX on different devices are described. Since the available and relevant literature is limited there is chosen to not only use literature about mobile websites but also about mobile applications.

Ickin, Wac, Fiedler, Janowski, Hong and Dey (2012) aimed to derive and improve the understanding of users quality of experience trough a combination of user application and network data on user's phones. Ickin et al. (2012) performed a user study for 4 weeks with 29

android users. During these 4 weeks they collected data through a combination of interviews, application data and network data on the user's phones. The researchers captured a widely set of mobile activities such as web browsing, internet-based radio, video streaming, news, online games and email in users in natural environments and different daily contexts. Ickin et al. (2012) presented some interesting findings that confirm the dynamic, context-dependent and subjective nature of UX.
Some participants of the study did not experience a good UX on mobile devices. When the users described the negative experience they used expressions like: sloppy, freeze, sluggish, performance, speed and usage of memory. This negative experience especially arose when the users experienced the website on desktop first and had high expectations, resulting in a lower UX (dynamic). Some of the participants of the study, who prefer to use a smartphone for visiting websites, experienced a good UX. For those users, the websites had enough usability to enable them to not use a larger and potentially more comfortable desktop device (subjective). Other mobile participants expressed their tolerance for less performing websites while using it "on the move" (context-dependent).

Pušnik, Ivanovski and Šumak (2017) state that the following factors contribute to a good mobile UX: interaction with a mobile device, which is natural, easy to use, intuitive, flexible to the wishes and needs of individuals and comfortable. In the literature differences in screen size, interaction and mobile resources between mobile and desktop UX are mentioned. Lee and Lee (2015) described some differences between PC's and mobile devices. The information structure of mobile devices is different from PC's, because of the small screen size. In addition, the amount of media should be in balance, as an overload should be avoided since it would influence the ease of comprehension and wrong use (Hiltunen, Laukka & Luamala, 2002). Another unique feature of mobile environments is the touch gestures that create specific UX patterns (lee & lee 2015). One example Icking et al. (2012) mention about the potentially more comfortable desktop device is that typing on a real keyboard, especially for long messages, provides a better experience.

Hiltunen et al. (2002) mentioned that mobile developers should learn from the mistakes of PC developers. According to Hiltunen et al. (2002) in most PC applications typically 90% of users never take advantage of about 90% of the features of the application. Since the mobile device recourses are limited, the feature set must be minimized. The traditional modes

developed for PC applications would not work well on mobile devices. According to Hiltunen et al. (2002) personalization of many interface facets would help users perceive and react quickly to events on the mobile phone. An example of personalization can be a configurable menu based on usage frequencies.
Later research from (Pušnik, Ivanovski and Šumak, 2017) confirms the differences mentioned above. They described several restrictions related to the mobile device, namely: display sizes, significant differences in the features of the differences of the device, restrictions of the use and connectivity, as well as a constant change of mobile context. The last mentioned restriction, the constant change of mobile context, thrives around the environment and circumstances of usage as a mobile device can be used at anytime, anywhere.

2.3 Evaluating UX

The many and varying definitions of UX also have influence on the evaluation of UX. According to Harpur (2013) there are already more than 100 UX evaluation methods.

Most of these methods are grouped by Petrie and Bevan (2009) into the categories described below. These methods are also used for usability and accessibility evaluation.

- automated checking of conformance to guidelines and standards
- evaluations conducted by experts
- evaluations using models and simulations
- evaluation with users or potential users
- evaluation of data collected during during eSystem usage

One of the methods Petrie and Bevan (2009) describe is evaluations with users or potential users. This method can be used at all stages of development. An evaluation with users is a suitable method to provide evidence of the accessibility and usability of a system in real use by the target audience. In a user-based method users undertake realistic tasks in realistic situations, or at least as realistic as possible. There are two different types of user-based methods: formative methods and summative methods. The formative methods typically employ thinking aloud protocols. These methods focus on understanding the users intentions, expectations and behavior. With these methods the encountered problems can be understood. The summative methods measure the product usability and accessibility. These methods are used to establish and test user requirements.

To evaluate UX it is important to not only measure the accessibility and usability, but also aim to get a wider understanding of users' real experience and interaction with technical systems. To understand this real experience it is important to measure the emotion of the users. There are different instruments that can be used to measure the underlying emotion. Most of them rely on physiological reactions such as pupil dilation, facial/vocal expressions and heart rate. Self-report is also a possibility. These can be verbal or non-verbal methods (Andersson & Isaksson 2007). Desmet, Overbeeke and Tax (2001) wanted to find a technique that made it easier for users to express what they feel. Desmet et al. (2001) created a tool: emocards, which help users to express their emotional responses without using words.

As UX on both desktop and mobile devices is a subjective, complex and dynamic phenomenon, quality assurance of UX has many challenges (Pušnik, Ivanovski & Šumak, 2017). UX on mobile devices needs to deal with even more restrictions, because the differences in display size, features of the device, restrictions of the use and connectivity and constant change of mobile context have a major influence on UX.

Arhippainen and Tähti (2003) defined different factors to make UX evaluation more systematic and tried to describe how UX could be evaluated for mobile websites. The capturing of UX is quite difficult according to them, because there are so many different factors in user-product interaction and the mobile devices bring new aspects to the field of UX research. To make the evaluation more systematic the factors should be clarified and they defined these as follows:

- User characteristics (values, emotions, expectations, prior experiences, physical characteristics, motor functions, personality, motivation, skills, age, etc.)
- Social factors (time pressure, pressure of success and fail, explicit and implicit requirements, etc.)
- Cultural factors (sex, fashion, habits, norms, language, symbols, religion, etc.)
- Context of use (time, place, accompanying persons, temperature, etc.)
- Product (usability, functions, size, weight, language, symbols, aesthetic characteristics, usefulness, reputation, adaptively, mobility, etc.)

Wigelius and Väätäjä (2009) support the view that factors around the product itself, defined as the context, are important for evaluation. They state that the contextual factors may

significantly contribute to the user's perceptions, preferences, behaviors, accomplishments and even emotional responses to using a mobile system or device. In addition, Park et al. (2013) identified three elements that influence mobile UX. They obtained these insights by a combination of in-depth interviews, a literature review and indirect observations. The elements are: usability, affect and user value.

Since the concept UX was introduced usability and affect have been widely studied. Usability was defined as the efficiency and effectiveness of the user interface (Park et al. 2013). Research on affect had been widely conducted on computers and it is stated that affective satisfaction is influenced by product appearances. In addition, there are indications that affect is significantly related to willingness to purchase consumer products (Park et al. 2013). User value can be regarded as a subset of life value and an association with a certain product or service (Park & Han, 2013). Or as Kim, Lee, Cho, Koo and Kim (2017) describe, user value may be related to how meaningful and significant the user thinks the product is in his or her life. Park et al. (2013) also identified some sub elements, explained as attributes of each element. All the elements and sub elements are shown in table 1. The definitions of the sub elements of usability, user value and affect are shown in appendix C.

Table 1 ***Influential elements of UX***

Usability	**User value**	**Affect**
Simplicity	Self-satisfaction	Delicacy
Directness	Pleasure	Simplicity
Efficiency	Sociability	Texture
Informativeness	Customer needs	Luxuriousness
Flexibility	Attachment	Color
Learnability		Attractiveness
User support		

In this study the elements of Park et al. (2013) are used to measure the UX. These elements are used because not only the pragmatic factors (usability) play an important role but also the user value and affect (hedonic) are an important part of the whole.

2.4 Research gap

As described in the theoretical framework, there are many different opinions and theories about UX, many different definitions about UX and also many different ways to measure UX. Although the existing theory gives insights in the influential elements and restrictions of mobile UX there still exist a lot of different perspectives. This literature review shows that the existing literature misses a clear view of the actual differences between the influential factors of UX on desktop and mobile devices. In addition, it is also unknown how experts from the work field experience these differences, how these experts deal with these differences and whether users experience and perceive the elements usability, user value and affect, as described by Park et al. (2013), as influential. Further research is required in order to get a better understanding of these gaps in the literature.

The following research question and sub questions are proposed:

"Which factors influence the website User Experience according to experts and users?"

Sub questions:

Which factors influence the desktop and mobile User Experience according to experts?

Which factors influence the desktop and mobile User Experience according to users?

In the following chapter the expert interviews and user experiments are described that are needed to answer the research questions. The first study focuses on what experts in the UX field think about UX and the differences on desktop and mobile devices. The second study is a user study in which the experiences of users are measured to be able to compare UX on desktop and mobile devices.

3. Method

This part of the study gives a description of the methods that are used to answer the research questions of this study.

3.1 Interviews with experts

In this study interviews were conducted, as this is the most common technique to give insights in opinions and underlying feelings of people. These interviews were conducted with experts in UX in line with the research question. The interviews are used to get insights in how experts are dealing with UX on different devices and to reveal their personal opinion about mobile and desktop UX. This information is needed to answer the research sub question: *Which factors influence the mobile and desktop User Experience according to experts?*

3.1.1 Design

Interviews are the most common techniques used to gather research information. For this research semi-structured interviews were chosen since these provide a structure of open-ended question and give room for a flexible approach (Al-Busaidi, 2008). This seems suited as in this research an explorative approach is used in which the researcher needs to enter new areas to produce richer data. In addition, semi structured interviews also elicit people's own views and thus have the benefit of uncovering issues or concerns that could not have been anticipated by the researcher. In conclusion, the semi structured interview method is grounded to use as it enables to explore views, experiences and beliefs of the experts.

3.1.2 Participants

The study was conducted in 2016 and 2017. The sample consisted of five participants. All participants were Dutch males with age's ranging from 29 till 42 years. Three of them were selected from the personal network of the researcher, others via the University of Twente. The three participants who are selected from the personal network of the researcher work in the online marketing field and have interfaces with UX at their job. The marketing and communication department of the University gave contact details from potential participants from different companies that are responsible for the website of the University of Twente. Two of the approached experts, who are partly responsible for the website of the University of Twente, were willing to participate. Since the interviewed experts have different functions and work in different branches and domains a comparison might lead to interesting views.

From the participants 2 participants are working at an agency that develops websites, 1 participant is working at an online marketing agency, 1 participant is working at an insurance company and 1 is working at a company in the automotive industry. The job titles of the participants are: project manager, online UX specialist, online marketer, owner of a web development agency and owner of an online marketing agency.

3.1.3 Procedure

The interview questions focused on five themes: background of the interviewee, general opinion about UX, role of UX within the company, policy of company concerns UX and opinion about UX on mobile and desktop devices. At first, the background of the interviewee was asked to find out more about the function within a company and about the role UX plays within the function. Second, the general opinion about UX is asked by asking how they should describe UX, the importance of UX and what they think is the most important aspect of UX. The third phase focused on the role of UX within the company. The fourth phase was about how the company deals with UX. In this phase was discussed which procedure is used when a new service on different devices is released, how the company deals with UX on different devices, and what they perceive as advantages and disadvantages of the policy and the ideal method. The last phase focused on opinions of UX on different devices. The questions focused on what the participants perceive as important elements and differences of UX on desktop and mobile devices.

Appointments were made to conduct the interviews. The interviews took place at different dates (from November 2016 till February 2017) and at different locations. All the interviews were conducted through personal contact with the expert. Only the interviewer and the expert were attending the interview. Prior to the interview the participants where informed about the topic of the interview. Before the interview the participants received an informed consent form. The interviews were recorded with a Dictaphone application on a mobile phone. The average time the interviews lasted was around 30 minutes.

3.1.4 Data analysis

All the recorded interviews were transcribed word by word. The transcripts were imported into ATLAS.ti. After preliminary reading of two of the random selected transcripts a code list was developed. After coding all the interviews a second coder is asked to code an interview. The second coder selected a number which was linked to an interview, the second coder selected interview 4. The second coder received all 19 quotations of the interview with the list

of different codes. The second coder coded 16 of the 19 quotations with the same code. After discussing the codes with the second coder the score was 19 out of 19. The code list is added to the appendix A.

3.2 Experiment with users

Next to the interviews also an experiment took place in this study. This experiment gave insights in the UX that the actual users experienced on the website of the University of Twente on desktop and mobile devices. This information is needed to answer the research sub question: *Which factors influence the mobile and desktop User Experience according to users?*

3.2.1 Design

For the experiment with the users is chosen to carry out a field study. The experiment involved collecting, analysing and interpreting data by observing what people do and say. This field-testing was useful for identifying the problems the users encounter and for collecting qualitative data from the actual target audience. During the experiments each user had to perform tasks. Half of the participants performed the tasks at a desktop device; the other half performed the tasks at a mobile device. After performing each task the user was asked to link an emotion to the task performance and after that a short interview was conducted.

3.2.2 Tasks

Three different tasks are formulated. The tasks differ in the area of difficulty. The first task can be classified as difficult, the second task as medium and the last task as easy. For the first task the user needs to download a file on a certain webpage to find the right information to complete the task. For the second task the user needs to combine the available information on two webpages to complete the task. The information that was needed to complete the third task was available at one webpage. With the most difficult task the user needs to process lot information, it needs more cognitive load to complete the task and therefore may be perceived as difficult.

The first task was to find information about the requirements to start with the master thesis within the master track. The second task was about if it is possible to study in the library next Sunday and if there was catering available. For the third task the participants needed to find the visitor address of a certain professor at the University of Twente. The complete description of the three tasks is shown in table 2.

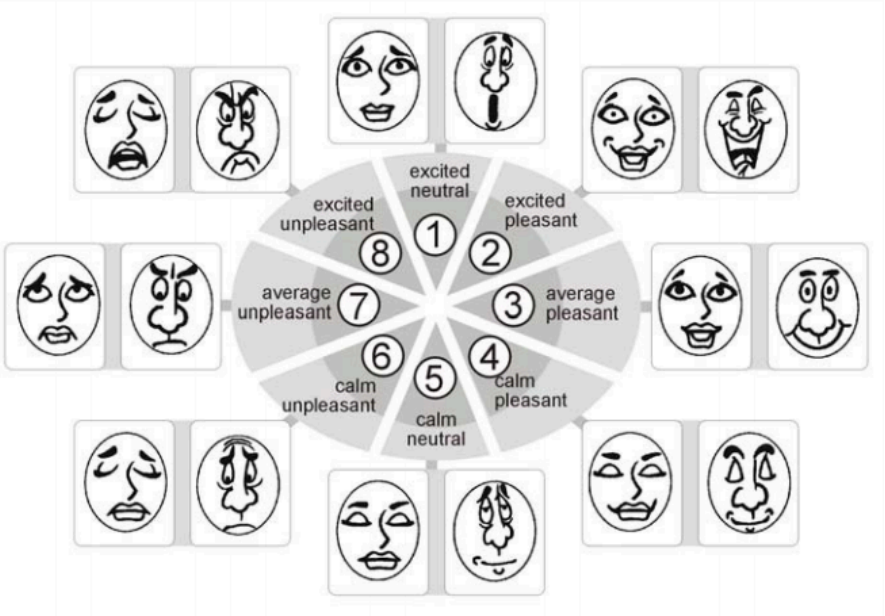
Table 2 *Task description experiment*

	Task description
1.	Imagine: you almost finished your bachelor. When you finished your bachelor you would like to follow the master track Philosophy of Science, Technology and Society. You are curious when you can start with your master thesis. Can you start right away or do you need to complete a few courses first?
2.	You want to know if it is possible to study in the library of the University of Twente next Sunday. Find out if it is possible to study in the library next Sunday and if there is catering available.
3.	You have an appointment with Peter-Paul Verbeek but you do not know where you need to be. Find out where his office is located at the university.

3.2.3 Measures

Harpur (2013) stated that the evaluation of UX is more than the attainment of their practical tasks and goals; it also measures the emotional factors such as joy. The evaluation of UX involves determining their UX, their level of satisfaction, with a system. The evaluation of UX should measure how users feel about the use of a system. The method of Desmet et al. (2001) with the emocards is therefore suitable for this. The emocards consist out of 16 cartoon faces with eight distinct emotional expressions. The expressions vary on the basis of the dimensions "arousal" and "pleasantness". 8 of the faces are female and the other 8 are males. Each emotion can be described in the terms of the level of arousal and pleasantness. The described emotions are a combination of excited/average/calm and neutral/pleasant/unpleasant. All the different emotions are shown in figure 1.

Figure 1 Eight emotional categories and Emocards



This tool helps users express their emotional responses without using words. Users can select a card that best expresses their emotional responses to a product or service. This functioned as a starting point for a conversation with the researcher. After the participants performed each task a short interview was conducted. The observation of the participants who are performing a task while using the think aloud method is important, but to really understand the experience of the users it is necessary to ask through to acquire the bigger perspective.

After the participants performed a task and selected an emocard a short interview was conducted. The following questions were asked to the participant:

1. Why do you choose this emocard?
2. What did you liked about this task?
3. What did you dislike about this task?
4. Would you like to perform this task at a mobile/desktop device? Why?

3.2.4 Participants

The study was conducted in 2017 and took place between the 13th of May and the 9th of June. One of the participants was selected from the personal network of the researcher, all the others were asked at the campus of the University of Twente whether they wanted to participate in the study. All the participants were students of the University of Twente. The sample consisted of a group of 24 participants. 12 participants performed the tasks at a desktop device and the other 12 performed the tasks at a mobile device. 8 of the participants were female and 16 were male. Both bachelor and master students took part in the experiment. An overview of the desktop and mobile users, their education, whether they are a bachelor or master student and their gender are shown in table 3 and table 4. The groups were similar to each other. Both groups consisted out a wide variety of master and bachelor courses. The desktop group consisted out of more master students and females in comparison to the mobile group. The mobile group consisted out of 3 females and the desktop group out of 5. From the participants who performed the task on a mobile device 3 were master students; the desktop group consisted out of 5 master students.

Table 3 *Desktop participants*

Participant number	Education	Bachelor/master	Gender
1	Business administration	Master	Male
2	Embedded systems	Master	Male
3	Biomedical technology	Bachelor	Male
4	Communication studies	Master	Female
5	Industrial design	Bachelor	Female
6	Psychology	Bachelor	Male
7	Biomedical technology	Bachelor	Female
8	Computer science	Bachelor	Male
9	Embedded systems	Master	Male
10	Nanotechnology	Master	Male
11	Psychology	Bachelor	Female
12	Technical medicine	Bachelor	Female

Table 4 *Mobile participants*

Participant number	Mobile users	Bachelor/master	Gender
13	Biomedical technology	Master	Female
14	Electrical engineering	Bachelor	Male
15	Industrial design	Bachelor	Male
16	Mechanical engineering	Master	Male
17	Advanced technology	Bachelor	Male
18	Business and IT	Bachelor	Male
19	International business administration	Bachelor	Male
20	ATLAS	Bachelor	Male
21	Advanced technology	Bachelor	Male
22	Industrial design	Bachelor	Female
23	Biomedical technology	Bachelor	Female
24	Mechanical engineering	Master	Male

3.2.5 Procedure

All the experiments were conducted through personal contact. The researcher and the participant were the only 2 persons present during the experiment. The participants are students at the university of Twente and are known with the website of the university. The students were asked to participate in the research in a real life and natural setting at the University of Twente. The users who were used for this experiment were end-users, they all have to use the website of the university. During the tasks the user was asked to use the think aloud method. The user observation in combination with the think aloud procedure gave insights in the intentions, expectations and behavior of the participants.

The participants of the experiment needed to perform three tasks at the website of the University of Twente. Half of the participants completed the task on their mobile devices and the other half completed the tasks on their desktop devices. All the desktop participants made use of their own desktop device (laptop) or mobile device. This is chosen because the users are familiar with their own device and the navigation. This might lead to a limitation, because the users might have a different web page look. However, as the University of Twente has a responsive website, which means that it can be viewed on different devices in a similar way, it is appropriate to use for this experiment. Except the screen size of the devices there were no other big differences in showing the website. The only aspect is that the different brands of devices have a slightly different way of navigation. In figure 2 is a print screen of the website of the University of Twente on a desktop device displayed and figure 3 displays a print screen of the website of the University of Twente on a mobile device.

The participants were asked to perform the tasks one by one consecutively. It was told on forehand that it was also possible that the user could give up on a task. There was also a time limit, this was not told to the users, after 10 minutes the users were told that they could stop performing the task. It took around 3 minutes on average to perform one task. After performing each task the participant was directed to the emocards. It is a fast and easy technique for the user to understand.

The duration of the experiment took around 20 minutes. The average time the participants needed for the tasks was around 10 minutes. After completing each task a short interview was declined, these three short interviews also took in total around 10 minutes.

Figure 2 Screenshot of the website of the University of Twente on a desktop device

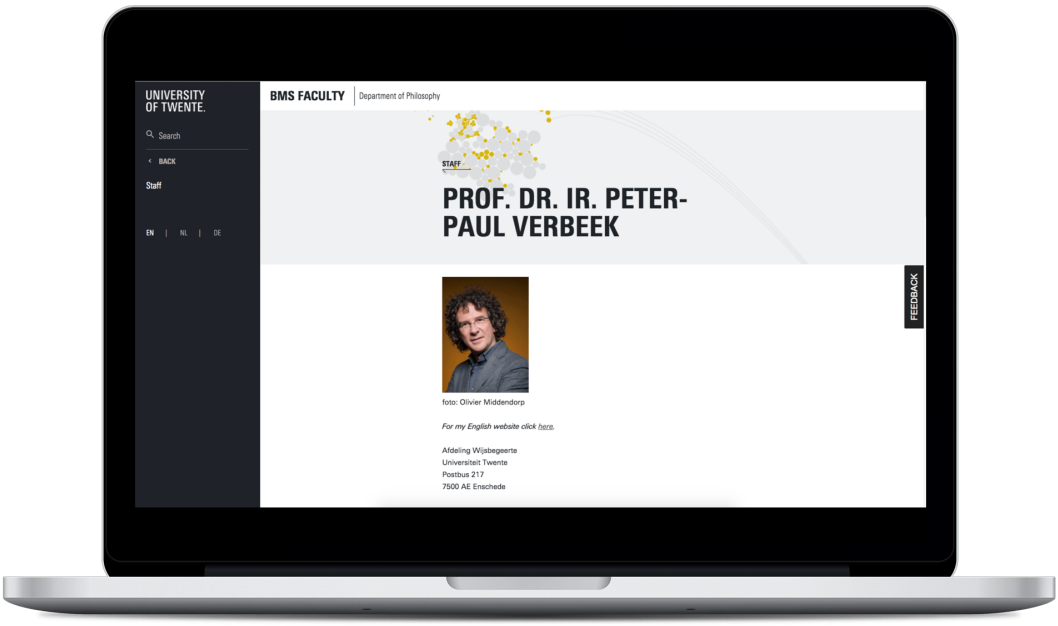
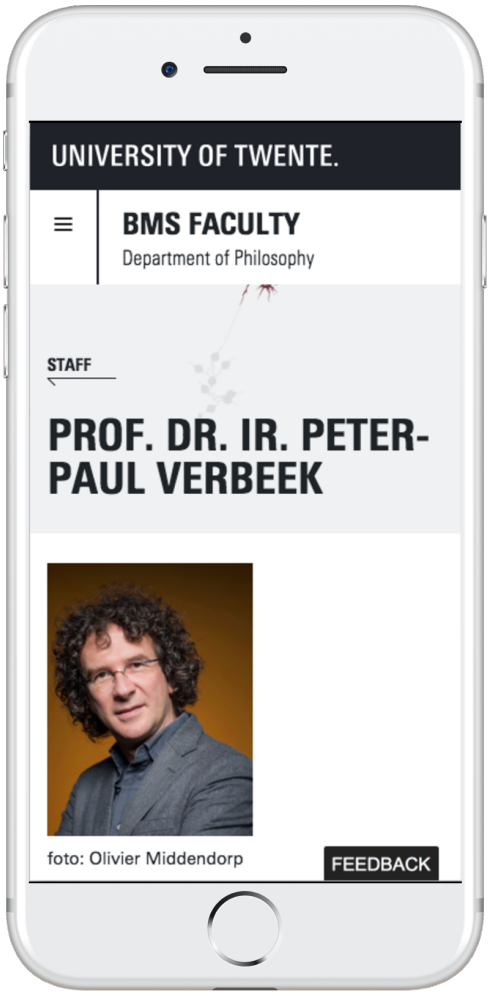


Figure 3 Screenshot of the website of the University of Twente on a mobile device



3.2.6 Data analysis

The experiment resulted in different types of data. First the think aloud protocol captured the users thoughts, feelings and experiences. During the tasks performance the participants were observed while thinking aloud in which a number of bottlenecks came to light. These bottlenecks were thereafter discussed in the interviews to get a better understanding of the experience.

The participants chose an emocard after performing each task. The different selected emotions are compared with each other on different levels, namely: device and tasks. This data gave insight in the different UX per device and the different UX per task. After the participants selected an emotion a short interview was conducted. The interviews are recorded with a Dictaphone. All the recorded interviews were transcribed word by word. The transcripts were imported into ATLAS.ti. A code list was developed after reading three random selected transcripts and is added to Appendix B.
The (sub) elements of Park et al. (2013) are compared with the experiences of the users. During the interviews is not asked about the specific elements, some elements came up for discussion during the interviews initiated by the users. For coding these elements the definitions of the sub elements are used. The definitions of the sub elements from Park et al. (2013) are showed in Appendix C.
The task performance of the users gave more insights in the usability. This can be divided into effectiveness of task performance and efficiency of task performance. The effectiveness of the task performance was measured by calculating the mean number of tasks that each participant performed correctly. The efficiency of the tasks performance was measured by the time the participants spend on performing the tasks.

4. Results

The results of the interviews and the experiments are described in this chapter. First the results of the interviews are described, second the results of the experiments.

4.1 Interviews with experts

The interviews consisted out of different parts. The different parts of the study are: opinions about UX, importance of UX, how to apply UX in an organization and differences between desktop and mobile devices. The results of each element is described.

4.1.1 Opinions about UX

The general opinion, or definition, of how the participants describe UX is shown in table 5.

Table 5 ***Opinions about UX***

Participant number	Quotation
1	"I see UX as the experience an user has with something, that can be online but also offline."
2	"I think UX is the impression a user gets from a website or application, did they achieve what they wanted to achieve?"
3	"According to me, the UX is good as users can find something they need without having questions."
4	"UX is the experience of an user on the page, and how you can use these pages as good as possible to lead the user to their goal. "
5	"For me, the most broad definition I would say: optimally meet the needs of the users, being relevant. The needs can consist of what he needs to do, understand it and consider the content as relevant."

Although there are no big differences and the opinions are in line with each other, they all have a own description of what UX is according to them. Participants 2 and 4 mention the goal in their definitions. Participant 1 also mentions the goal: "it can be an experience where you want to push your customer in a certain direction or facilitating your customer". Participant 3 also mentions that with good UX the user allows to find what they need. As all participants mention the goal it might therefore be perceived as important for UX.

Regarding to participants 1 and 2 UX lead to a lot of discussion, because a lot of people have different opinions about UX. Participant 1 mentions that it is almost something like design; everyone seems to have an opinion about it. He states that only the educated UX professional can give an indication of how people are going to react.

4.1.2 Importance of UX

In the table 6 is outlined what the importance of UX is regarding the participants.

Table 6 ***The importance of UX***

Participant number	Quotation
1	"When a company is not orientated on the users but only focussing on their product it will be the end of story in the end. It is very important to listen to your users, what do they think and what do they experience, and how you can optimize this experience. When you do this, it will result in surviving as a company."
2	"UX should serve a purpose. What you create as a company should make possible that your user can do what they need to do. For our company it is also important that users can finish their tasks without reaching out for us."
3	"When you deliver a website that does not function well, it does not feel right."
4	"I think UX is super important. Sometimes I work with campaigns where no attention is paid to the UX. These campaigns lead to almost nothing."
5	"I think the importance of UX is big. When the UX is not good, when you not satisfy your users, you do not get the optimal effort of your visitors. For organizations it is important for their efficiency. I think it is the component that determines the success of everything. "

All 5 experts are aware of the importance of UX and they think that it is important for organisations. Participant 2 and 3 speak from the point of view of the organization, that you want to deliver good functioning products with a good UX to your costumers. Participants 1, 2, 5 perceive it more as a very important overarching element for the organization. Participant 1 and 5 even think it is so important that it determines the success of a company and it is crucial to survive as a company.

4.1.3 How to create good UX on desktop and mobile devices as an organization

All the companies of the experts are making products for desktop and mobile devices. The experts described the different ways of how their companies are dealing with different devices. Table 7 shows these different descriptions.

Table 7 ***What method does the organization uses***

Participant number	Quotation
1.	"The company where I work established a mobile first scrum team. The goal of this team is to help the company more towards the mobile first method. This team will be unnecessary when the whole company is applying the mobile first method. Most people are still inclined to start with desktop. They translate the desktop design to a mobile design. The goal of the mobile first team is to turn this around. The result is that the teams are applying this mobile first method. We used to start wire framing for desktop devices, now we start with the mobile devices."
2.	"Nowadays we start with the mobile devices. Mostly visitors of websites are mobile visitors."
3.	"We make 3 sorts of prototypes, for desktop, tablet and mobile at the same time. We compare these so we can see the differences. We do not make interactive prototypes, it takes too much time. We prefer to build a basic version to test it but most of the time there is no budget or time for it."
4.	"We make wireframes for the different devices. We wireframe for desktop, these resolutions should be sufficient for tablet. We also wireframe for mobile, so our focus is on desktop and mobile. For the business market we start with desktop but for the consumers we prefer to start with mobile."
5.	"Ideally we start with mobile first but I have to confess that it is most of the time still desktop."

4 of the 5 experts mentioned the mobile first method. They all apply it or applied it in the past. The experts mentioned different reasons for choosing the mobile first method; these arguments are shown in table 8.

Table 8 *Argumentation for choosing the mobile first method*

Participant number	Quotation
1.	"When you wireframe from desktop to mobile the mobile version is a desktop light version. You strip the desktop version to a mobile version. When you start with mobile you need to start with the essence. On desktop you have more space for positioning. Eventually you can add some things, but not much."
1.	"It is logical when you start with mobile first that that version is ideal for mobile. It is not a wannabe version of desktop, which is eventually presentable on mobile devices."
1.	"The desktop light version, from desktop to mobile, is a kind of trade off. There is no urgency to decide which elements are essential because there is space for it."
4.	"For business we wireframe for desktop first. Desktop is still very important for this target audience. For the consumers we emphasize mobile more. The mobile traffic is growing rapidly; it is almost half of all the visitors."
4.	"For business (target group) we start with desktop wireframing because we need to communicate a lot. Our thought behind it was to start with the complete version. The complete version needs to be translated to mobile; some elements need to be skipped. We saw it like a sort of stocktaking of what was needed."
5.	"With mobile first you are forced to return it to the essence."

The experts also mentioned some arguments why they did or did not chose the mobile first method. Participant 1 mentioned an advantage and a disadvantage of the method:

"An asset is that as a user you are forced to think about the essentials: what do I need to communicate, what is essential? You have to be stricter about when it is enough. A disadvantage is that mobile first is focussed on mobile devices and less good for desktop devices".

Participant 4 and 5 also mentioned this disadvantage. Participant 5 describes that when there is only budget for one device that the client struggles with the translation to desktop as a major disadvantage. He recognizes less trouble when they have to translate desktop

wireframes to mobile wireframes. Yet he states that with the mobile first method ensures that you focus more on the essence:

"With mobile first you are forced to return it to the essence, you are not losing information because you start with the smallest screen"

Participant 2 also recognizes this as a major advantage. The last advantage of mobile first is that when you specifically develop wireframes for mobile you achieve better results than when you rebuild a desktop wireframe, regarding to participant 4:

"You have a different wireframe for mobile when you start with desktop than when you start with mobile wireframes. Mobile first is more mobile oriented."

So the method mobile first has advantages and disadvantages but the experts also spoke about an ideal method. Participant 1 thinks mobile first is a better method than desktop first. To his opinion the ideal situation is more like a cross channel approach in which there is always a device you start with, but where you keep the different approaches in mind during the development process. So you start with the idea without linking it to a certain device. Participant 2 is content with the approach his company uses. For them it is the most obvious approach regarding the following reasoning:

"When you start with the smallest device, you cannot lose anything, it is possible to add things for desktop to make it even better".

For participant 3 the ideal situation only exists when you do not have budget or time limitations. As this situation does not exist regarding to him you always need to take in mind that you have to take some decisions that are contradictory to the ideal situation. According to participant 4 the ideal method depends on the situation. For participant 5 the ideal method cannot be assigned to a certain device on forehand. Participant 5 states that it would be better to set priority to the certain information need that is required. So you should define the funnels without linking it to a device.

Thus, the experts agree that mobile first is a better method than desktop first. Some participants even describe a method that functions better than mobile first. In this ideal method you define the ideal funnel without linking it already to a device.

4.1.4 Differences between desktop and mobile devices

The experts mentioned a few different elements that have an effect on UX on the different devices. The mentioned elements are: mood, tension, current location, other needs, purpose, multitasking (during use), mouse, on hovers, screen size, space, overview, clear hierarchy,

scan path, ambiance, baby steps, pixels, control, text links, repositioning, reduce, enlarge, zoom, tabs, multitasking, order, balance, style elements ((hamburger)menu, buttons, images), stare, sore eyes, data stream, Java, 4G, broadband and cashing. The mentioned elements that influence the UX on mobile and desktop devices can be divided into 3 groups, namely differences in interaction, differences in screen size and differences in technique. The experts especially mentioned a lot different elements that can be grouped under differences in screen size. All the mentioned elements are shown in table 9.

Table 9 *mentioned elements that influence UX*

Subjects	Mentioned elements
Difference in interaction	Mouse, on hovers
Difference in screen size	Screen size, space, overview, clear hierarchy, scan path, ambiance, baby steps, pixels, control, text links, repositioning, reduce, enlarge, zoom, tabs, multitasking, order, balance, style elements ((hamburger)menu, buttons, images), stare, sore eyes
Difference in technique	Data stream, Java, 4G, broadband, cashing

Participant 5 explicitly mentioned the difference in experience on the different devices. He states that you experience less on a mobile device in comparison with a desktop device regarding the following quote:

"When I want to experience the whole experience I am swapping my mobile phone for a 27-inch screen".

Some participants also mentioned some similarities of the different devices. Participant 1 states that overview, control, clear hierarchy, clear information scent and good interaction are important principles of UX regardless the device. He states that it is easer to have a good overview on desktop than on a mobile device. Thus, one should consider that the principles need to be applied in a different manner to obtain a good overview on a mobile device.

4.1.5 Conclusion interviews with experts

The interviews gave insights in the opinions of the experts and how the experts deal with the different devices in their organization. "UX is the component that determines the success of

everything" is a quote of one of the participant 1. Some other experts support this view by arguing that UX is essential to survive as a company. Although the other experts also emphasize the importance of UX within a company they merely describe it from the perspective of delivering good function products with a good UX for your customers. It is surprisingly that all experts mention the goal of the user to be achieved when they needed to define UX.

The experts describe different processes of how the companies are dealing with UX on different devices. The experts describe the methods desktop first and mobile first. It is notable that the experts stated that when they wireframe a website for desktop first, the UX of the mobile version is less good than when they would start on mobile. Some experts also stated that when they wireframe a website for mobile first the UX of the desktop version is less good when they started with the desktop version. According to the experts the device, which has not the first focus, is, as it were, a trade of the original version. When a company does not want a "trade of version" of their website they do not have to focus on the UX on one device but on the UX. In a later stadium this can be linked to the certain devices. The mentioned elements that influence the UX on mobile and desktop devices can be divided into 3 groups, namely differences in interaction, differences in screen size and differences in technique.

4.2 Experiment with users

The results of the experiments are described in this part. At first, the efficiency and effectiveness is described to require an understanding of the usability. Thereafter is a description given of all the tasks. The description of tasks consists out of: the emotion, outcomes of the desktop participants, outcomes of the mobile participants and the opinion about the other device.

4.2.1 Usability

Usability is divided into effectiveness of task performance and efficiency of task performance. The effectiveness of the task performance is measured by calculating the number of tasks that each participant performed correctly. Table 10 shows the mean number of correctly performed tasks (out of three) per condition. An unpaired t-test showed no statistical difference between the desktop condition (M=2,17, SD=0,58) and the mobile condition (M=2.33, SD=0.65) conditions; t(22)=0.66, p=0.51.

Table 10 *effectiveness of task performance*

	Desktop		Mobile	
Correct performed tasks	Mean	SD	Mean	SD
(Total of three tasks)	2.17	0.58	2.33	0.65

Note: n= 12 for the desktop condition and n=12 for the mobile condition

The efficiency of the task performance is measured by the time the participants spend on performing the tasks. Some participants completed the task within 10 minutes, others gave up within 10 minutes and the last group, the persisted participants, were stopped after 10 minutes. Only 8 participants were able to finish all three tasks. This number is not enough to analyse the data to test for difference in participants' efficiency of task performance. In table 11 is shown how the desktop and mobile participants have performed on each task.

Table 11 *efficiency of the task*

	Desktop	**Mobile**
Task 1		
Completed	3	5
Gave up	8	5
Persisted	1	2
Task 2		
Completed	11	11
Gave up	1	1
Persisted	-	-
Task 3		
Completed	12	12
Gave up	-	-
Persisted	-	-

The participants were struggling completing the first, most difficult task. Three participants were not able to finish the task within the time limit of 10 minutes and the participants gave up on 15 tasks in total. The biggest problems they encountered were related to their incapability to find the correct information between the overload of information. More information about the encountered problems is described in 4.2.2. The other two tasks turned out to be doable because most of the participants were able to complete the other tasks.

4.2.2 Task 1

Emotion task 1

After performing the first task the participants were asked to select the card that best expressed the emotional response to the task. The emotion card that is most selected by the participants is calm neutral. 4 of them used the desktop variant and the other 4 used the mobile variant. The most selected emotions for the desktop users are calm unpleasant and calm neutral. The mobile users selected others, namely: average unpleasant and calm neutral. Another difference between the desktop user and mobile users is that none of the mobile users experienced the task as pleasant while 2 desktop users experienced the task as pleasant. An overview of the selected emotions per device is shown in table 12.

Table 12 *emotions task 1*

Emotion	Total	Desktop	Mobile	Subtotals
Exited unpleasant	**1**	1	0	
Average unpleasant	**5**	1	4	12
Calm unpleasant	**6**	4	2	
Calm neutral	**8**	4	4	10
Exited neutral	**2**	0	2	
Calm pleasant	**2**	2	0	
Average pleasant	**0**	0	0	2
Exited pleasant	**0**	0	0	

Task 1 desktop device

Desktop participants mentioned different positive aspects of the task. Some positive comments were: not extremely hard, you needed to search well but it was not frustrating, it was a challenge to find the answers but not impossible, I have seen worse on the website of the University, the information was complete and it was quite easy.

There were also some negative comments from the desktop users. The following comments were mentioned: I wanted to know something but I could not find it, unpleasant, I did not expected to be so hard, I did not know where to search, I did not have the feeling to come closer to the answer, I could not find it, for me it was a hard task to perform, it was hard, it was not clear, information was missing, complex, problematic, I could not find it and I did not

know why, I needed to click a lot, it was a lot of information, the information was not structured well and I needed to download additional pages.

Task 1 mobile device

Although none of the mobile participants selected a positive emocard the participants on the mobile phone mentioned some positive elements: the website looked good, text was clear and readable, zooming was not needed, mobile friendly, fast response time, it was not that hard but it could have been easier, I could find the information and there was a lot of information available.

However, the mobile users also mentioned a few negative comments about the task: I could not find it, I unconsciously clicked on several links, I lost the overview, it did not work out, I did not knew where to search, it was hard to use, it went less quickly than expected, I expected that it was easy to find, the site did not worked properly, difficult to use, the website was quite clear but I could not find this piece of information, the links were not clear, I did not completed the task, it went slow, downloading the program guide was inefficient, I needed to read and scroll a lot.

Opinion about the other device

All participants who performed the first task at their desktop device stated that they preferred to perform the task at a desktop device instead of a mobile device. The participants mentioned different reasons for preferring desktop: more safe, the screen size/overview, easier search options, physical keyboard, use of shortcuts, use of tabs within the web browser and speed. The participants mentioned also some disadvantages of the mobile device such as more difficult to scroll, smaller screen, not available CTRL F search function, loading time, operation.

Only 1 of the 12 mobile participants preferred to perform the task on a mobile phone again, the other 11 preferred to do it on a desktop device. In the first instance 4 mobile phone participants mentioned not to prefer a device to perform the task on. When they were required to select one of the devices 1 of them selected the mobile phone and the other 3 selected the desktop device. The participants mentioned different reasons for selecting a certain device. Arguments for selecting the desktop device are: scrolling, clicking, screen size, tabs, faster, downloading, keyboard, setting, zooming, CTRL F function and overview. The argument for using the mobile device was that there are no differences with a desktop device.

4.2.3 Task 2

Emotion task 2

The most selected emotion after performing task 2 is pleasant. Average pleasant is the most selected emotion card as the participants chose this emotion 10 times. 7 of them were mobile users and the other 3 used the desktop device. 1 mobile user experienced it as unpleasant, whereas none of the desktop users experiences the task as unpleasant. The mobile users selected more positive emotions than the desktop participants. An overview of all the participants is showed in table 13.

Table 13 *emotions task 2*

Emotion	Total	Desktop	Mobile	Subtotals
Exited unpleasant	**0**	0	0	
Average unpleasant	**0**	0	0	1
Calm unpleasant	**1**	0	1	
Calm neutral	**3**	2	1	7
Exited neutral	**4**	3	1	
Calm pleasant	**2**	2	0	
Average pleasant	**10**	3	7	16
Exited pleasant	**4**	2	2	

Task 2 desktop devices

The participants on the desktop devices had different opinions about performing task 2. Positive aspects that were mentioned were: easy to find, it worked surprisingly well via Google, it was a nice experience, a good integration with Google because I landed immediately on the right page, founded the information in one go, I founded the information via Google, easy to find on Google, the information page is clear, short, concise and with a nice table. Other positive mentioned elements are clear search results, it took less time, simple to reach the goal and it was like expected.

The desktop users also mentioned some negative elements. Mentioned elements are: incomplete information, not able to find the right information, it will take a lot more time to search via the website of the university. Another desktop participants found it less easy than expected and was not able to find it via the website of the university and needed to use Google.

Task 2 mobile devices

The mobile users ran into different things during the task. Most participants were positive about the mobile experience, they mentioned it as easy, quick to find, superfast and properly. They found the opening hours via the first link on Google, founded the information within a few clicks and they found the information immediately in a clear overview. Some found it easy because they have done it before; others found it quite okay but not mind-blowing. A participant was enthusiastic that Google was showing the crowdedness; another was satisfied with only using the words “library utwente” as search terms.

There were also a few negative comments. A participants did not want to bother to search via the website of the university because it will take too much time, so he used Google instead. Another landed on a desktop page and needed to zoom a lot.

Opinion about the other device

From the participants who performed task 2 on a desktop device 4 of them preferred this device. The other 8 expressed their preference for mobile devices. One participant mentioned that he thought that he was able to perform the task on a mobile device, but that he probably liked the experience on a desktop device more. The participants mentioned different advantages such as the bigger screen size and availability of the actual keyboard. The participants describe these advantages in different ways: everything is bigger on a desktop device, a bigger screen reads more pleasantly and I can see more information on the screen of a desktop device. A participant also mentioned that his laptop is very fast so it is easy to look it up on his laptop. Another participant mentioned when he is having a hard time looking something up on his mobile phone he prefers to grab his desktop device.

The participants who preferred the mobile device mentioned several advantages. The participants prefer the mobile device for the accessibility, the complexity of the task and the time needed for the task. Other mentioned advantages are: “I have done it before so I know what to expect”, “the task is quite easy so a mobile device is okay”, “I think you will find the information faster on your mobile device” and “I would prefer my mobile phone, because I always have my phone with me and it is easy to find”.

From the 12 participants who performed task 2 at a mobile device 8 preferred to do it on a mobile device. The other 4 participants would prefer to perform this task on desktop devices. The participants mentioned different advantages and disadvantages of both devices. Advantages of the used device, the mobile device, have a lot to do with the complexity of the task and the effort that is needed before you can start searching on a desktop device. Some

participants mentioned that it would take more effort to go to a desktop device and put it on than search it quickly on a mobile device. The difficulty of the task was manageable on the mobile device. Quotes of the participants are: “my desktop device is too big to grab”, “put my desktop device on will take more time” and “this task was not so complicated so a mobile device will suffice”.

Some participants also mentioned some advantages of the desktop device. Some participants think it is easier on a desktop device. Some mentioned reasons are: the bigger screen size, the availability of an actual keyboard and the availability of an actual mouse.

4.2.4 Task 3

Emotion task 3

Calm pleasant was the most selected emotion card after completing task 3. Four of them were mobile users and the other four were desktop users. One of the users, a participant who performed task 3 at a desktop device, experienced task 3 as unpleasant. In table 14 an overview is shown from the selected emotions per device.

Table 14 *emotion task 3*

Emotion	Totaal	Desktop	Mobiel	Subtotals
Exited unpleasant	**0**	0	0	
Average unpleasant	**0**	0	0	1
Calm unpleasant	**1**	1	0	
Calm neutral	**1**	0	1	2
Exited neutral	**1**	1	0	
Calm pleasant	**7**	4	3	
Average pleasant	**6**	2	4	21
Exited pleasant	**8**	4	4	

Task 3 desktop device

The participants experienced performing task 3 on the desktop device in different ways. Most of the mentioned comments were positive, such as this was an easy task, I founded it quickly via Google, it took less effort to find the right information and it was a positive experience. Some of the participants had done it before and thus knew what to expect. However, there were also some negative comments about the task, one participant was not able to find the right information and another found the alignment confusing.

Task 3 mobile device

The participants who performed task 3 on the mobile device had different opinions about the task. All of the opinions were positive. Some of the participant performed the task before so they knew what to expect. Finding the right information more quickly than they had expected surprised some of the participants. Superfast, very positive, easy, quick and fast are quotes about task 3 on the mobile device.

Some examples of remarks about performing the task are " I could find it very easy on the mobile friendly website" and "it worked fine for me, even on the mobile device". Other comments from the participants were: "they arranged the website very well", "I only used his name and utwente and I landed on the right page" and "I immediately landed on the right page".

Opinion about the other device

From the 12 participants who performed the task at a desktop device 9 of them had a preference to perform the task at a mobile device. Only 3 participants indicated that they would prefer to perform the task at a desktop device. The participants who would prefer a desktop device gave the following comments: "I think I will be able to complete the task at a mobile device, but it would probably took me more time", "when I perform this task at a mobile phone I will be more distracted from incoming WhatsApp messages etcetera" and "from my own experience I think there is always less information on a mobile version of a website".

Advantages for using a mobile phone instead of a desktop device for this task are that the information is easy to find and that the mobile device is within reach most of the time. Examples of quotes about the availability of the mobile phone are: I would prefer my mobile phone because it is within reach, when I am walking around I will just grab my mobile phone and sometimes it is just easier to use your mobile device instead of grabbing your desktop device. Another participant mentioned something about the difficulty of the task namely; the information does not sound very detailed so I think I can find this easily on my mobile device.

Most of the 12 participants who performed task 3 at a mobile device preferred to do this at a mobile device. Only 5 of them indicated that they would prefer to perform the task at a desktop device when they could choose. The mentioned advantages of the mobile phone are mostly about the accessibility: "I always carry my phone whit me", "for a shorter task like this a mobile phone suits better" and "I think the mobile phone is easier and faster". As disadvantage of the mobile phone one participant mentioned the error sensitiveness of the

keyboard on mobile phones. The participants mentioned also some advantages of the desktop devices. Mentioned advantages are: faster navigating, faster typing with the actual keyboard, use of mouse and the bigger screen size. The mentioned disadvantages are about the accessibility of a desktop device: “I do not want to grab my laptop out of my bag for this task”, “it takes a while to type on the mobile phone but it will take even more time to grab my laptop, to put it on and open the website”, “it would took too much effort to find this on a desktop device”. Another participant also mentioned the possibility of distraction because of the several columns in one view on a desktop device.

4.2.5 Conclusion experiment users

Task 1 is most preferred to be executed on a desktop device and for task 2 and 3 the mobile device is more preferred. The exact numbers are shown in table 15.

Table 15 ***Prefer desktop or mobile device per task***

	Prefer desktop	Prefer mobile
Task 1	23	1
Task 2	8	16
Task 3	8	16
Total	*39*	*33*

The (sub) elements that Park et al. (2013) describe are compared with the description the participants of the experiment gave about the experience. The file with the described sub elements can be found in appendix C. The definitions of the sub elements are compared with the opinions of the participants gave about experience of performing the task on a certain device. It was interesting that the participants mentioned a lot of the sub elements of Park et al. (2013). However, there was one difference in the mentioned sub elements between the different devices as all the mobile participants mentioned something about the flexibility (usability) and none of the desktop participants mentioned this sub element. An overview of the mentioned (black) and not mentioned elements (red) is shown in table 16 and 17. As shown in the tables the participants mentioned the most sub elements of usability and the least of affect.

Table 16 *Sub elements desktop*

Desktop		
Usability	**User value**	**Affect**
Simplicity	Self-satisfaction	Delicacy
Directness	Pleasure	Simplicity
Efficiency	Sociability	Texture
Informativeness	Customer needs	Luxuriousness
Flexibility	Attachment	Color
Learnability		Attractiveness
User support		

Table 17 *Sub elements mobile*

Mobile		
Usability	**User value**	**Affect**
Simplicity	Self-satisfaction	Delicacy
Directness	Pleasure	Simplicity
Efficiency	Sociability	Texture
Informativeness	Customer needs	Luxuriousness
Flexibility	Attachment	Color
Learnability		Attractiveness*
User support		

* Only mentioned during one task

All the described advantages and disadvantages for the certain devices are shown together in table 18.

Table 18 *Advantages and disadvantages per device*

	Advantages	Disadvantages
Desktop	More save Bigger screen size Easier search options Physical keyboard Use of shortcuts (like CTRL F) Use of tabs within the web browser Speed Scrolling is easier Physical mouse for clicking Downloading is easier Less zooming in Overview Faster navigation	It will take more time to grab my desktop device, put it on and search It will take too much effort on a desktop device Higher possibility of distraction because of more columns in one view
Mobile	Easy task is easier on mobile device It is quicker on a mobile device Mobile device is within reach Easier when I am on the way Easier Faster	More difficult to scroll Smaller screen The absence of the CTRL F search function Loading time Operation It will take more time I will be more distracted because of incoming WhatsApp messages Less information available on mobile devices Error sensitiveness of keyboard on mobile phone

5 Conclusion

The last chapter of this research provides a discussion of the results, the limitations of this results, implications for further research, practical implications and the conclusion.

5.1 Discussion

The goal of this study was to answer the research question and the research sub questions. The results of this study will be discussed on the basis of the three influential elements of Park et al. (2013): usability, user value and affect. The first part of this discussion consists of a description of the expert views on all elements in order to be able to answer the sub question *What factors influence the mobile and desktop User Experience according to experts?* The second part of the description of each element of Park et al. (2013) consists out of the results of the users. This is the answer on the sub question: *What factors influence the mobile and desktop User Experience according to users?* At last are also the implications of the method of the experts and the expected difficulty of the task according to the users discussed.

Usability

Just like the many different definitions of UX found in the literature, the experts also use different definitions for UX. Remarkable is that all the experts mentioned that the goal of UX is that the user should be able to achieve their goal when they were asked to give their opinion on UX. This goal is not explicitly mentioned in the definitions that are found in the literature. The ISO standardization defines UX as: “a person’s perceptions and responses that result from the use or anticipated use of a product, system or service”. The other mentioned definitions in the theoretical framework also focus on the experience itself: “all aspects of the end-user’s interaction with the company, its services, and its products” and “UX has emerged as an umbrella phrase for new ways of understanding and studying the quality-in-use of interactive products’. This indicates that the experts have a more practical view than the researchers have in the literature. This is also in line with the reasoning of Hassenzahl (2008), who states that experts focus on how goals can be achieved, the usability, which leads to a good UX. Thus, whereas the literature focuses more on be goals the experts seem to focus more on do goals.

The (sub) elements that Park et al. (2013) describe are also compared with the description that the participants of the experiment gave about the UX. There was one difference in the mentioned sub elements between the different devices the participants used as all the mobile

participants mentioned something about the flexibility and none of the desktop participants mentioned this. This might indicate that flexibility is more relevant for mobile users.

User value

The experts mentioned some of the user value elements from Park et al (2013). The element self-satisfaction was mentioned, especially the sub element challenge (achievement). For example: “According to me, the UX is good as users can find something they need without having questions”. Customer need is also an element that is mentioned by the experts. This is for example mentioned in a quote about UX: “I think UX is the impression a user gets from a website or application, did they achieve what they wanted to achieve”. The last mentioned element is attachment, which was mentioned in the following quote: “When the UX is not good, when you not satisfy your users, you do not get the optimal effort of your visitors. For organizations it is important for their efficiency.” Pleasure, sociability and attachment are not mentioned.

Users of experiment did not mention 2 of the 5 elements from user value. The users did not mention anything about sociability and attachment. However, they did mention the same 3 elements as the experts, namely self-satisfaction, pleasure and customer needs. It is remarkable that both the experts and the users mentioned the 3 same elements and both did not mention the elements sociability and attachment. This might indicate that the 3 elements self-satisfaction, pleasure and customer needs are the most important elements for user value. In addition, it also undermines the importunateness of the other two elements, which is contrary to the insights of Park et. al (2013). An explanation for this might be that these elements are only important in other mobile domains, such as mobile applications.

Affect

Most sub elements of the aspect affect from Park et al. (2013) were not mentioned during both methods. These sub elements are: delicacy, texture, luxuriousness, color and attractiveness. However, the elements simplicity and attractiveness were mentioned. Although simplicity is more discussed among the participants of the experiments one expert stated in his definition of UX that a user should understand it. Participants from all devices and on all performed tasks mentioned something about simplicity. The description Park et al. (2013) gave about simplicity is: “the way a product/service looks and works is simple, plain, and uncomplicated. This indicates that for the aspect affect simplicity is the key element. One participant of the experiment who performed task 1 at a mobile device mentioned something about the

attractiveness. Since only one participant mentioned this no conclusions can be attached to this statement.

Method of the experts

All the experts are aware of the difference between the UX on the different devices. They approach the desktop and mobile devices in different ways. It is notable that the experts point out that when they wireframe a website for desktop first, the UX of the mobile version is less good than the UX of the desktop version. Some experts also mention that when they wireframe a website for mobile first the UX of the mobile version is better than the UX of the desktop version. The device, which has not the first focus, is, as it were, a trade of the original version. When a company does not want a “trade of version” of their website they do not have to focus on the UX on one device but on the UX on both devices. In a later stadium this can be linked to the certain devices. A possible solution is that UX professionals do not limit themself by the constraints of UX on the different devices, but that they first analyze and map which goals the users have. Based on that analysis it is expected that UX professionals are better able to apply the different aspects needed per device and prevent "trade of versions". Further research should address how UX professionals can make this analysis.

Expected difficulty of the task according to the users

As described in the results, the experts and participants mentioned differences that influence UX on the different devices, but these differences have some overlap. Whereas the experts mainly focus on differences in technique the users mentioned some things about fastness and speed. However, these might also be intertwined to each other. In addition, the users mentioned a lot about the consideration between the perceived difficulty of the task and the effort to select a device. When a task is perceived as easy most of the users prefer to use a mobile device, because they find this quicker and easier. When the task is perceived more difficult the users are more willing to grab a desktop device, put it on and start searching. The experts did not mention the differences in difficulty of the tasks. Indirectly they mentioned elements that can influence this, like baby steps and multitasking. Another difference is the wording of the differences. The users talked about bigger/smaller screen size, better/less overview while experts mentioned scan path, balance, and clear hierarchy. From this research there are indications that the perceived easiness to perform a task is the major reason for users to perform a task on a mobile device or a desktop device. When one understands when users

perceive a task as easy or hard this might give important insights on which device is most important to focus on.

5.2 Limitations

This study has some limitations that might have influenced the results. For both the interviews with experts and the experiments with users the generalization is an important limitation. As only a small group of experts is interviewed it might be possible that another group of experts have a slightly different opinion about UX. The participants of the experiment were all young and high educated; they all were students at the university of Twente. The participants only performed tasks at a certain website, the website of the university. Other education level, age or website can lead to different results. Before the experiment took place the participants were asked if they wanted to perform the tasks on their mobile or desktop device. The device that they selected probably had their preference, which could have influenced the results. Only the last participants were forced to perform the tasks at a certain device because there were already enough participants for a certain device.

The experiment was a field study and it took place in a natural setting. A scenario was created to simulate a real setting. Although, it is close to a real setting it is not the same and this might have influenced the motivation of the participants as they are told to perform a task and they do not want the information for their own interest.

5.3 Future research

This study had a small amount of participants for the experiment. With more participants the task performance can be measured, this will give insights in possible differences between for example the efficiency and effectiveness of task performances on different devices. It is also interesting to actual measure the elements usability, user-value and affect. During the experiment became clear that the users made a consideration between the difficulty of the task and the amount of work to grab a device. Future research should give more insights on which tasks are preferred on mobile devices and which tasks are preferred on desktop devices. Thus, to be able to understand when a task is considered as difficult and when it is considered as easy. The results of this study cannot be generalized. For organizations it is necessary to study their target group. How are the users experiencing their websites? What tasks can be performed on the website, which tasks are performed at desktop devices and which tasks are performed at mobile devices. Insights in these subjects will give the organizations leverage to serve their users in the best possible way.

5.4 Practical implications

UX experts should keep in mind that users make a consideration between the different devices on basis of the expected task difficulty. This can play an important role to be able to make better decisions to wireframe a website mobile first or desktop first. However, it is even better to wireframe a website without linking it to a certain device first. This implies that experts start with a wireframe without linking it to a certain device. After this general wireframe is developed these can be adjusted to the certain device. Another important practical implication that UX experts should consider is that flexibility is only important for mobile users.

5.4 Conclusion

In this subchapter are the conclusions provided and is answer given to the research question: *"Which factors influence the website User Experience according to experts and users?"*

Based on an analysis of a user study this study shows that the factors simplicity (usability), directness, efficiency, informativeness, learnability, self-satisfaction, pleasure, customer needs and simplicity (affect) are factors that influence UX on both devices and that these are mainly related to the elements usability and user value. From this user study is also obtained that flexibility is the main factor that explains that UX on mobile and on desktop devices is not the same. This can be explained by the finding that flexibility is more relevant for mobile users. This research also provides insights that experts struggle to chose a certain method for creating a website for different devices and that this often leads to trade off versions for one of the devices. This can be prevented by focusing more on the funnel and needed information of the tasks. From the user study is obtained that users seem to make a consideration on the perceived difficulty of the task to choose a certain device, which might be a guideline to cope with the struggle to choose a certain method for certain pages. For simple tasks the users prefer to use their mobile phone, but when the task is more difficult they prefer to use a desktop device. Another interesting finding is that the experts mostly focus on achieving goals while the literature focuses more on the whole experience. An explanation for this finding is that the experts are all working in the field and aim for the best possible UX, but that achieving goals is decisive.

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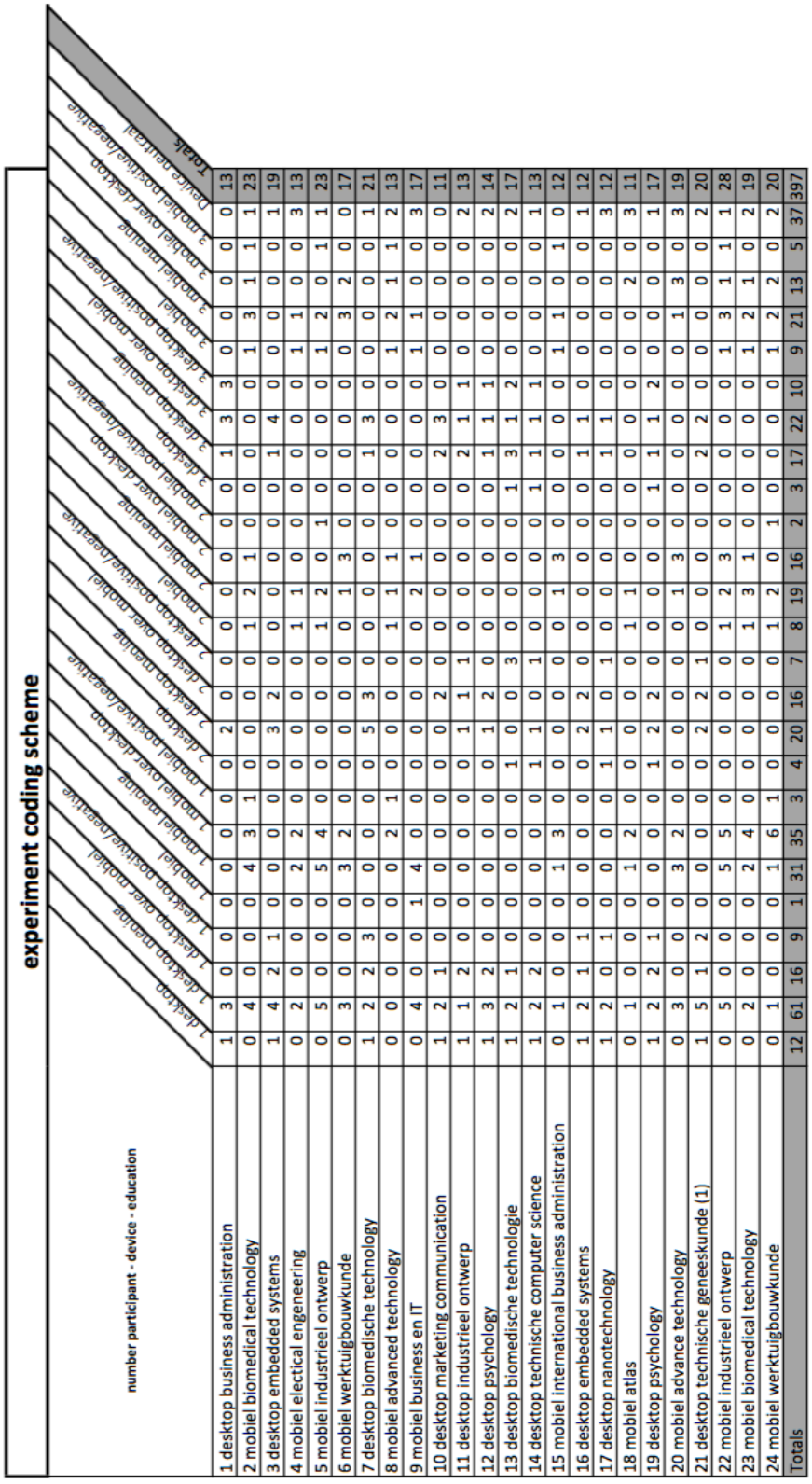
APPENDIX A Coding scheme interviews with experts

User experience coding scheme						
	Participant number					
Code name	1	2	3	4	5	Totals
Importance UX	3	2	1	2	2	10
Jobtitle	1	1	1	1	1	5
Opinion - definition	1	0	2	1	1	5
Opinion - goal	0	2	0	0	1	3
Opinion - opinion	1	1	0	0	0	2
Method - ideal situation	2	1	1	0	1	5
Method - why mobile first	3	1	0	3	1	8
Method - disadvantage	1	0	0	1	2	4
Method used in company	2	0	3	3	1	9
Method - advantage	1	0	0	1	1	3
Similarities desktop mobile UX	4	0	0	0	0	4
Differences dekstop mobile UX	0	2	0	1	1	4
Differences - interaction	4	2	0	1	3	10
Differences - screensize	9	5	4	4	4	26
Differences - technique	0	0	0	1	0	1
Totals	32	18	13	19	19	101

APPENDIX B Coding scheme experiment with users



number participant - device - education	experiment coding scheme																															
	1 desktop	1 desktop mealtime	1 desktop over mobile	1 desktop positive/negative	1 mobiel	1 mobiel mealtime	1 mobiel over desktop	1 mobiel positive/negative	2 desktop	2 desktop mealtime	2 desktop over mobiel	2 desktop positive/negative	2 mobiel	2 mobiel mealtime	2 mobiel over desktop	2 mobiel positive/negative	3 desktop	3 desktop mealtime	3 desktop over mobiel	3 desktop positive/negative	3 mobiel	3 mobiel mealtime	3 mobiel over desktop	3 mobiel positive/negative	Device neutraal	Totals
1 desktop business administration	1	3	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	13
2 mobiel biomedical technology	0	4	0	0	0	4	3	1	0	0	0	0	1	2	1	0	0	0	0	1	3	1	1	1	0	23
3 desktop embedded systems	1	4	2	1	0	0	0	0	3	2	0	0	0	0	0	0	1	4	0	0	0	0	0	1	0	19
4 mobiel electical engeneering	0	2	0	0	0	2	2	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	3	0	13
5 mobiel industrieel ontwerp	0	5	0	0	0	5	4	0	0	0	0	0	1	2	0	1	0	0	0	1	2	0	1	1	0	23
6 mobiel werktuigbouwkunde	0	3	0	0	0	3	2	0	0	0	0	0	0	1	3	0	0	0	0	0	3	2	0	0	0	17
7 desktop biomedische technology	1	2	2	3	0	0	0	0	5	3	0	0	0	0	0	0	1	3	0	0	0	0	0	1	0	21
8 mobiel advanced technology	0	0	0	0	0	0	2	1	0	0	0	0	1	1	1	0	0	0	0	1	2	1	1	2	0	13
9 mobiel business en IT	0	4	0	0	1	4	0	0	0	0	0	0	0	2	1	0	0	0	0	1	1	0	0	3	0	17
10 desktop marketing communication	1	2	1	0	0	0	0	0	0	2	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	11
11 desktop industrieel ontwerp	1	1	2	0	0	0	0	0	1	1	1	0	0	0	0	0	2	1	1	0	0	0	0	2	0	13
12 desktop psychology	1	3	2	0	0	0	0	0	1	2	0	0	0	0	0	0	1	1	0	0	0	0	0	2	0	14
13 desktop biomedische technologie	1	2	1	0	0	0	0	0	1	0	0	3	0	0	0	0	1	3	1	2	0	0	0	2	0	17
14 desktop technische computer science	1	2	2	0	0	0	0	0	1	1	0	1	0	0	0	0	1	1	1	1	0	0	0	1	0	13
15 mobiel international business administration	0	1	0	0	0	1	3	0	0	0	0	0	1	3	0	0	0	0	0	1	1	0	1	0	0	12
16 desktop embedded systems	1	2	1	1	0	0	0	0	2	2	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	12
17 desktop nanotechnology	1	2	0	1	0	0	0	1	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	3	0	12
18 mobiel atlas	0	1	0	0	0	1	2	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2	0	3	0	11
19 desktop psychology	1	2	2	1	0	0	0	1	2	2	0	0	0	0	0	0	1	1	1	2	0	0	0	0	0	17
20 mobiel advance technology	0	3	0	0	0	3	2	0	0	0	0	0	0	1	3	0	0	0	0	0	0	1	3	0	0	19
21 desktop technische geneeskunde (1)	1	5	1	2	0	0	0	0	2	2	1	0	0	0	0	0	2	2	0	0	0	0	0	2	0	20
22 mobiel industrieel ontwerp	0	5	0	0	0	5	5	0	0	0	0	0	0	1	2	3	0	0	0	0	1	3	1	1	1	28
23 mobiel biomedical technology	0	2	0	0	0	2	4	0	0	0	0	0	0	1	3	1	0	0	0	0	1	2	1	0	2	19
24 mobiel werktuigbouwkunde	0	1	0	0	0	1	6	1	0	0	0	0	1	2	0	1	0	0	0	1	2	2	0	2	0	20
Totals	12	61	16	9	1	31	35	3	4	20	16	7	8	19	16	2	3	17	22	10	9	21	13	5	37	397

Appendix C Definitions of (sub)elements of UX

Definitions of sub elements of usability

Note: reprinted from Park, J., Han, S. H., Kim, H. K., Cho, Y., & Park, W. (2013). Developing elements of UX for mobile phones and services: survey, interview, and observation approaches. *Human Factors and Ergonomics in Manufacturing & Service Industries*, *23*(4), 279-293.

Subelement*	Definition
Simplicity	way a product/service looks and works is simple, plain, and uncomplicated
Modelessness	Capability that allows the user to do whatever they want when necessary (e.g., easy to change a mode of product or service)
Directness	Degree of user's perception of directly controlling the user interface of a product/service
Accessibility	Degree to which a product/service is easy to approach or operate
User control	Ability for the user to regulate, control, and operate the user interface of a product/service
Efficiency	Degree to which a product/service enables a task successfully without wasting time or energy
Effectiveness	Accuracy and completeness with which specified users achieved specified goals in particular environment
Effortlessness	Ability of a product/service to require or involve no effort of the user
Informativeness	Degree to which a product/service is instructive and gives all the necessary information to the user in a proper manner
Comprehensiveness	Degree to which a product/service covers or includes extensive information that is needed or relevant to the user
Explicitness	User's perception that the way a product/service looks and works is clear and accurate
Visibility	Degree of user's perception of clearly seeing objects on the user interface of a product/service
Legibility/readability	Degree of user's perception of reading or understanding a word, line, or paragraph written in the user interface of a product/service
Flexibility	Extent to which a product/service can accommodate changes to tasks and environments beyond those first specified
Adaptability	Degree to which a product/service is changed easily to fit different users and/or conditions
Interoperability	Ability of two or more product/services are used or operated reciprocally
Learnability	Time and effort required for the user to learn how to use a product/service
Memorability	Degree to which a product/service is easy to remember
Familiarity	Extent to which the user's knowledge and experience in other domains or real world can be applied to interacting with a new product/service
Predictability	Ability for the user to expect the effect of future actions based on past interaction experiences
Intuitiveness	Degree of user's perception of understanding the way a product/service looks and works by intuition
Consistency	Similarity in the way a product/service looks and works and the input/output behavior arising from similar situations or tasks
User support	Ability for the user to operate a product/service easily through its entire life cycle
Easy installation	Ability for the user to install or initiate a new product/service easily
Error prevention	Ability to help the user preventing errors and taking corrective actions once an error has been recognized
Forgiveness	Ability for the user to cancel or undo their tasks on the assumption that the user may make a mistake
Feedback	Degree of presenting feedback information for the user input
Helpfulness	User's perception that a product/service communicates in a helpful way

Definitions of sub elements of user value

Note: reprinted from Park, J., Han, S. H., Kim, H. K., Cho, Y., & Park, W. (2013). Developing elements of UX for mobile phones and services: survey, interview, and observation approaches. *Human Factors and Ergonomics in Manufacturing & Service Industries*, *23*(4), 279-293.

Sub-elements*	Definition
Self-satisfaction	Degree to which a product/service gives the user satisfaction with himself or herself or achievements
Identity	User's perception of being the distinct personality of an individual (related terms: personality, self-expression, unique)
Challenge	User's perception of achieving something new and difficult which requires great effort and determination (Related terms: Achievement)
Confidence	Belief in oneself and one's abilities reflected by a product/service (related terms: pride, fullness)
Pleasure	User's feeling of being pleased or gratified by interacting with a product/service
Fun	Degree to which a product/service gives the user enjoyment, amusement, or pleasure
Refresh	Degree to which a product/service provides the user new vigor and energy
Sociability	Degree to which a product/service satisfies the user's desire of being sociable
Social emotion	Degree to which a product/service set the stage where the user can feel, express, or share their emotions socially
Social value	Degree to which a product/service provides the user values related to social issues, problems, and reforms
Friendship	User's perception of having a friendly relation with other people
Customer need	Degree to which functions or appearances of a product/service satisfy the user's needs
Eagerness	User's perception of having keen interest or intense desire
Expectation	User's act or state of looking forward or anticipating
Usefulness/Utility	Degree to which a product/service has a beneficial, practical use
Customizability	Degree to which a product/service is changed or built easily to fit personal specifications or preferences
Attachment	Ability for the user to attach subjective value to a product/service
Novelty	Degree to which a product/service is novel, new, or unique (related term: curiosity)
Preciousness	Degree to which a product/service is valuable, precious to the user
Trustworthiness	Degree to which a product/service deserves of trust or confidence (related terms: belief, trust)

Definitions of sub elements of affect

Note: reprinted from Park, J., Han, S. H., Kim, H. K., Cho, Y., & Park, W. (2013). Developing elements of UX for mobile phones and services: survey, interview, and observation approaches. *Human Factors and Ergonomics in Manufacturing & Service Industries*, *23*(4), 279-293.

Sub-element	Definition
Delicacy	Degree to which a product/service is elaborate, or finely and skillfully made
Simplicity	The way a product/service looks and works is simple, plain, and uncomplicated
Texture	Degree to which a product's texture or touch appeals to the users
Luxuriousness	Degree to which a product/service is luxurious or looks superior in quality and expense
Color	Degree to which the color used in a product/service is likable, vivid, or colorful
Attractiveness	User's perception that a product/service is pleasing, arousing, interest, and attractive