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Cross-Platform Interaction Design

Master Thesis

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Author’s declaration

I hereby declare that, apart from work whose authors are clearly acknowledged, this document is the result of my own and original work.

This thesis has not and is not being submitted for any other comparable academic award.

"30th" December 2012

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Abstract

This master thesis tries to bring light into how to design interactions for cross-platform environments. The thesis expands the topic through an overview of the current cross-platform enabling devices and their typical usage scenarios, possibilities and limitations. Moreover the contemporary user interface design and interaction design practices are presented and finally, a case study on a single platform service called Projektur that was redesigned into a cross-platform service through the use of scenario-based design is described. Thereby, a design reflection was created in whether current interaction design practices are suitable for cross-platform interaction design.

The main findings of the thesis are that the most important cross-platform enabling devices today are laptops, smartphones, tablets and desktops. People use the devices for the same types of services and to the same extent, however, the concrete tasks and activities at hand differ from device to device. Therefore, cross-platform interaction design is based on the tasks and activities that people do with the systems. They define how a system should be designed together with the contexts of use – location, time, etc. That is why a design approach that addresses the tasks and activities should be used for cross-platform development.

We can see that mobile devices are used commonly for viewing and reading tasks and entertainment purposes, whereas computers are preferred for thorough work and time-consuming tasks like editing, formatting and writing.

Finally, scenario-based design approach can be considered sufficient to address cross-platform interaction design as long as tasks and activities that the service is going to offer are at the focus. Moreover, by including representative users to the design process a finer result can be achieved, and an interface design creation should be considered relevant early on in the design process in order to help users better visualize the interactions with the system across devices.

Keywords:

Interaction design, cross-platform, multi-platform, cross-device, cross-platform interaction design, smartphone, tablet, laptop, desktop, mobile device, scenario-based design, usage-centered design

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Introduction

"A central concern of interaction design is to develop usable interactive products. This requires considering who is going to use them, how they are going to be used, and where they are going to be used." (Sharp, Rogers, & Preece, 2009, p 2-6) In addition, the activities that people are going to do with the products or services are important for interaction design. Imagine all the different types of interactive devices that are available today. "There are multimedia applications, virtual reality environments, speech-based systems, handheld devices, and large interactive displays. There are also many ways of designing how users can interact with a system, e.g. via the use of menus, commands, forms, icons, touchscreens, sensors, etc." (Sharp, Rogers, & Preece, 2009, p.6)

It is becoming increasingly common to design interactions for cross-platform environments, so that people could use the same system from multiple platforms. Today people use various devices to read their emails or browse the web when only recently the one and the only tool for it was a computer. "The tendency for multiple platforms will increase with the move towards ubiquitous computing where users are supposed to have seamless access to applications regardless of their whereabouts or the computing device at hand" (Weiser 1991, as cited in Meskens, 2008, p. 233). A regular computer is definitely not enough anymore. Cross-platform environments provide a better service to the customer and thus lead to improved user experience.

The field of cross-platform interaction design in terms of research is comparatively young. So far designing for multiple platforms meant that designs were made for each platform individually and thereafter they were made to interact with each other. This of course keeps the development costs high, but also leads to inconsistency.

People do not necessarily know what they need. If 10 years ago one was asked would they need an iPad or an MP3 player, the most probable answer would have been no. Nevertheless, if presented with a possibility of having one, they would have been more accepting.

Therefore, a designer has to know the characteristics and capabilities of the user, what they are trying to achieve, how they achieve it currently and whether they would achieve their goals more effectively and have a more enjoyable experience if the goals were supported differently. (Sharp et al., 2009, p. 432) That is the case with all new gadgets: at first, one cannot find a use for it and later cannot get by without it. Today there is the possibility for cross-platform use that makes the life of people simpler and provides them a better user experience, and so the designers design for it. Of course, the user is not that often asked anymore whether they see benefits in cross-platform environments, whether they consider it relevant at all and how exactly they use their multiple devices today. This is one of the issues this master thesis tries to find answers to.

Moreover, once designing for cross-platform environments there are not many guidelines to follow. So far designing has been done by adding single platforms to the package or developing cross-platform user interfaces, but little focus has been put on interactions. When there was a need to add a new platform to the system, the whole process was simply started from scratch. Still, it was not initially decided that the software should be functional on X number of platforms and have a common interface. Currently the field of interaction design lacks guidelines to provide concrete support for cross-platform designs. "By promoting combinatorial use practices and supporting cross-platform user experience through considerate design guidelines, new opportunities for utilizing both existing and new technologies become available" (Wäljas, Segerståhl, Väänänen-Vainio-Mattila, & Oinas-Kukkonen, 2010). This master thesis tries to explore how to design interactions for cross-platform environments.

The following are the research problem, questions and the goals this thesis is trying to achieve. Nowadays we are not expected to design interactions for one user / one device scenarios but rather for one user / many devices, yet, most interaction design and development approaches build on the single user and single device assumption. Therefore, it is needed to understand what changes must be brought into the process to address the emerging design and development challenges.

The main research questions of the thesis are:

- What are the emerging cross-platform enablers and usage scenarios?
- What approaches in the Interaction Design community are being used for cross-platform interaction design, if any?

- To what extent can existing interaction design approaches be used for cross-platform interaction design?

The research goals are the following:

- How and where do people use their devices nowadays?
- What are the technical solutions used for adaptations onto multiple platforms?
- How is cross-platform interaction design approached in the Interaction Design community?
- To present a design example of single platform software redesigned into cross-platform context.
- To reflect on the potential changes in interaction design practices in the cross-platform context.

The general outline of the thesis is as follows. The introduction provides the background information on designing interactions for cross-platform environments. The research problem, the research questions and goals are stated here.

The first chapter provides the methodology used in the thesis, which consists of a methodology for literature review, the survey and the design sessions. In the literature review there was an in-depth research done to get the main findings about cross-platform devices and cross-platform interaction design practices. The survey was conducted online using self-selected sampling and the design sessions were conducted using a modified version of scenario-based design approach. Together the methodology contributes to a better understanding of how to design interactions for cross-platform environments.

The second chapter presents the contemporary cross-platform enablers across four devices – smartphone, tablet, laptop and desktop – based on the findings in the literature and the results of the survey conducted, both of which offer insights into the better development of cross-platform services.

The third chapter presents the literature overview of cross-platform interaction design with a definition for cross-platform and interaction design. Moreover, it provides the state of the art approaches used in interface design.

The fourth chapter provides the results of the design sessions using scenario-based design to redesign a single platform software called "Projektur" into a cross-platform software.

Finally, in conclusion of the thesis the findings are presented and conclusions are drawn together with the areas for further research.

1 Methodology

1.1 Literature Review

There was an in-depth research done in order to get the main findings of how, where, when and why people use their computational devices. Additionally, the possible limitations, challenges and future areas of development were researched. The research was done across four main devices that today support cross-platform services – smartphones, tablets, laptops and desktops.

Thereafter, the literature was reviewed to find out how cross-platform interaction design is approached in the Interaction Design community and to find the state of the art technical approaches used for developing and adapting interfaces across multiple devices.

1.2 Survey

The research goal of the thesis was to gain an understanding of how and where do people use their devices nowadays. Together with the literature overview, the survey tries to answer this question. The survey was done in co-operation with a doctoral student, whose thesis is on the topic "Ubiquitous Mobile Interactions" with the goal of developing guidelines for designing services that are anticipatory, context-aware, and available all the time, everywhere, and on any device. Quantitative data was collected about whether and what for the users consider the use of cross-platform software necessary. Furthermore, the data collected was about what activities the users typically do with their mobile devices (the smartphone and the tablet) and computers (the laptop and the desktop) and where they use them. In addition, some qualitative data was collected through open-ended questions.

The sampling methodology used for the survey was self-selection sampling. It is a type of non-probability sampling, which is based on the judgement of the researcher. The researcher puts a questionnaire online and invites people to respond. The advantages of this type of sampling are that the time needed to contact the people is minimized and that once selected the respondents are more likely to fill in the entire questionnaire. This was also the reason for

choosing this sampling method. The disadvantages however, that the selection may be biased, which can lead to the sample not being representative of the population studied or exaggerating some particular finding. (Laerd Dissertation, 2012) Therefore, in this thesis the survey generalizations are made only on the level of the sample and not on an entire population. The survey was a semi structured questionnaire. A semi structured questionnaire means that open questions are added.

The survey was done online, and created using Limesurvey, an online tool for creating tailor-made surveys. It was shared in a social media channel Facebook and sent out to a variety of emailing lists in the Tallinn University and worldwide. The data was analysed with MS Word 2010, MS Excel 2010 and IBM SPSS Statistics 2.0.

The explanatory letter for Facebook and for emailing lists has been added to the thesis in Appendix A.2, and the questionnaire with findings itself in Appendix A.3.

The survey consists of three sections. Section 1, Personal Information about the respondent, Section 2, Services and Devices, questions on the services the respondent uses on their devices and Section 3, Additional Questions, to get further insights into whether the respondents recognize any limitations to the use of the devices. In total the questionnaire consisted of up to 33 questions, depending on how many devices the person used.

Firstly, there was a pilot study made using accidental sampling. Accidental sampling or convenience sampling is a type of non-probability sampling which involves the sample being drawn from that part of the population which is close to hand. This means that the sample is not representative of the population, however, sufficient for the purpose of a pilot study. (Trochim, 2006) From the pilot study an estimate on completion time and potential areas of misunderstanding were found. For the pilot study there were 3 respondents chosen for online testing of the survey and 1 respondent for a talk-aloud session of the survey. The pilot resulted in a few changes being made to the survey.

- A question regarding the country of the respondent was added to Section 1.
- Explanatory sentences to the questions were repositioned so that they come right after the question, whereas initially they appeared after the answering box.
- To the questions about the services that people use on each device the examples were repositioned so that the most well-known examples were the first, in order for the respondent to be more likely to get an association with the example.
- Smart TV was added to the list of devices.

- Some questions were rephrased for better understanding.
- In the last section of the survey in Additional Questions one question was deleted and one question was rewritten.

The survey was live from 4th October – 1st November 2012. In total there were 101 full responses and 100 incomplete responses, so in total 201 responses.

All the incomplete responses were discarded, because the respondents closed the survey before some meaningful data for the results was added.

1.3 Design sessions

The goal of the design sessions was to create a cross-platform design example of a single platform software under development called Projektur. The design sessions were done individually and took place on three separate days in the end of November and beginning of December 2012. The first day for activity and information design sessions, the second day for interaction design sessions and the third day for the usability evaluation. The sessions were recorded and photographs and notes were made to help further analysis. The script of the design sessions can be found in Appendix A.4.

The background of the participants was as follows:

- A teacher who is acquainted with using Projektur in school context
- A lecturer from Tallinn University who is skilled in leading projects
- A colleague from Tallinn University who has participated in university projects

The design sessions were conducted using the Rosson & Carroll, 2002 scenario-based design framework with some modifications. The framework foresees that scenarios are created to be evaluated by designers and/or users, however, the approach in this case was that users were introduced the initial idea of the software Projektur and they were asked to re-create the software in their own context and explain how they would use the software. Furthermore, according to usage-centered design principles (see chapter 3.2.3) the users were asked to create interface sketches before interaction with the system was evaluated in order to help them visualize their ideas and better explain the interactions with the system.

The scenario-based design framework foresees that the process consists of the following steps: requirements analysis, activity design, information design, interaction design and finally usability evaluation.

The initial idea of the software and the user characteristics and preferences served as the requirements overview and analysis of the software. The software is meant for project writing in the university/school context, therefore, the typical user is often writing or carrying out projects and the person would like to use the software both on the computer and on a mobile device.

In the activity design sessions the participants were asked to explain how they go about project work in their context and how the project teams are formed. Furthermore, to explain with the use of activity flowcharts what their project work involves. The participants used post-it notes to write down their activity flowcharts of how they go about a project work.

Subsequently in information design, the participants were asked to explain what information requirements they have in order to fulfil the projects they do and how they would like to visualize the materials. The two activities resulted in the core functionalities, which the people needed Projektur to have. The core functionalities were written down on carton cards and were taken into interaction design sessions, where participants were asked to categorize the functions and activities they do with the software and explain how they would interact with the objects on different platforms. Moreover, the participants created primitive user interface visuals of how they would see the software most appropriate on a computer and on a mobile device screen and described the interactions they would perform on each platform.

Thereafter, in usability evaluation sessions participants were asked to describe the tasks and activities they would do with the software and this was complemented by the tasks that became apparent in previous sessions. The participants were asked to evaluate on which device would they use the tasks and whether their current interfaces support those tasks.

Finally, this input from the participants was developed into design recommendations on how Projektur should be designed as a cross-platform service and based upon the case study a reflection was created on whether scenario-based design is fit for cross-platform interaction design.

2 Cross-platform Devices and Usage

The purpose of this chapter is to establish the relevance of the research on cross-platform interaction design. The chapter will provide an overview of the different devices people use – how they use, where they use, when and also the possibilities and limitations the devices have. Additionally, the quantitative and qualitative results of the survey and a discussion on contemporary cross-platform devices are presented. The focus of the research is on computers (desktop and laptop) and mobile devices (smartphone and tablet).

2.1 Contemporary Cross-Platform Enablers

2.1.1 Smartphone

Overall information

Smartphones have come to the market quite recently and the consumers have quickly adopted them due to the vast possibilities they offer and the increasing potential. A 2011 Pew Internet study reports that about one third (35%) of adults in the US own a smartphone (Smith, 2011). A smartphone is always carried with the person, therefore is always available and is always switched on. Previously feature phones (*a mobile phone that has Internet access and media capabilities, but lacks the advanced functionalities of a smartphone)* were primarily used for communication and text messaging, now with the coming of the smartphones people use the devices more and more for other purposes like surfing the Internet, calendaring, emailing, playing games, etc.

The display sizes of smartphones vary greatly in display size and resolution. The most common screen sizes are from 2 inches to over 4 inches. The common resolution for a smartphone varies from 240x340 to 640x960 pixels, in some occasions even up to 720x1280 pixels. The most common operating systems used on a smartphone are Apple's iOS, Google's Android, Nokia's Symbian, RIM's BlackBerry OS and Microsoft's Windows Phone. (Wikipedia, 2012a)

Where are smartphones used?

Smartphones are always carried with the person due to being lightweight and small in size. We can assume that they are used everywhere – on the go, at home, at work, when travelling, etc. A variety of studies (Church, Ernest, & Oliver, 2011; Church & Smyth, 2009; Nylander, Lundquist, & Brännström, 2009; Sohn, Li, Griswold, & Hollan, 2008) have been conducted by researching the mobile web usage of people. Research on the web usage allows getting further insight into the locations where people use their smartphones from. Less research has been done on the overall use of the smartphones, which is why this section looks into the use of smartphones occasionally through the prism of mobile web usage.

According to Nylander et al. 2009 and Hendrik et al. 2012 findings there is a trend towards the use of mobile devices in familiar and stationary environments, primarily at home and work (over 70% of occasions of web usage). This is due to the more advanced computing capabilities a smartphone has compared to a feature phone. A smartphone has a vast variety of possibilities for use like a PDA (personal digital assistant), portable media player, digital camera, video camera, GPS (Global Positioning System) navigation tool, etc. The use in mobile contexts represents only 17% of the mobile web usage.

Sohn et al. 2008 carried out a diary study of mobile information needs looking at the types of needs that arise while on the go. The authors found that 72% of entries were prompted by explicit contextual factors including activity, location, time and conversation. (Sohn et al., 2008) Church & Smyth 2009 carried out a similar study but allowed participants to track all information needs that is while at home, at work or while being mobile. They found that contexts like location, time, activity and social interactions have an effect on the type of needs that arise while mobile (Church & Smyth, 2009).

People actually prefer their phones over computers due to convenience for short duration activities like a quick Internet access or viewing the calendar (Nylander et al., 2009; Oulasvirta & Sumari, 2007). This was also confirmed by Church et al. 2011 where a user commented that accessing the Internet via his mobile at home allowed him “lots of 1 minute Internet interactions around real life”. (Church et al., 2011)

How are smartphones used?

According to Bao, Pierce, Whittaker, & Zhai, 2011 people expect their smartphones to act as a substitute for traditional computers. This refers to the need of having cross-platform services, which look the same and work in the same way across platforms.

Smartphones have been designed for one-handed interaction – that is with index finger, but some techniques also use the thumb. Other approaches use the outer frame of the phone to improve pointing accuracy. (Wagner, Huot, & Mackay, 2012)

Generally users use smartphones when they are unable to access their traditional computers. According to Bao et al. 2011 people start using their phones when their laptop's battery dies or when their laptop/desktop is too far away. Being too far away is quite subjective as the users reported that being far away can mean that the laptop is in another room. Therefore, taking the time to walk to another room to fetch the computer is troublesome. Moreover, booting up the laptop takes too much time, and as the smartphone is increasingly able to support and even co-opt desktop based tasks like web browsing and emailing, then it is obvious that the ease of access is why the smartphone has become more and more handy. However, when given a choice, users prefer to use computers due to having a bigger screen and being able to properly type. (Bao, Pierce, Whittaker, & Zhai, 2011)

The smartphone is a social gadget. In more than 65% of cases, the user was not alone and in almost 50% of cases, users were with family or friends. (Hendrik, Gove, & Webb, 2012) In one of their studies Church et al. 2011 asked users of smartphones to flag their search queries as urgent and not urgent. They found that approximately 60% of all entries were flagged urgent. Furthermore, the search queries often include location information like a city name, mobile search queries are more focused, tend to have a shorter query length and are centered around transactional content (Church, Smyth, Bradley, & Cotter, 2008). Maps are used when the current location of the user is considered important to plan the next move. The mobile search is used at random intervals to satisfy information needs that arise spontaneously. (Church et al., 2011) Hence, we can state that mobile search provides crucial information while on the go in order to plan the next moves or activities and the needs arise from the surrounding environment.

Smartphones have a small screen and we can assume that this has an effect on the reading and typing speeds on the device. Bao et al., 2011 found that there was not a great difference in the reading speeds of phones and computers, the computer to phone reading speed ratio was 1,15[1] for short emails and 1,2 for long emails. On the other hand, the typing speeds on the phone were 2,5 to 3 times slower than on the computer. The respondents themselves confirmed that a phone is used less for generating content than for reading or viewing it.

[1] The separators used in the thesis are with a comma instead of the dot.

The reason was that working on a computer is easier because of input mechanisms and general user experience. People also explained that the main purpose of their phones was to "check and read status" or "browse lightweight information". (Bao et al., 2011)

The main categories of activities that were found to be used on smartphones were: awareness (emails, social media feeds, news sites, schedules, find directions, time management), diversion (the need to alleviate boredom), social connection (connect or engage with other people) and curiosity related activities (familiarize with unfamiliar topic). The categories mentioned above highlight that the location and contexts people are in play a key role in their mobile search behaviour. (Church et al., 2011) Therefore, it is crucial to analyse how and where people are going to use a new service or software to better design it for them.

Church et al., 2011 explained that there is a tendency towards an increase in social activities and using native applications on the smartphones. Instead of turning to Google to find specific items, mobile users are more likely to use a specific application for a specific purpose. To get information on movies, users download a movie database application, for news a news portal application. The use of specific application makes the user experience better and people have a quicker access to the content they want (less taps). The types of apps used have been found to differ throughout the day, e.g. news apps are accessed in the morning, games apps at night, and communication apps throughout the day. (Böhmer, Schöning, Hecht, Krüger, & Bauer, 2011)

The possibilities and limitations of the smartphone

Smartphone screens are very small in size, which makes it difficult to understand large amounts of information and even harder to type. That is why people are reluctant to answer emails or read longer texts on the smartphone and the focus on development should not be on creating content. Smartphones are more commonly used at home and less on the go. At home they are often a substitute for the unbooted laptop, which means that the possibility for quick interactions is crucial for a smartphone. They are used as a spontaneous tool for quick searches and the explicit context has a strong effect on how they are used. Therefore, it is important to consider what are the situations people are going to use a service or an application in to improve the user experience. The interactions tend also to be urgent, which means that people cannot wait for another time, when the need arises the interaction has to be fulfilled right away. Hence, the fewer taps a user has to do to fulfil his needs the better, which is why a flat application hierarchy should be used for the (native) applications. Finally, locative technologies are commonly used to plan the next move and searches are conducted

using the location. Therefore, developing applications that take the users location into account may be relevant. Hendrik et al. 2012 suggests that "priority be given to assemblability, so that smartphone users can create their own user experiences with adapting the applications to their own needs" (p. 2).

2.1.2 Tablet

Overall information

Tablet computers have provided a new device format for users to enjoy access to a wide variety of digital experiences and information. People use tablets to search the Internet, communicate with friends, download mobile apps, watch videos, play games – much alike the use of smartphones. A Pew Internet study has revealed the ownership of tablets is rapidly increasing. In May 2010 3% of United States population owned a tablet, three months later in August 2010 the percentage had already risen to 10% of total population (Rainie, 2012). Studies show that tablet ownership reduces the amount that people use for other devices, while aggregate device usage is generally increasing. It is also important to note that tablets are mainly personal devices. About 91% of reported tablet use was for personal purposes, while only 9% was related to work (Hendrik et al., 2012).

The types of tablets vary greatly, hence also the display sizes. There are slates, convertibles, booklets, mini tablets and phablets. The most common screen sizes are from 8.4 inches to over 14.1 inches. The typical mini tablets and phablets have a 5-7 inches display. They are not considered a phone nor a tablet really. The common resolution for a tablet is highly dependent on its form factor, however, the general variation is from 1024x600 to 1280x800 pixels. The slates and booklets support even higher resolutions, as they are basically laptops. The most common operating systems used on a tablet are Apple's iOS, Google's Android, Microsoft Windows (Wikipedia, 2012b).

Where are tablets used?

The most common locations for using the tablet included home (living room, couch, table, kitchen), at work (office, desk, meeting), while on the go (car, train, subway), and in other places (restaurant, gym, classroom). Tablets are more likely to be left at home with 82% of the cases, as compared to being fully mobile. The only exception was made when travelling, because the tablet then became a substitute for the laptop. (Hendrik et al., 2012)

How are tablets used?

Wagner et al. 2012 have found that people mostly interact with the tables with one hand freeing the other for support. They also noted that users frequently change position to combat fatigue, which is why people develop multiple holds to use the tablet. (Wagner et al., 2012) Wobbrock et al. 2008 made a research on how various hand positions on the front or back of a handheld device affect interaction performance with the index finger or the thumb. For both front and back the index finger performed best and the horizontal movements were faster and more accurate than vertical movements. (Wobbrock, Myers, & Aung, 2008)

One distinguishing feature of a tablet is its touchscreen – instead of clicking one taps with the pointer or with a stylus. This direct manipulation method is well suited for the positions people use the tablet in (Hendrik et al., 2012). Hendrik et al. 2012 also stated that none of the possible text input mechanisms is really sufficient and ideal. Tests were done with external keyboard, on-screen keyboard, and handwriting recognition. For e-mail and chat, 71% of users preferred the external keyboard and for entering URLs, 67% preferred an on-screen method. Some users also switched from handwriting recognition to on-screen keyboard due to a high level of inaccuracy in the handwriting recognition tool.

Previous research has shown that the use of computers and mobile phones differs depending on the day of the week (Halvey, Keane, & Smyth, 2005). Overall tablets were used more on a typical weekday compared to a typical weekend day (61% compared to 39%). Besides that, the total duration on a weekday was longer than on a weekend day. (Hendrik et al., 2012)

People like that the tablet is bigger in the form than the smartphone, therefore it is better for consuming media. Participants reported that they had migrated some activities they previously performed on laptops and smartphones to the tablet. The types of activities that they had transitioned tended to be leisurely activities such as media consumption that better fit the fun and leisurely experience that participants associate with their tablets. "People explained that the tablets can enhance their experience by extending an activity, like while watching a TV one can look up relevant information." (Hendrik et al., 2012, p. 6)

The tablets are limited in their functionalities towards productivity software, word processing and graphics, therefore people used the tablets in total less than their desktop computers or PCs. (Mcciard & Somers, 2000) Even though tablets are not well suited for productivity tasks Hendrik et al. 2012 ran a series of tests on this field. People claimed that they were willing to put up with the issues for the convenience afforded of the form factor of the tablet. The tools

that people used for productivity tasks were: 1) Evernote for syncing notes across multiple devices and for collecting recipes, 2) QuickOffice to view documents, 3) Google Docs to view and edit documents, 4) Notes for shopping and task lists, 5) Cosi for syncing lists, 6) AutoCad for reviewing drawings, and 7) email apps for reminders and file management. There were cases when people used the tablet to forward the document to the laptop to continue editing. People also reported that even managing files and transferring data across devices is difficult. It was reported that typing on the tablet was a major pain point which people found frustrating and it often limited the amount of data entry they were willing to do before moving to another device such as a laptop or desktop computer. (Hendrik et al., 2012) Several survey participants complained about the lack of printing capability with their tablet.

A PC is considered to be uncomfortable, because one has to sit at the desk in an upright position, while a tablet can be used anywhere and they are therefore more comfortable devices. A PC is more used for work and serious activities, while the tablet is better suited for fun and relaxation activities. The tablet was also considered to be convenient, handy and time-saving because it allowed multi-tasking that the PC did not support. Multi-tasking involves watching TV, socializing, doing chores, eating, etc. (Mcciard & Somers, 2000)

The tablet is most commonly used in parallel to other activities like watching TV, eating, cooking, and waiting – of all instances this was up to 41%. The preference is towards using native applications on a tablet to access news content, listen to music online, find cooking information or use email, note and TV/video applications. (Hendrik et al., 2012) The most common activities done on a tablet are: checking emails, looking up information, online shopping, reading a book/news, doing local searches, listening to music, checking weather, recipe search and cooking, social networking, playing games, watching movies/videos, instant messaging and videoconferencing. Moreover, tablets are frequently used for the same activities just as smartphones. (Hendrik et al., 2012; Mcciard & Somers, 2000; Nielsen, 2011) Quite commonly, the activities done in the tablet were followed by real life activities that were based upon the tablet results – like going to a restaurant or making a purchase in a store (Hendrik et al., 2012).

Wagner et al. 2012 have researched the possibilities to improve the interactions with a tablet. They have created BiPad, a toolkit for bimanual tablet interaction with the thumb and fingers of the supporting hand and BiTouch, a design space to support the function. Though, tablets are not designed from bimanual input, according to the results bimanual taps outperformed one-handed interaction in both landscape and portrait orientations. (Wagner et al., 2012)

Other bimanual interaction techniques developed involve RearType, which includes a physical keyboard on the back of a tablet PC (Scott, Izadi, Ruszkowski, Bi, & Balakrishnan, 2010), Gummi, a "bendable" tablet that enables limited bimanual interaction (Schwesig, Poupyrev, & Eijiro, 2004) and Lucid Touch, a proof-of-concept see-through tablet that supports simultaneous touch input on the front and on the back of the device (Wigdor, Forlines, Baudisch, Barnwell, & Shen, 2007).

The possibilities and limitations of the tablet

Tablets are bigger in their size as smartphones, which makes them better suited for reading and viewing tasks. Typing, however, is just as much of an issue on the tablet as it is on the smartphone. Even though tablets support productivity related tasks, they are limited in them and not comparable to laptops or desktops.

Tablets are mostly used at home for personal purposes. People have integrated many activities onto the tablet that were previously done on the laptop or smartphone. They support the idea of quick interactions too, but are rather seen as devices for leisure and fun related activity like playing games or social tools. According to Hendrik et al. 2012 people are really passionate about the activities that the form factor of the device affords them.

Tablets are limited in the sense that they do not offer much external device support, they are not fit for managing files or data transfer and the websites and activities people want to use them for are not supported all the way through (like shopping and payments). As people prefer to use native applications and are limited with websites, perhaps a better incorporation of such web activities into native applications would be helpful. Also websites themselves should be developed so that they support tablets and tablet specific affordances like touch and swipe, but also include all the functionalities that are otherwise available for computers.

2.1.3 Laptop

Overall information

A Pew Internet Report claims that in 2011 52% of adults own a laptop and millennials are the only generation that are more likely to own a laptop than a desktop (Zickuhr, 2011). The laptop is a portable device, but not a mobile device – one can move around with it, but cannot operate it smoothly in a variety of environments and contexts. The typical components of a laptop include a display, a keyboard and a pointing device; they can be used on a battery, which allows portability.

Where are laptops used?

Laptops are used mostly at home and at work. Due to their portability and great possibilities they offer laptops have found a way into the business world and are being very commonly used there. Laptops are routinely used in a relatively small number of places. One might assume that due to being wireless laptops are used to compute anywhere, however, they appear to be a used in just a few places actually. The most common places are home office desk, dining table, couch and on the bed. (Woodruff, Anderson, Mainwaring, & Aipperspach, 2007) and at work at the office desk or in the meeting rooms (Dearman & Pierce, 2008).

How are laptops used?

A laptop is commonly used with other assemblages like a mouse, a horizontal surface to place the laptop on, a power adapter and peripheral devices such as printers, monitors, keyboards, or speakers. Therefore a laptop is not a single device actually, but instead a configuration of devices or an infrastructure to support laptop use. (Oulasvirta & Sumari, 2007; Woodruff et al., 2007) The interesting notion pointed out by Woodruff et al. 2007 about the use of laptops is that people do not really bother to get up to get a laptop. Even when a laptop is conveniently located, the booting time is a distinct obstacle. On many occasions people would walk to other rooms to access a computer that is running, instead of booting up one that is at hand. Hence, when people are looking for short-term interactions or to search the web quickly, they turn to their smartphones or tablets; previously these tasks just went unfulfilled. Furthermore, people are often reluctant to use laptops without a power adapter or a mouse. The lack of an adequate place to put a laptop on is a barrier – laptops are plainly difficult to use while standing up or while doing other physical activities. (Woodruff et al., 2007)

The laptops are often strategically kept near activity or other people in the home due to being limited in movement possibilities – they are heavy and difficult to carry in one hand and even more difficult to carry with the additional infrastructure. Also they are fragile in their nature, which limits their use in "dangerous" zones like kitchen or bathroom. (Woodruff et al., 2007)

The laptops are not that limited in their activities as smartphones and tablets. Most of the functions and software has been initially designed for laptops and desktops and adaptations have been made for the mobile device, which is why basically all the activities that are supported on smartphones and tablets are also supported on laptops, and they are not limited in the screen size or processing power. However, they need recharging after a few hours

depending on the capacity of the battery and their usability is greatly decreased in direct sunlight.

The comfortable environments for the use of laptops are characterized firstly by comfortable seating, such as a sofa or bed and the laptop supports a variety of seating positions. The typical tasks done in comfortable environments are more relaxed activities like web surfing, instant messaging and emailing. Just as smartphones and tablets are often aside secondary activities, laptops too offer parallel activities to be done – such as watching television, talking on a phone, socializing and reading. (Woodruff et al., 2007)

Ergonomic places are characterized by upright chairs positioned in front of tables or desks – offices and work areas. Both the positions of people and laptops are more static in ergonomic places than in comfortable places. The tasks and activities done in ergonomic places involve using a mouse or using the surface of the desk for books and papers. (Woodruff et al., 2007)

The possibilities and limitations of the laptop

One can say that the laptop compared to the mobile devices is a brilliant portable device. Everything that works on a desktop works also on the laptop, with only a few constraints on the processing power and graphical possibilities compared to the desktop. The laptop is the most widely used device of the four, especially among the millennials, and it is not limited in its shape and size either. Therefore, developing software for the laptop still makes very much sense and the possibilities for development are vast.

In regards to limitations the people are reluctant to use a laptop without some of its' external objects like an adapter and a mouse. Furthermore, they are limited in the amount of external infrastructure that typically is connected to the laptop, besides mouse and adapter also a keyboard, printer, an extra monitor, etc. Also, if the laptop is not booted, people rather choose a mobile device or ignore the need, then start the laptop. Finally, laptops are considered to be fragile, which means that one cannot use the laptop everywhere, not to mention the difficulty to use a laptop when on the go.

2.1.4 Desktop

Overall information

A Pew Internet Report claims that in 2011 59% of adults own a desktop. (Zickuhr, 2011)

The information on the desktop in this section can be somewhat outdated, due to the fact that nobody today is researching the usage of desktops anymore and the focus is on mobile devices instead.

Where are desktops used?

Desktops are used today at home, at work and at school. The preferred location for the desktop at work is the office desk and at home the family office. If the family does not have one, then a room has to be chosen which is quiet enough to be able to concentrate, but accessible to everybody at all times. (Frohlich & Silverman, 2001) When in 2001 the general view was that desktops should not be put into children's rooms due to inaccessibility in the evening and the need to have a control over them, then in 2003 the child's bedroom had become already the second best choice. (Frohlich & Kraut, 2003)

How are desktops used?

The desktop computer is considered to be less comfortable to use than a laptop, because one has to sit at the desk in an upright position and desktops do not support different ways of interaction. The desktop is also considered "confining" and "isolating", due to not being portable and resulting in not being able to be around family. (Mcciard & Somers, 2000)

According to Frohlich et al. 2001 the desktop is not a personal computer but instead a shared computer of the family. In all instances of the study the whole family used the computer, adults usually one at a time and children more commonly together. Searching for the web was done usually as a joint activity. (Frohlich & Kraut, 2003; Frohlich & Silverman, 2001)

The usage behaviour of the desktop users is displayed in Table 2-1.

Day profiles	PC on (avg.)	PC used (avg.)	Ratio use/on
Always On - 20%	20 h. 34	3 h. 41	18%
Daily available – 25%	12 h. 19	6 h. 0	49%
Evening only – 15%	7 h. 48	3 h. 45	48%
Occasional use – 27%	4 h. 1	2 h. 34	64%
One-shot – 13%	0 h. 59	0 h. 43	73%

Table 2-1. Five classes of desktop usage (Beauvisage & Leclerc, 2009)

We can see that the most common usage behaviour for the desktop is to have it occasionally in use or available daily. The highest usage ratio is for one shot users, who start the computer

only for the task at hand. An interesting fact is that when the desktop is on longer, the usage share is smaller, which means that the computer is mostly idle. Secondly, switching on/off and total usage time is not linked. The average time the computer is used is the same for "always on" and "evening only", moreover, "daily available" is using the computer the most. According to Beauvisage et al. 2009 keeping the computer working is strongly related to the use of network related software. 50% of the households have the need to be always connected, whether for synchronous communication or for file sharing, the computer has to be available permanently. For the other 50% of the households, switching the computer on means that it is being used. (Beauvisage & Leclerc, 2009)

The desktop supports all the activities that were mentioned in the previous sections under smartphones, tablets and laptops. However, it is most suitable today for tasks that require a lot of processing power like graphic/video editing and playing games, also for office tasks. Frohlich & Silverman 2001 state that the most common activities the desktop is used for are for writing school/work papers, play games, write emails, listen to music and overall fun and relaxation, but also for work related tasks.

The possibilities and limitations of the desktop

Desktops today are still very widely used for all kinds of activities and a lot of households still own them. Their speciality includes tasks that require a lot of processing power, but they are well suited for much simpler tasks too.

A limitation of the desktop is yet again the need to boot it up in order to use. That is why quite a few families keep the computer constantly on or during daytime, so that it would be easily accessible. The other limitations of the desktop are not being portable, being big and expensive, and needing constant power supply. Additionally, a desktop supports basic interaction styles only and work on a desk in an upright position is needed. The possibility to reduce the boot time would be a huge improvement for the users as well as the possibility for usage detection. The latter due to the fact that the usage of the users tends to focus on five applications in average, so if they could be pre-loaded, it would result in a higher user-experience. (Beauvisage & Leclerc, 2009)

2.2 A Survey on Cross-Platform Usage

2.2.1 Quantitative results

There were 101 complete results to the survey. Initially there were four age groups, however, as there was nobody over 65 and only one person in between 45-65 then the results were restructured as can be seen from Table 2-2. 53,5% of the respondents were under the age of 26 and 46,5% were 26 and over. In total 41,6% of the respondents were female and 58,4% were male. In the age group of under 26 there were 51,9% female and 48,1% male. In the age group of 26 and over there were 29,8% female and 70,2% male.

Age	Total	Female	Male
under 26	53,5%	51,9%	48,1%
26 and over	46,5%	29,8%	70,2%

Table 2-2. Age and gender of the respondents

The two biggest sources where the respondents were selected from where Facebook and Tallinn University email lists, therefore, it is necessary to look at their population structure. For the other emailing lists used in the survey, the author was unable to get a structure of the lists by sex or by age.

According to a social media case study by OnlineMBA 2012, the user structure of the Facebook users is 43% male and 57% female as can be seen from Table 2-3. Furthermore, the user's age structure is 14% under 25 years old and 86% for 25 years old and over. (OnlineMBA, 2012)

	Male	Female	Under 25	25 and over	Under 26	26 and over
Facebook users	43,0%	57,0%	14,0%	86,0%		
Tallinn University students	24,4%	76,6%			55,5%	44,5%

Table 2-3. Facebook users and Tallinn University Students by sex and age (OnlineMBA, 2012)

Additionally, according to the statistics provided by Tallinn University Student's Office, there are 24,4% male and 75,6% female students, altogether 10 239 students and 55,5% under 26 years old and 44,5% of the students 26 and over. Hence, we can conclude that the self-selection sampling was definitely biased and the division of neither the overall users of Facebook nor the students of Tallinn University are closely represented with the sample. Therefore, generalizations can be made only in the level of the sample and not on a

population. Yet, the results provide meaningful and valid data on the usage of devices of men and women and younger and older people and also the total number of complete responses is sufficient for basing conclusions on.

Table 2-4 presents an overview of the country of residence of the respondents. In total there were respondents from 9 countries. As was expectable, most of the respondents were from Estonia. Cape Verde is well represented, because a professor of the university asked his students from Cape Verde to answer the questionnaire too.

Country of residence	Percentage
Angola	1,0%
Austria	1,0%
Belgium	1,0%
Cape Verde	25,7%
Estonia	59,4%
Ethiopia	1,0%
Finland	4,0%
Germany	2,0%
Italy	1,0%
Netherlands	2,0%
United Kingdom	2,0%

Table 2-4. Country of residence of the respondents in alphabetical order

Occupation	Percentage	Female	Male
Employee	64,4%	19,8%	30,7%
Student	50,5%	29,7%	34,7%
Entrepreneur	14,9%	3,0%	11,9%
Housewife / househusband	3,0%	1,0%	2,0%
Retired	0,0%	0,0%	0,0%
Other (unemployed, serving in the army, etc.)	2,0%	1,0%	1,0%

Table 2-5. Occupation of the respondents

Table 2-5 presents the occupation of the respondents. This was a multi choice question. One can see that the biggest share of the respondents was employees and students, a little fewer were entrepreneurs. 3% of the respondents were a housewife/househusband and 2% who did not fit into the category and chose "other" as their preferred choice. None of the respondents was retired. Most of the men and women who answered the survey were students.

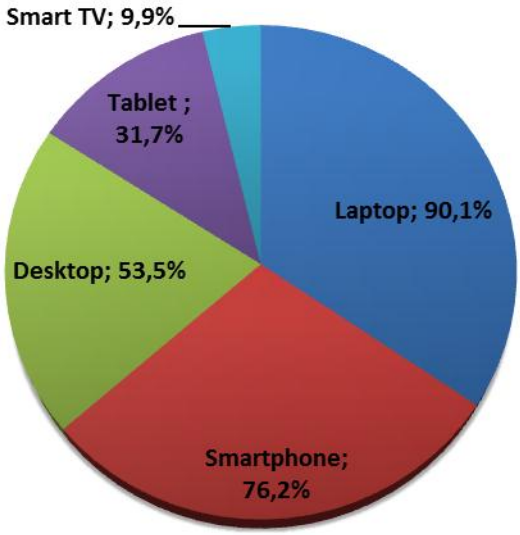

Figure 2-1. The devices people use

Figure 2-1 reveals that laptops are the most popular devices with 90,1% of the respondents having one to use. Smartphones are used by 76,2% of the respondents. We can see that people still use desktops quite often, almost 53,5% of the respondents have a desktop they can use, which is in line with the findings from the literature. Tablets are also quite popular among the respondents, almost every third person has a tablet to use. Smart TVs are still a very rare device to use and only 9,9% of the respondents have one. As there is not sufficient data on Smart TVs they are dropped from further analysis.

The high number of laptop, smartphone and tablet users is greatly exceeding the average number of users according to literature (Smith, 2011; Zickuhr, 2011), which can be due to the sample being young in age and more tech savvy.

A Pearson's chi-squared test was conducted for a test of independence – i.e. to determine whether preferences in the use of devices of men and women and under and over 26 year olds are different of each other or not.

Assumptions required for a Pearson's chi-squared test of independence:

- The number of objects is greater than 40 (confirmed, N=101)
- The expected counts are higher than 1 (confirmed, minimum expected count 9,98)
- The expected counts are higher than 5 on 80% of occasions (confirmed)
- Nominal/ordinal data (confirmed)
- Observations are assumed to be independent of each other (confirmed)

Hypothesis:

H0: The preferences of women and men for the use of smartphones are same

H1: The preferences of women and men for the use of smartphones are different

Statistical significance $\alpha = 0.05 = 5\%$

IBM SPSS results:

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	,882[a]	1	,348		
Continuity Correction[b]	,493	1	,483		
Likelihood Ratio	,898	1	,343		
Fisher's Exact Test				,477	,243
N of Valid Cases	101				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 9,98.

b. Computed only for a 2x2 table

Table 2-6. Chi-squared test results for preferences of men and women on smartphones

Explanation of the results: the assumptions for conducting the test are fulfilled. The results in Table 2-6 show that chi-squared value is 0.348 or 34.8%, which is higher than the chosen statistical significance criteria $\alpha = 5\%$, hence, the criteria is not met and Hypothesis 1 is not proven, and the preferences of men and women have to be considered to be the same for this case.

The same method has been used to get the following results for men and women according to each device and under and over 26 year olds. In the comparison between men and women the analysis has shown that for the case of tablets the preferences of men and women are different, where men are more likely to use a tablet. For desktops the preferences are not proven different, therefore, they have to be considered to be the same and for laptops the criteria for the assumptions was not fulfilled, because there were not enough people who do not use a laptop.

In the comparison between under and over 26 year olds the analysis has shown that for smartphones, tablets and desktops the preferences of men and women are different, where 26 and older people are more likely to use the device. For laptops the criteria for the assumptions was not fulfilled, because there were not enough people who do not use a laptop.

The respondents were asked to rank the different devices they use based on the frequency of usage. Table 2-7 shows the results according to the rank people chose. The results have been weighed with the total users of each device.

Devices ranked based on the frequency of usage	Rank 1st	Rank 2nd	Rank 3rd	Rank 4th	Rank 5th
Smartphone	29,9%	48,1%	28,6%	6,5%	5,2%
Tablet	9,4%	31,3%	68,8%	50,0%	15,6%
Laptop	59,3%	34,1%	14,3%	1,1%	0,0%
Desktop	38,9%	33,3%	40,7%	22,2%	5,6%
Smart TV	0,0%	30,0%	20,0%	120,0%	230,0%

Table 2-7. The devices people use based on the frequency of usage

The laptop is certainly the first device to be used followed by the desktop and the smartphone. Second in the row, people are likely to use either the smartphone or the laptop. Thirdly, they prefer the tablet or the desktop computer. People are least likely to choose the Smart TV. As answering the question was not dependant on whether the respondent had a Smart TV or not, the results show percentages above 100% for the frequency of use of Smart TVs. Hence, we can see that for the 4^{th} and 5^{th} rank people showed an increasing confidence that Smart TV is the least used device.

The respondents were also asked to explain why they ranked the devices this way. The data showed that some people ranked the smartphone first as it was always with them, even though they did not use it all the time. Respondents also mentioned that they prefer to use a desktop or laptop at home and at work and a smartphone or a tablet while on the go. Hence, we can conclude that the typical list of devices people use based on the ranks is: a laptop, a smartphone and thirdly a tablet.

People were asked to answer what types of services they use regularly on their devices. This resulted in a detailed overview. Figure 2-2 shows an overview of what kind of activities people are most likely to use on all of their devices.

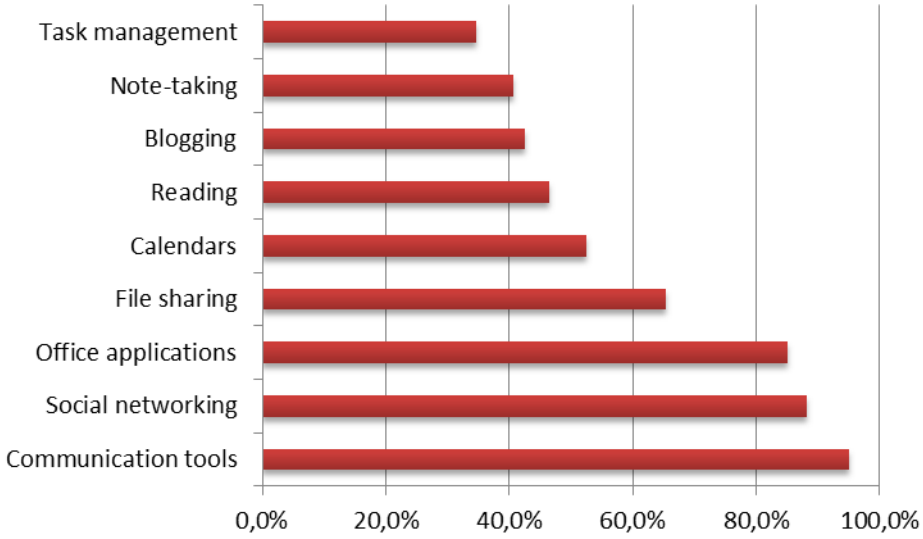

Figure 2-2. The services people use regularly on all of the devices

The most common services used on the devices are communication tools, social networking and office applications. The least common services are task management and note taking services, with a little more than every third person using them.

	Smartphone	**Laptop**	**Desktop**	**Tablet**
Communication tools	96,1%	94,5%	94,4%	96,9%
Social networking	90,9%	87,9%	90,7%	84,4%
Office applications	84,4%	85,7%	85,2%	90,6%
File sharing	71,4%	65,9%	70,4%	68,8%
Calendars	62,3%	54,9%	61,1%	68,8%
Reading	51,9%	47,3%	48,1%	62,5%
Blogging	48,1%	42,9%	40,7%	46,9%
Note-taking	48,1%	42,9%	44,4%	43,8%
Task management	40,3%	37,4%	37,0%	46,9%

Table 2-8. Types of services people use according to the devices

Table 2-8 shows that in device specific view the order of services used and the % of services used is mostly the same, with slight differences in desktops, where note-taking is more used than blogging, and in tablets, where task management is more used than note-taking. This means that the same types of services are used across all devices almost up to an equal amount.

To better understand the services people use a Pearson's chi-squared test was conducted for a test of independence – i.e. to determine whether preferences in the use of service types for men and women and under and over 26 year olds are different of each other or not.

The method used for conducting the analysis was the same as previously, therefore only results are displayed. In the comparison between men and women the analysis has shown that for the case of reading services the preferences of men and women are different, where men are more likely to use reading services. For office applications, file sharing, calendars, task management and note taking the preferences are not proven different, therefore, they have to be considered to be the same and finally for communication tools and social networking the criteria for the assumptions was not fulfilled.

In the comparison between under and over 26 year olds the analysis has shown that for the case of file sharing and calendaring the preferences are different, where over 26 year olds are more likely to use these services. For social networking, office applications, reading services, blogging, task management and note taking the preferences are not proven different, therefore, they have to be considered to be the same and finally for communication tools the criteria for the assumptions was not fulfilled.

In the next section a summary of the specific tasks that people prefer to use on each of the devices will be given according to the types of services shown in Figure 2-2. See Appendix A.3 for further details.

- Communication tools – all SMS and call related activities are preferred on smartphones. Reading emails and instant messaging is quite equally divided between laptops and smartphones. Laptops also prevail in answering, composing emails, saving drafts, attaching files, managing emails and for searching through emails.
- Social networking – highly dominated by laptops in monitoring friends, adding posts, commenting, sharing, searching for friends, managing friends. For sending direct messages laptops and smartphones are almost equally used. Smartphones prevail also in check-in related services and location tagging.
- Office applications – computers have the upside here, especially laptops which are dominant over desktops in every aspect.
- File sharing – dominated by laptops across all fields.
- Calendars – smartphones are used for creating and viewing events, also for adding alerts and syncing, laptops are better for editing events setting recurring tasks, sharing calendars and subscribing to calendars.
- Reading – for simpler reading services of eBooks and PDF tablets are prevalent, also for highlighting text and bookmarking. Computers are more used for thorough search in texts, getting definitions, social sharing, and synchronization.

- Blogging – is fully dominated by laptops.
- Note-taking – for adding (formatted) text, images, videos, links and tags – laptops are considered more suitable. Smartphones are prevalent in reading tasks, like reading notes but also in searching by location.
- Task management – mobile devices are preferred for adding and reading tasks, adding dates and notifications, synchronizing, and marking tasks completed. Laptops are preferred for creating lists, and adding locations.

In conclusion, the tasks used on each device are different, because people have different preferences for the devices, but also the device affordances themselves affect what the people use the devices for. This has resulted in the difference of usage patterns across devices.

Figure 2-3 shows whether people consider cross-platform use important. Thereafter, explanations of the respondents are added to display the reasons why people consider it important or not important.

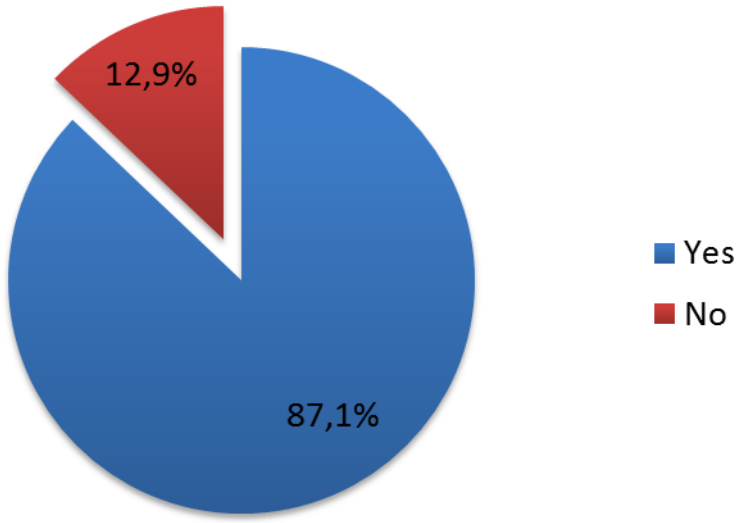

Figure 2-3. Is using a single service on multiple platforms important for you?

According to the survey people consider using a single service on multiple platforms important i.e. using cross-platform services. The respondents who chose "no" as an answer explained that they are either new to cross-platform use or they have already chosen the devices which they use for specific activities and do not need to use other devices for the same purpose. Some people are however synchronizing emails and some other data between devices, even though they could do without it – so some cross-platform use can be seen among them. One survey participant pointed out that he/she likes to keep the work and private

life separate, thus syncing everything is not worth considering. Another person noted that he/she tries to avoid centralized data storage, most probably due to security issues.

The people who considered cross-platform services important and answered with a "yes", explained that cross-platform services and the possibility to synchronize data puts them on top of all things. People want to be up-to-date with their data anytime, anywhere and on any device. Different environments mean that one does not have all devices always handy, therefore, a substitute is necessary. Furthermore, one respondent said that it would be silly to look for another device just because this one does not have the service/application (cannot handle it). Cross-platform services save time, make life more comfortable, help people be on top of their data and avoid double work (like multiple calendars) or losing data (one can start from one device and end on another). There is no need to think about the differences of tools, so it makes the life more convenient.

2.2.2 Qualitative results

Qualitative data was collected through open questions in the questionnaire. Respondents were asked where they prefer to use their devices and what kind of limitations they have experienced on these devices. The reason behind these questions was to get further insights into how respondents use their devices.

Laptop

Respondents tend to use laptop mostly at home and at work, less occasionally on the go, in public spaces, while travelling, at conferences and at client's offices. When it comes to study purposes or work related tasks, then people reported using the laptop everywhere, no matter the location. Some of the activities the laptop is considered prevalent are: office tasks, planning events/activities, fun and entertainment, watching movies, videos and pictures, listening to music, emailing, social networking, instant messaging or voice/video communicating, downloading files, surfing the Internet and programming.

The usage behaviours of people seem to contradict, for some it is a substitute for the desktop computer at home, thus taking the laptop outside of the home is a rare occasion, for others the laptop is a work related object, thus they rarely bring it home or open it at home. One person mentioned that he uses the laptop to write larger emails, and the tablet/smartphone for smaller emails. Another confirmed that everything he cannot get done with a tablet, he uses the laptop

for – examples included flash content, longer emails, online banking and payments. People also stated that the laptop is preferred for time-consuming tasks.

The limitations of the laptop were considered to be the low processing and graphical power, low battery time and the relatively small screen. They were considered to be too big and heavy to be carried along all the time. Laptops' touchpad and mouse are not good for drawing and design and by no means can substitute an external mouse or drawing pad.

Smartphone

According to the results people use their smartphones literally everywhere – on the go, at work, at home, at school/university and while travelling. One person even mentioned that she uses the phone while taking the bath. Many people pointed out that the smartphone allows for quick interactions, which make it very convenient to do a quick search on Google or check bus schedules, check for email or plan the next move. It was very common for people to use their smartphone while doing other tasks like waiting for a bus, eating a lunch and waiting in a queue. The most frequent activities were: checking emails, quick searches from the web, check public transport or movie schedules, listen to music, take photos, make notes, navigation or checking for traffic, social networking, reading news, using communication applications, synchronizing between devices, playing games, calendaring and checking the time. What is remarkable is that only a few people mentioned that they use the device for calling and SMS messaging, which seems to be taken for granted. The frequent applications used were communication, parking and sport applications. People also mentioned that they are likely to use their smartphone when any other device is not available or too far to reach.

The limitations of smartphones that were pointed out were firstly involving the low resolution, small size and low battery capacity/high battery consumption of the device. Furthermore, people considered smartphones to be slow, not fit for writing longer texts, having functionality limitations for office tools and many file types. Likewise, data transferring was considered difficult between applications (copy-paste). A lot of websites were claimed not to have smartphone support or that the website's smartphone mode greatly limits the functionalities that can be used. Smartphones were not considered fit for typing and editing texts, reading long emails, answering emails, reading papers, blogging. Also, applications tend not to be well thought through – one cannot take photos once the battery is low or that the screen fades while watching videos. iPhone users complained about issues with Bluetooth services, no flash support and file sharing difficulties.

Tablet

The results show that people use the tablet on the go, at school, while travelling, but mostly at home. The more common activities included: reading news, emails, e-books, e-magazines, articles, surfing the Internet, watching films/series/TV, listening to music, social networking, playing games and other fun related activities. One of the respondents mentioned using the tablet himself very rarely, but that the children preferred to use it to play games. Some of the more interesting answers were that people use tablets for application testing and developing, for quick interactions because the tablet is always on and available, so there is no need to boot up the computer. One respondent also revealed that while on the go he uses it for quick interactions and for searching relevant information that helps plan his further movements, which is how smartphone users use their device too.

The limitations of tablets were considered to be: limited functionality for office tools, sending links and transferring data between applications was considered troublesome (copy-paste) and text editing is not well supported. Moreover, saving and managing files and connecting other data storage devices were considered difficult. People also considered it relevant to point out that the many websites do not support mobile devices and if they do, then they are very limited in functionality. iPad users pointed out also the need for flash support and that there are compatibility issues with operation system versions and applications.

Desktop

The results of the survey reveal that people use desktops both at home and at work or at school/university. Desktops are used mostly for activities that require more processing power – like gaming, video/image editing, graphical design, but also for simpler activities like checking email, calendaring, using office applications and social networking. Respondents also mentioned that they use a desktop when they need a bigger screen. The more interesting responses were that one person uses a desktop only when there is a need for MS Windows, otherwise the person uses a Mac OS laptop. One person uses a desktop for backup services as the computer is always on and online.

The only limitations pointed out to desktops were not being portable, no webcam by default and the need for constant power support.

Smart TV

The respondents use Smart TV mostly for their original purpose – i.e. watching TV at home and rarely for the "smart" solutions that the TV has. One of the users claimed that the user

interface of the TV is barely usable, therefore one can assume that people rather avoid using them. The only "smart" activities people mentioned doing on the Smart TV were watching videos from Youtube, renting movies and watching TV on demand (Time-shift TV).

The limitations of the Smart TV include: the text input systems are considered very bad, which makes them practically useless as one respondent said. Overall there are too few applications or features developed for Smart TVs. In order to improve the user experience tools like social networking, notes, RSS should be added according to the answers of the respondents.

2.3 Closing Remarks on Contemporary Cross-platform Devices

In this chapter, the author provides a discussion on the results of the survey together with the findings of the literature.

The most popular devices that over 90% of the people in the sample use are laptops, followed by smartphones with 76,2% and desktops with 53,5%. Even though smartphones are a quite recent phenomenon people have understood their advantages over the feature phones and are increasingly using them. The data showed that people use the smartphones literally everywhere, the device is always with the person and it is very handy. Desktops are still used by over half of the people, most probably the number is decreasing as people see laptops more fit for their mobile life and one can see that with the increasing capabilities of the laptop, the desktops are losing their advantages and becoming less used. Tablets, on the other hand, have also been taken into use quite recently and have become very popular. Today every third person has one, which is quite a high number considering the price of the tablet and that the combination of a laptop and smartphone together is a good substitute for the tablet. Finally, Smart TVs are still in the baby steps, 1 out of 10 people have one and as the results reveal the input mechanisms and the possibilities for use of the Smart TV are still very limited and they are rather considered to be just plain TVs.

The preferences of men and women are different in the use of tablets, where men are more likely to use a tablet. There was no statistical significance for preferences over desktops and smartphones and for laptops there were not enough people who do not use one, because over 90% of participants used a laptop. In comparison of under and over 26 year olds the results revealed that the preferences of smartphone, tablet and desktop users are different. In all cases over 26 year olds are more likely to use the previously named devices. The reason can be that

quite a big number of the younger people are still students, which means that they really have no need for a tablet or a desktop computer, and they can get their tasks done with a laptop. Regarding smartphone, the most likely explanation could be that the younger people have less purchasing power and therefore have not yet changed their devices for the new ones.

The typical list of devices that people use based on the frequency of usage is a laptop, a smartphone and thirdly a tablet. The smartphone is always with the person, however, is not used that often as the laptop. Another interesting fact is that a lot more people mentioned using a desktop than a tablet, however the frequency of usage of tablets is much higher compared to desktops. This reveals that even though more people use a desktop, tablets are used more often, most likely for shorter interactions with the device. Smart TVs are used the least due to their limited functionality.

The most common services people use on their devices are communication tools, social networking and office applications. The least used service types are task management and note taking services, with a little more than every third person using them. Therefore, we can assume that people are quite likely to use sheets of paper for notes or a diary for calendaring – i.e. these activities have not yet digitalized that much compared to others. Furthermore, the order of services used and the % of service types used in every device is mostly the same, which means that the same types of services are used across all platforms approximately to the same extent. Therefore, people are interested in the cross-platform use of the same types of service. Functionalities that each device has and the tasks that people do with them are different across platforms, but the types of services used are the same.

According to the preferences the results indicate that on most occasions there is no statistical significance to the preferences of men and women and younger and older people in the types of services they use, with the only exceptions in reading services, where men are more likely to use reading services and in calendaring and file sharing services, where over 26 year olds are more likely to use these services. The difference in preferences in reading services can be explained with the higher share of men using the tablets and as tablets are the most suitable device for reading e-books and e-magazines, then the connection is quite obvious. In regards to calendaring services, the reason might be that youngsters use a diary more often than digital calendaring services and in file sharing services the possible explanation remains unknown.

Now when looking into the specific activities and functions that people use on their devices the results show that the typical scenarios for each device are the following.

On **smartphones** all calling, SMS related and instant messaging activities are preferred, also smartphones prevail in all sorts of reading and viewing activities like checking emails, texts, notes and public transport schedules. They are used less for editing tasks, but they are not suitable for writing activities due to the small screen. Smartphones are also preferred for tagging and location based activities (check-in, location searches, adding location, navigation or checking for traffic), but also for listening to music, taking photos and increasingly for playing games. Moreover, they are good for creating and viewing events in the calendar, but also for adding and reading tasks, adding dates and notifications and alerts. As the phones are always with a person then using alerts and notifications makes sense to use on these devices instead of laptops or desktops.

They are good for quick interactions, which is what most of the above mentioned activities actually afford and therefore, they are often used at home as a substitute for the desktop and laptop. However, when people have the choice, they actually prefer to use a computer at home. A smartphone can be used simultaneously while doing other activities like waiting for a bus or in a queue. Hendrik et al, 2012 found that typically about 60% of the search entries are flagged urgent, which means that the needs arise from the surrounding environment and contexts like location, time, activity and social interactions have an effect on it. All this can be required to plan the next move or activity.

The smartphones are limited in their size and resolution and the low battery capacity and high battery consumption of the applications on the device. The small size of the screen makes it difficult to type, which is why they are not suitable for working with longer texts, rather for small chunks of text and little input from the user. This has been confirmed by the literature with the reading speed difference between computers being not that great, only 20% slower, however, writing speeds are 2,5-3 times slower on a smartphone (Bao et al., 2011). They have little support for many file types and office tools, however, this is not what they are actually intended for. In order to improve the usability of the smartphones, applications developed should be well thought through in terms of where, when and how they are intended to be used as well as current and future websites/web-applications should have support for a smartphone view with a greater list of functionalities. Moreover, there is an increased tendency towards the use of native applications (Church et al., 2011), and the application usage differs greatly throughout the day (Böhmer et al., 2011), which has to be kept in mind too. Finally, Hendrik et al. 2012 suggested that assemblability should be used on a smartphone, so that users can adapt the applications to their own needs – restructure the display of the application.

Tablets are commonly used at home, but are suitable also on the go. This was also confirmed by the literature saying that tablets are used more commonly in stationary environments, with exceptions related to travelling (Hendrik et al., 2012). They are widely used in the same activities as smartphones, however, they are preferred only in a few activities like PDF and e-Book reading and highlighting text and bookmarking. The more common usage areas for tablets besides the above are: reading news, checking emails, surfing the web, watching films/series/TV, consuming media, listening to music, instant messaging and all fun related activities like games. Just as the smartphone, the tablet is good for quick interactions because it does not require constant booting up. The tablet is well fit for leisure activities, and according to Hendrik et al. 2012 about 91% of the usage was centered on personal activities, which means that the tablet is less commonly used for work related matters.

The tablet's larger screen affords a better overview, yet, they are limited in the input mechanisms and therefore the typing speed in the same way as smartphones. Similarly with smartphones, tablet users also prefer native applications.

The limitations of tablets were considered to be: lack of support for office tools and for adding attachments and for data transferring between applications. Similarly with smartphones, the lack of proper tablet supported websites is considered an issue for the users as well as the limited functionalities in web applications.

Computers prevail in a number of activities, however, it seems that desktops have fully lost their edge over laptops and they are only considered somewhat better than laptops in a few concrete activities, which have nothing to do with the strengths of the desktops mentioned in the literature. People use **desktops** both at home and at work or at school/university. They are used more commonly for activities that require more processing power – like gaming, video/image editing, graphical design, but also for simpler activities like checking email, calendaring, using office applications and social networking. Respondents also mentioned that they use a desktop when they need a bigger screen and a better overview. However, the usage of desktop computers typically results in "isolation" from the rest of the people/family due to not being portable. The only limitations pointed out to desktops were not being portable, no webcam by default, the need for constant power support and the long time it takes to boot up the computer. Beauvisage & Leclerc, 2009 suggested that as people use mostly up to five applications in average, then these could be pre-loaded per user profile to increase booting time and user-experience.

Laptops on the other hand prevail in a variety of activities over all other, they are fully dominating file sharing activities, blogging and office applications. Laptops are equally used with smartphones for reading emails, however, they support a wider variety of activities like searching through emails and composing, attaching files, managing emails, etc. In social networks laptops are preferred to be used for most of the activities like managing friends, searching for new friends, sharing, commenting, etc. In calendaring services laptops are dominant in tasks that require a better overview, which a small screen of the mobile device does not provide, these are tasks like setting recurring tasks, sharing calendars, subscribing to other calendars and editing events. Therefore, laptops are used for thorough work on text that requires a lot of editing and formatting or for tasks that are more time-consuming and that require a good overview, which the bigger screen affords, but also for activities where external attachments need to be added, because the possibility to move easily between windows affords this.

The laptop is increasingly a configuration of devices and not a single device, with all the assemblages like a mouse, keyboard, power adapter, monitor, speakers, etc. (Woodruff et al., 2007). Furthermore, people are reluctant to use laptops without power or mouse. The literature also suggested that the booting time is a major drawback of the laptops too, and users are likely to choose a smartphone or a tablet instead. The further limitations of the laptop were considered to be the low processing and graphical power compared to desktop computers, low battery time and the relatively small screen. The latter is debatable, as laptops come in a variety of screen sizes and it really depends on what they are compared with. Additionally, they were considered to be too big and heavy to be carried along all the time, which is why they are better suited for stationary environments. However, in terms of possibilities for use, the laptop has only a few limitations and as most of the services and programs have been developed keeping laptops in mind. Therefore, at this stage they are basically unmatched by other devices.

Smart TVs are mostly used for their original purpose of watching the TV at home and rarely for the "smart" solutions that the TV has. The user interface of the Smart TV is considered to be not well usable, the input systems are very bad and finally the "smart" set of functionalities available on the Smart TV are minimal. Therefore, the full potential of Smart TVs is yet to be revealed.

Cross-platform services were considered a necessity by most of the participants. People want to be on top of their activities, have a good overview on any of their devices anytime and

anywhere. Cross-platform services make the lives of the users more comfortable and avoid double work or loss of data. Even some of the people who considered cross-platform services not to be important for them, admitted that the reason for it is that they are either new to the topic or to some limited extent they are actually still using it, like for synchronization between devices. Hence, a conclusion can be drawn that cross-platform services are required, they are useful for the people, and thus should be developed and improved.

In conclusion, this chapter has answered how and where people nowadays use their devices by enlisting the possible areas of use, the typical usage scenarios and the limitations and challenges the four main cross-platform enabling devices have. Additionally, the Smart TV has been analysed to a limited extent. Hereby, the need for research on the topic cross-platform interaction design has been confirmed, because people are doing different tasks on different devices and in different contexts and there is a need to further analyse how they go about using their devices.

Now that the relevance for cross-platform services is established the next chapter will provide insights into what user interface and interaction design approaches are used for cross-platform development and which design practice will be chosen for the case study. It is relevant to see how and whether tasks and activities are addressed in the literature.

3 Designing for Cross-platforms

In this chapter, the technical solutions that are used to adapt user interfaces onto multiple platforms are described. Moreover, the concepts cross-platform and interaction design are discussed in the chapter based on previous research from the literature and finally, the chapter looks into design practices of how is cross-platform interaction design addressed in the Interaction Design community.

3.1 Contemporary Approaches

3.1.1 Thin client

"A thin client computing system consists of a server and a client that communicate over a network using a remote display protocol" (Lai & Nieh, 2006, p. 143). The core of the data is stored on a server and graphical displays are sent to the client device, while application logic is executed on the server. Thin client is the opposite of a fat client, where the system covers most of the data and is therefore independent on the server. Figure 3-1 shows the difference between a typical fat client and thin client approach. In the case of the thin client we can see an extra server in between the web server, which handles and "filters" all the data before sending it to the client.

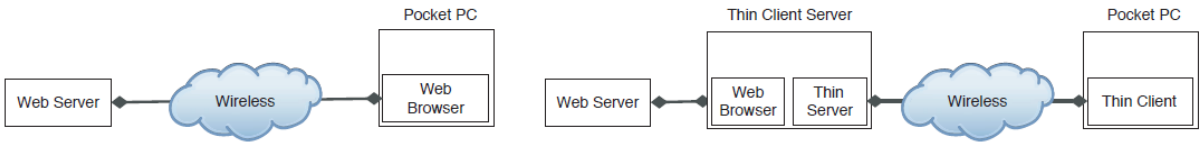

Figure 3-1. Fat client vs. thin client with Pocket PCs (Lai et al., 2004)

"In a thin client system using the remote display protocol, the client transmits user input to the server, and the server returns screen updates of the user interface of the applications from the server to the client" (Lai & Nieh, 2006, p. 143). The recent trends in thin client computing are ultra-thin client, web thin client and Run Time Environment (RTE) client, where the system no longer runs a full operating system, but only the specific software needed to fulfil its' task.

The limitations and challenges of a thin client firstly and most of all are the Internet connection, which they rely heavily upon. They send and receive everything over the Internet, which can be a positive but also a negative aspect. If the server crashes, the client seizes to function and moreover data loss can be inevitable. Secondly, thin clients are in trouble when streaming lots of high quality graphics over the network. They would either require that the screen resolution should be kept low or the client should have high detail uncompressing bitmaps, but even then the result would be in a higher latency to the server communication (*Ibid*). Today with 3G and 4G wireless networks and fibre optic lightning cables the issue of graphics can be minimized, but not fully resolved. In a cross-platform context device detection software has to be used to feed the most appropriate content to device, this however, has to be kept up to date with new browsers and devices.

The benefit on a thin client approach is that one can keep all or most of the data on a server and only keep the minimum on the thin client. Everything that the user needs for thin client is streamed from the server. Ritschard, 2009 has also offered some key benefits of thin clients. The clients can be very limited when it comes to hardware and software, thus they are much cheaper. Clients require minimal user support, once plugged in and set up, they are fully functional, only requiring rebooting from time to time. Moreover, they support multiple operating systems, which can be easily achieved on the server and the clients support a high level of mobility. Basically, the entire session is ubiquitous depending on the limitations of the device only, the only requirement is the Internet connection. This makes it a perfect candidate for cross-platform use. Thin clients also have a proven higher reliability and they are more cost effective. The security issue is much simpler on them, only the server needs to be secured and this is already handled by the professionals, there is no need to achieve it on a single device level. (Ritschard, 2009)

There are various tools created to improve the performance of thin clients in a cross-platform context. Kim, Baratto, & Nieh, 2006 have come up with pTHINC (PDA Thin-client InterNet Computing) a system for thin client systems, where the software virtualizes and resizes the display on the server to efficiently deliver high-fidelity screen updates to a broad range of different clients, screen sizes, and screen orientations, including both portrait and landscape viewing modes. This enables pTHINC to provide the same persistent web session across different client devices. The same cookies, bookmarks, and other meta-data are continuously available on both machines simultaneously. (Kim, Baratto, & Nieh, 2006) From the cross-

platform interaction perspective a server determines the device according to the resolution and sends the predefined interfaces to the client.

3.1.2 Device-independent design

A number of approaches strive to provide device-independent access to web applications. In the interest of web device independence and content reuse, the World Wide Web Consortium (W3C) has defined the eXtensible Markup Language (XML) and eXtensible Stylesheet Language (XSL). The two can be used for static content to achieve device independence, but they lack support for dynamic content. Dynamic content support is vital for web services where users frequently expect interaction, personalization and up-to-date information. (Kirda, 2001) Book et al. 2006 also refer to the common use of adapting static content for different devices and designers tend to offer "a posteriori" approach, which means that a single platform design is previously created and then adapted into multiple devices. There are also "a priori" approaches, which enable device-independence from the beginning. There are various tools developed like XHTML, OODHM, WebML, UIML, XIML, etc. but each of them has their limitations (Book, Gruhn, & Lehmann, 2006)

Device-independent design can be achieved by using single or multiple authoring techniques, which fall into the "a priori" approaches. In multiple authoring techniques the developer creates a specific user interface for each device or category level, in single authoring a single implementation of the user interface is automatically adjusted when displayed on any device. (Simon, Wegscheider, & Tolar, 2005) This can be achieved by using a device independent toolkit to produce the user interface, or using a mark-up language to describe the interface and a presentation mechanism to display it, or using model-based user interface design methods. (Karampelas, Basdekis, & Stephanidis, 2009) Either one has its advantages and limitations. The multiple authoring techniques offer well adapted user interfaces, but they are more expensive, because there has to be as many designs as there are devices, also it may result in inconsistency between the different user interfaces. Single authoring technique offers consistency in the generated user interfaces and is more cost-efficient, however, is lacking device specific customization. Current single authoring solutions can usually be attributed to one of the following three categories (Simon et al., 2005):

- Platform independent vocabularies and toolkits allow the developer to specify interfaces using a set of generic widgets

- Extending established mark-up languages
- Model-based user interface development

There is also a third category called flexible authoring, which is a hybrid version of the former two, giving a designer more freedom. Karampelas et al. 2009 offers a design strategy for the preparation of different designs, which is based on flexible authoring methodology. The proposed method is a step-by-step guide for developing device-independent interfaces:

- Identify device-specific constraints or capabilities
- Identify the context of use for each device
- Select the ‘worst case’ device and start from it
- Design the first user interface prototype according to the device-specific limitations
- Infer a generic set of requirements based on the first UI design
- Design the user interface prototypes for the other devices applying the set of generic requirements
- Decide which user interface components can be automatically transformed between the diverse computing devices
- Evaluate the user interface prototypes for all the different devices
- Revisit the set of requirements and the prototypes according to the findings

The proposed strategy is very cost-efficient and allows the inclusion of unlimited number of devices with different specifications. Moreover, the strategy allows fully exploiting device characteristics, defining each time the functionality that cannot be supported in the "worst case" devices. The limitations of the design strategy involve possible limitations on functionality in order to perform well on the "worst case" devices. Also as the testing is done on a limited number of devices, an issue of usability might arise if new types of devices with different parameters are added.

3.1.3 Context-aware systems

In order to provide a better user experience a Web application would need to adapt to different contexts and environments. Service providers have traditionally provided multiple versions of a Web application, one for each platform and context. For instance, web developers have created applications which are HTML only, JavaScript enabled, low graphics version, etc. (Chang & Agha, 2007). However, this approach has outlived itself. This way the costs are much higher, the development process is ineffective and the end result is not good in

terms of usability and user experience. The more new devices emerge and the more potential use we can find them, the more crucial it is to develop context specific applications.

Therefore, context aware systems today follow a different approach. No matter how many versions the application supports, there are some elements in common, such as its core application logic. Chang & Agha, 2007 offer a three-layer approach to context-specific Web application development:

- At the bottom layer, we characterize a context-specific Web application with a particular component distribution plan which provides details for composing individual objects
- In the middle layer, recursively defined configurations provide a bridge which relates high-level context features to low-level component distribution properties, where a configuration is a combination of configurations and/or component distribution properties
- At the top level, a context management system selects desirable configurations according to the execution contexts

According to the literature the key limitations to context-aware systems are adaptivity and extensibility. The basic idea is to separate component design and distribution features. Using a three-layered system, "a Web application can adapt to specific contexts through reconfigurable component distribution." (Chang & Agha, 2007, p. 250)

The challenges ahead with context-aware systems are that a good adaptation depends on human design in specification blocks and adaptation policies. As mentioned earlier, a typical Web application is executed numerous times a day and a few bad deployments do not incur much loss. "We expect future Web applications will adapt themselves automatically by learning their past usage patterns." (Chang & Agha, 2007, p. 251)

3.1.4 Adaptive design

"Adaptivity is the ability of a system to react to changes in the user profile, the user device, and any attribute of the usage environment demanding for modifications of the offered contents and services" (Daniel & Milano, 2006, p. 2). Adaptivity should be started early on in the design process in order to make interfaces take into account the future cross-platform use already. Web applications can be exposed to a multitude of adaptive behaviours. "Based on their scope it is possible to distinguish between localized and sparse adaptivity" (*Ibid*):

- Localized adaptivity is strictly coupled with some hypertext elements (e.g., pages, links, etc.), as it happens in the case of an automatic update of the contents published by a particular page as reaction to a change in the user profile or in the usage environment.
- Sparse adaptivity requirements, on the other hand, may be bound to several hypertext/application components or may have no specific binding at all. An adaptation of the overall application's presentation properties represents a sparse adaptivity action.

A strategy to approach adaptive web design is called progressive enhancement. The two terms are used in synonyms context. Progressive enhancement was introduced by Steven Champeon in 2003. It is a strategy for web design, which makes the data accessible on any browser or device connected to the Internet. Progressive Enhancement was chosen to be #1 on .net Magazine's Top Web Design Trends for 2012, followed by Responsive Design on #2 (Grannell, 2012). Progressive enhancement is based on a three-layered idea of separating a document's content, presentation and behaviour (Wells & Draganova, 2007):

- Content Layer - using semantic XHTML mark-up, accessible by all devices.
- Presentation Layer - using externally linked CSS, giving a branded look and feel for modern devices.
- Behaviour Layer - using externally linked JavaScript, adding a touch of elegance and interaction for devices capable of running JavaScript.

"Under a progressive enhancement model, the web page is constructed semantically, based on its content and regardless of its visual end-state, resulting in a lowest-common-denominator, extremely portable and accessible representation" (Hall, 2009, p. 67). Thereafter layers of presentation such as CSS and behaviour such as JavaScript are added to improve user experience and provide cross-platform and cross-browser compatibility. JavaScript layers allow for tailor made functionalities across devices, which only reveal themselves on specific platforms.

The benefits of applying the progressive enhancement approach in web design and development include: improved semantics, accessibility, improved Search Engine Optimization (SEO), improved usability and cross-platform and cross-browser compatibility.

The challenges of progressive enhancement are cases where the applications rely heavily on JavaScript to achieve user interface presentations or behaviours. Moreover, this core

approach of progressive build up takes time to execute and results in a delay. ("Mobile Web Content Adaptation Techniques," 2012) Progressive enhancement is considered to be limited in that it does not effectively address performance or the myriad of potential combinations of browsers and form-factors. The more browsers and devices you need to support the more metadata, CSS selectors, scripts you need to add, which makes the code heavier. For a simple end user hence most of the code is ignored and useless and increases loading time. In progressive enhancement older versions of browsers are often considered less significant, which results in a failure to offer a visual experience when the client has an outdated browser. (Hall, 2009)

3.1.5 Responsive Design

Responsive Design is a term coined by Ethan Marcotte in his article in the webzine A List Apart in 2010. Responsive design basically means fluid grids, fluid images/media and media queries to achieve resolution independence. However, responsive design does not achieve full adaptivity. Responsive design is considered to be a subset of adaptive design. Where responsive design is limited to providing an optimal viewing experience in a cross-platform context (laptops, mobile devices, desktops), then adaptive design goes further and adds JavaScript layers onto it to increase functionality and user experience.

Marcotte has offered web designers concrete set of tools to achieve resolution independence across devices:

- A flexible grid—making sure that the underlying page grid scales nicely with screen resolution rather than using fixed pixel dimensions
- Flexible images—images that work well within a flexible grid
- CSS media queries—using CSS styling tailored to ranges of resolutions or types of device

The benefit of responsive design is that it offers cross-platform use and is resolution independent; moreover it works well also on older browsers. With some reasonable effort and CSS work-arounds sites will work well on all browsers and devices. ("Mobile Web Content Adaptation Techniques," 2012)

The limitation of responsive design is that it adapts to each device and browser, however does not entail the full functionality offered by the device or browser. A web site or application will look good on a mobile device, but will not support the use of buttons, etc. – it will not harness the true potential of the mobile, so you cannot achieve the big goal of cross-platform which is to make every device work where it performs best. Therefore, responsive design supports cross-platform use, however, is not intended to replace mobile web sites (Marcotte, 2010).

3.2 Approaching Cross-platform Interaction Design

3.2.1 Interaction Design

Interaction design is designing interactive products to support the way people communicate and interact in their everyday and working lives. (Sharp et al., 2009) An interaction, grossly speaking, is a transaction between two entities, typically an exchange of information, but it can also be an exchange of goods or services. Interaction designers design for the possibility of interaction. The interaction itself takes place between people, machines, and systems, in a variety of combinations. (Saffer, 2010) Winograd describes interaction design as designing spaces for human communication and interaction (Winograd, 1997), whereas Thackara views it as the why as well as the how of our daily interactions using computers (Thackara, 2001). Obviously there is a multitude of views concerning what exactly interaction design is and this means that defining it can be difficult. A problem that occurs quite often is defining what interaction design actually covers and which the umbrella term is. For instance, the views of Shaffer are contra-dictionary in that sense to Sharp, Rogers, Peerce. For Shaffer user-experience is actually the bigger term that covers also interaction design, whereas Sharp et al. consider it the other way around that user-experience is bigger.

For the purpose of this thesis, interaction design is defined as an interaction between people and any digital artifacts with the purpose of offering a more useful and enjoyable experience. Moreover, interaction design is considered to be the umbrella term, this is displayed in Figure 3-2. It covers besides others also concepts like user interface design, software design, user-centered design and user-experience.

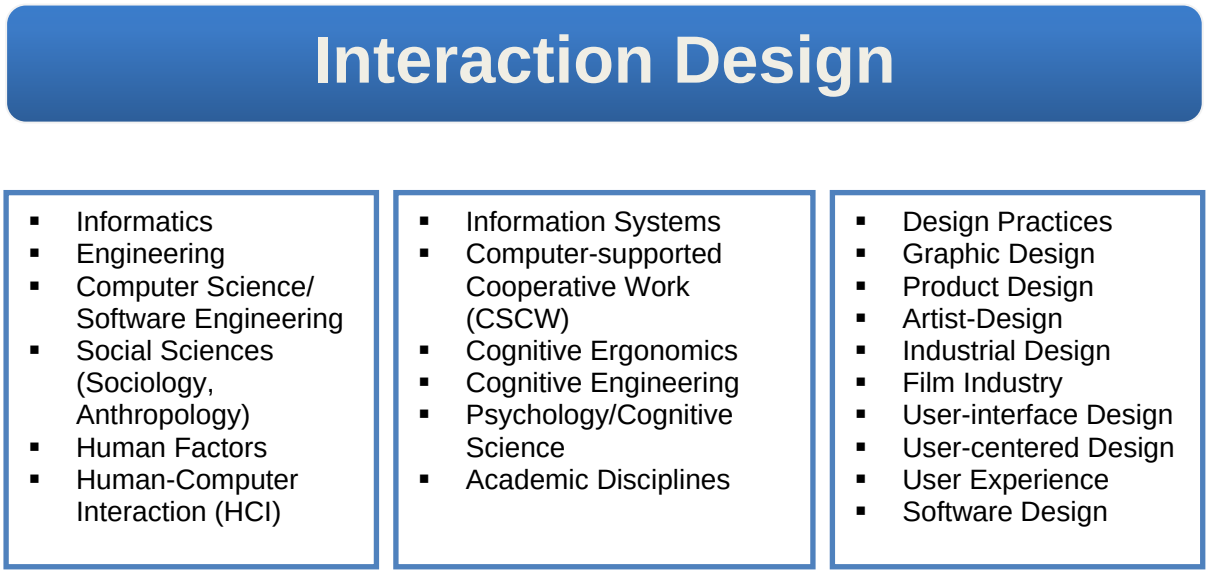

Figure 3-2. Relationships among contributing academic disciplines, design practices and inter-disciplinary fields concerned with interaction design (Sharp et al., 2009), modified by author

When looking at the figure, one might wonder why interaction design is considered to be bigger than HCI (Human-Computer Interaction). According to Sharp et al. 2009 interaction design is concerned with the theory, research and practice of designing user experiences for all technologies, whereas the focus of HCI has been narrower, covering only the design, evaluation and implementation of interactive systems.

The general purpose of interaction design is to develop products that are usable, by this people mean easy to learn, easy to use, intuitive and providing a good user experience. The key concerns that a designer needs to address when designing usable interactive products is to consider the following questions (*Ibid*):

- Who is going to use them
- How they are going to be used
- Where they are going to be used

Moreover, a designer has to consider the activities people are doing at the same time and even parallel to interacting with the products.

Today there is a diversity of devices and interfaces available. There are laptops, desktops, a variety of mobile devices, media players, but also cameras, washing machines, refrigerators, etc. – all of them having different shapes and sizes, being used in different activities and having digital systems inside. One can interact with them using keyboards, buttons, menus, commands, forms, sensors, touchscreens, etc. Therefore, there is a need to address them

through interaction design. What is more, now in the era of ubiquitous computing where interaction with devices takes place anytime and anywhere we are using multiple devices to support our activities and we increasingly engage in activities that span across devices. This has created the need to look at interaction design through a cross-platform way.

3.2.2 Cross-platform

There is a multitude of concepts used today when describing systems of multiple devices or platforms. "In HCI, the terms *multiple-user interface* (MUI) or *multi-device system* are frequently used. In addition, the terms *distributed user interface* (DUI), *multichanneling* (originating from marketing) and *cross-media* have been associated with *cross-platform* compilations." (Wäljas et al., 2010, p. 220) What is more, *cross-platform* is also used as a narrower concept covering for instance only operation system platforms like Windows, Linux or iOS, or even for web browsing platforms like Internet Explorer, Mozilla Firefox, Google Chrome, Safari, etc. Hence, some clarification of terms is needed for the purpose of this thesis. The focus of this thesis is on the interaction level, which is beyond user interface level, therefore terms involving interface can be left out.

"Cross-media or cross-medium can be defined as the publishing of a message or communication via multiple media channels, such as printed materials, electronic media and/or the Internet. The digital context was produced once, then it was converted and adapted into different platforms and/or devices, and finally the user was able to choose the most suitable way to access the content." (Soares, Neto, Filgueiras, & Consolação, 2008, p. 226) Therefore, cross-media uses those multiple platforms in order to spread its story and thereby contributes into a common goal, but the term is too broad.

With the terms multi-device, cross-device the HCI community means different devices that work together to improve the user experience. Thus, we are aiming at more integrated products that offer a constant experience and the possibility to use services on multiple devices, which is what we are looking for. The term cross-platform is used on many levels – the device level, the interface level, but also on the browser level. If a service is to be designed working on the device level, it has to perform as well on the more narrower levels, which is why the term cross-platform has been chosen as the common denominator. Cross-platform will be used synonymous to multi-device and cross-device in this thesis for the same

reason that the varieties of authors have not agreed upon a common term to be used. The cross-platform settings in focus will be desktop, laptop, smartphone and tablet.

3.2.3 Cross-platform Interaction Design Practices

"All devices are not created equal – there are devices better suited for some particular activity than others. The physical design (e.g. display size and orientation) and the modes of interacting with a device (e.g. keyboard, mouse, stylus, finger, etc.) as well as the use contexts (mobility vs. stationary) influence the suitability of a device for a specific activity." (Dearman & Pierce, 2008, p. 770) The goal of cross-platform interaction design is to make devices work in synergy and allow for services to work across platforms in a usable way. Studies have shown that applications' usability suffers when the data presented or requested on a small screen is too complex (Buchanan et al., 2001; Jones, Marsden, Mohd-Nasir, Boone, & Buchanan, 1999).

Cross-platform interaction design has not been addressed that much in the literature. The main focus has been on the user interface level and not on the interactions, which results in the lack of support for other platforms. In particular, user interfaces do not take into account the user's task with the context of use. "As a result, the user interface remains the weak point of many systems, because the problems of human-computer interaction are not being considered as a central issue regarding the design and development of complex systems." (Huebsch & Kadner, 2007, p. 736)

However, to provide a better user experience the interactions should be the focus point. Wäljas et al. 2010 have run a study on three web based cross-platform services to get insights into user experience. Based on their findings they claim the most important elements of a cross-platform experience to be: fit for cross-contextual activities, flow of interactions and content and perceived service coherence. As a result of their research they claim that there is a need for techniques for distributing functionality in cross-platform design cases. Moreover, guidelines and checklists should be developed to address this. (Wäljas et al., 2010)

Traditionally, the development of computer systems was mainly technology-driven and developers thought that users could adapt to whatever was created for them (Oviatt, 2006). Human-centered design was developed to overcome the poor design of software products. The goal of human-centered-design was to model user's pre-existing behaviour in order to make the interfaces more intuitive and the model of adaptation was to adapt technology to people. "By emphasizing the needs and abilities of those who were to use the software, usability and understandability of products has indeed been improved." (Norman, 2005, p. 14)

However, Don Norman, who is the author of the phrase "user-centered design" has suggested that in human-centered design the focus has been too much on the users and usability and this can be harmful, instead designers should focus on tasks that the user must perform with the application i.e. user-centered design (*Ibid*). Moreover, tools and technologies really do not adapt to people, instead people adapt to tools. "Yet, in user-centered design, a major problem is how to determine the desired functions and technical features, which would meet new challenges in designing pervasive applications." (Tang, Yu, Zhou, Wang, & Becker, 2010, p. 254) Besides that, user-centered design focuses on the tasks the users do, which is not on an abstract level and is still too much focused on the users. Users are unpredictable and unreliable, their approaches and wishes ever changing. (Norman, 2005)

Constantine, 2011 goes beyond tasks saying that the tasks users perform are always in a wider context and therefore for interaction design the activities, which are larger than tasks, have to be taken into account (Constantine, 2011). Constantine has based his approach on activity theory and human activity modelling, because they provide a powerful framework for understanding how people use tools and for delivering more usable solutions. Usage-centered design is a model-driven process for user interface and interaction design that takes its name from its primary focus on use or usage rather than on users *per se*, that is the tasks to be accomplished by users. (Constantine, 2004) Similarly, activity-centered design is based on activity theory and human activity modelling. The two are often used synonymously in the literature, because they are very similar and they complement each other. Activity theory outlines a three-level hierarchy to analyse activities – activities, actions and operations. Norman, 2005 added a fourth dimension to it with – activities, tasks, actions and operations, where for instance, an activity is setting up a project, tasks are adding description, a project name or a deadline. Actions are typing in the description, saving the description and finally, operations are clicking on the description field, clicking on save button, etc. The same

hierarchy is used now both in usage-centered and activity-centered design and will also be used in this thesis to distinguish between them.

"Usage-centered design is distinguished by the high level of abstraction of its models and the straightforward way in which these are interconnected" (Constantine, 2008, p. 4). Constantine refers to two of the most popular user modelling techniques, which are very concrete – personas and user profiles. However, for usage-centered design more abstract models are needed, hence user roles are used to show relationships between users and the system being designed. Moreover, a special form of use case, a task case has been invented to serve the needs of user interface and interaction design by distilling interaction to its simplest, abstract essence. (Constantine & Hayes, 2005) "Usage-centered design models roles instead of users for two reasons. First, the characteristics of the role, the relationship to the system, has a more immediate and direct relevance for interaction design than characteristics of the person playing the role. Second, the relationship to any given system represents a small subset of all possible aspects of the user." (Constantine, 2008, p. 5) Additionally, task cases are written as an abstract dialog representing user intentions and system responsibilities. "This form focuses on the essence of a task stripped of assumptions about how it might be performed with or supported by a particular user interface design." (*Ibid*)

To conclude, usage-centered design employs four closely related abstract models (Constantine & Windl, 2001):

- a role model capturing salient characteristics of relationships between users and a system
- a task model representing the fine structure of work users need to accomplish with a system
- an interface model representing the contents and organization of the user interface needed to support the identified tasks
- an implementation model or the interaction design – derives more or less directly from the interface model, particularly when the latter is expressed in canonical form.

This makes usage-centered design seem to be an appropriate design practice for cross-platform interaction design.

3.3 Closing Remarks on Cross-platform Interaction and User Interface Design

In this chapter, the author provides a discussion on cross-platform user interface and interaction design findings of the literature.

Cross-platform user interface design has been addressed a lot in the literature. The most contemporary approaches to user interface design that have been listed previously are thin client, device-independent design, context-aware systems, adaptive and responsive design. Their overall goal is to adapt a software or system onto multiple devices, to make it work on all devices with different screen resolutions and sizes, with touchscreens or pointer devices. The primary design is usually for the computer and adaptations are created for the mobile devices. Although, the mobile device unique characteristics may be used to the full extent (device specific buttons and icons, etc.), however, what cross-platform user interface design is missing out is the combination of contexts of use with the tasks and activities people would use it for. Therefore, it is a partial approach to cross-platform design. The methods are good for adaptations, but they do not replace cross-platform interaction design.

In order to approach cross-platform interaction design, three well-known methods have been pointed out, which could possibly be used. The fields of human-centered design and user-centered design are strongly focused on the user and the user input and less on the tasks and activities that the user performs with the system. The user is unpredictable and thereby unreliable in the sense that people are different, their views and thoughts change, however, activities and tasks in their essence are more stable and therefore more reliable. As Wäljas et al. 2010 also pointed out, for cross-platform experiences one of the most important aspects are activities. As was confirmed with the survey and overview of literature in the usage of cross-platform devices, people use the devices differently for different tasks and in different contexts, which is why a cross-platform approach that concentrates on the usage and not the user is required. The focus on the activities and tasks is well fit for cross-platform interaction design, which is why usage-centered design has been taken as a core design practice for the case study in the next chapter.

The approach that is going to be used for the case study in the next chapter is scenario-based design. The connection between scenario-based design and usage-centered design is that they both focus on the usage of the system through tasks and activities and that they use similar models to achieve the same goal. This is displayed in Figure 3-3. Scenario-based design

focuses on the tasks and activities via the use of use cases called scenarios. In usage-centered design a special form the use cases is used, called task case, which focuses on the tasks at hand. Moreover, requirements analysis and role model, activity design and task model, prototyping and interface design and interaction design are areas, which have connections and similarities with each other. That is why scenario-based design was chosen to be tested if and to what extent it supports cross-platform interaction design.

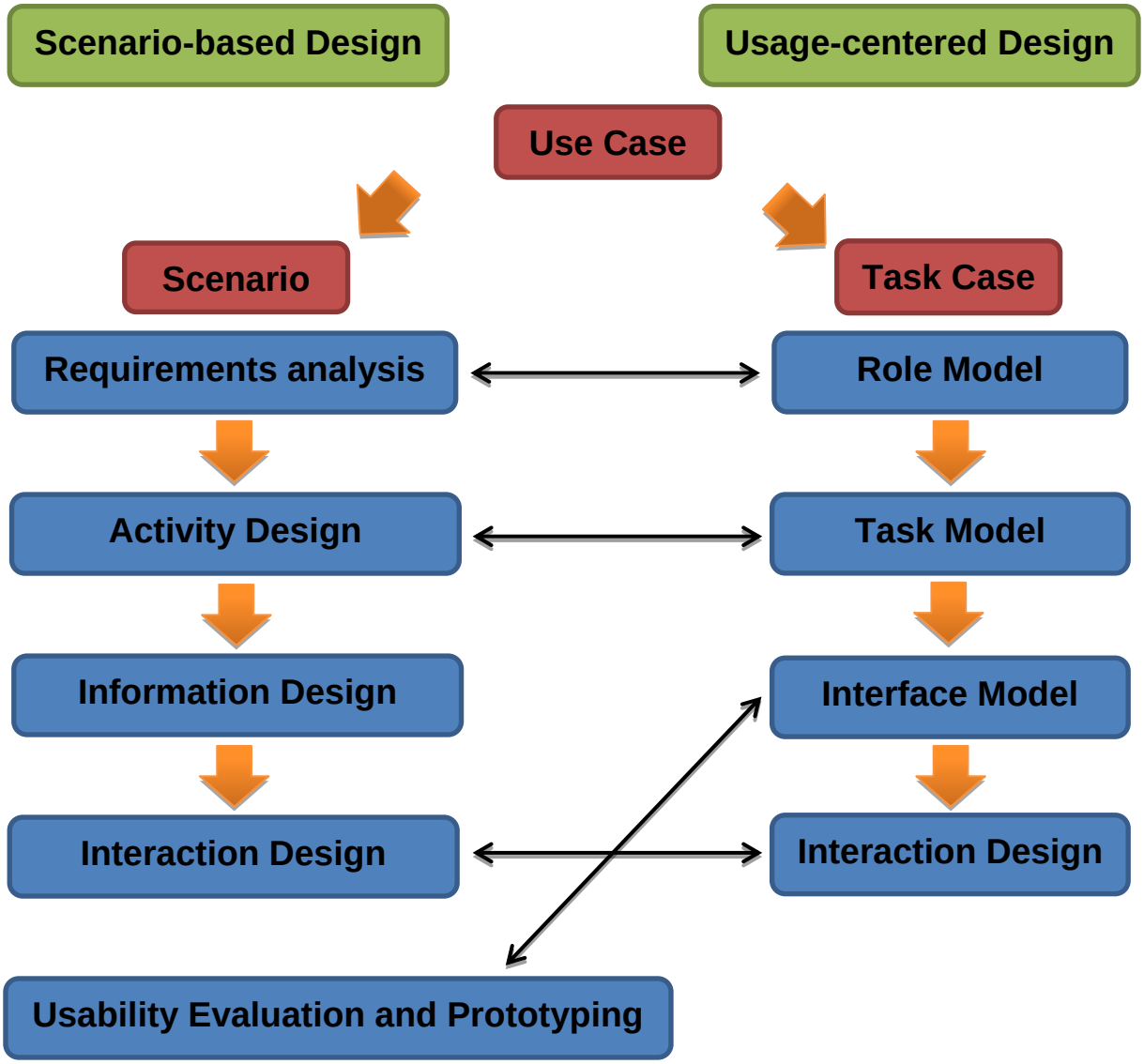

Figure 3-3. Scenario-based design and usage-centred design connections (Constantine & Hayes, 2005; Rosson & Carroll, 2002), modified by author

4 A Case Study on Cross-platform Interaction Design

The purpose of this chapter is to elaborate on scenario-based design, to describe the software "Projektur", which was used for the case study in the design sessions and to present the findings from the case study together with a discussion of how the method used supports cross-platform interaction design.

4.1 Scenario-based Design

In designing application and software there is a need to understand the context of use. "Scenarios support reasoning about situations of use, even before those situations are actually created" (Carroll, 1999, p. 2). A scenario is a description of meaningful usage episodes, it is about how people accomplish tasks. In its' essence a scenario is a simple story that consists of a setting, actors or agents with personal motivations and goals, a plot and various tools and objects that actors encounter and manipulate. The reason why scenarios have become so popular in interactive system design is that they enable rapid communication about usage possibilities and concerns among many different stakeholders, also they are at the same time flexible and concrete. Scenarios can be made even more effective as work-oriented design objects when users are directly involved in creating them. (Carroll, 1999; Rosson & Carroll, 2002)

"Scenario-based design is a family of techniques in which the *use* of a future system is concretely described at an early point in the development process." (Rosson & Carroll, 2002, p. 1) Scenarios are created about usage episodes to help design the software, they describe how people will use a system in order to fulfil their tasks and needs and not the functional or the behavioural aspects (*Ibid*). Basically, they are hypothesis about how the people will use the software, but their benefit is that they evoke reflection-in-action, and according to Donald Schön the "felt-path" or the experience of the people interacting with the design is something that a design should be aware of and this is what the scenario affords (Schön 1983, as cited in Carroll, 1999).

Figure 4-1 displays the scenario-based design framework, upon which the design sessions are based on. It consists of 5 stages: requirements analysis with problem scenarios, activity

design, information design, interaction design and finally usability evaluation and specification creation.

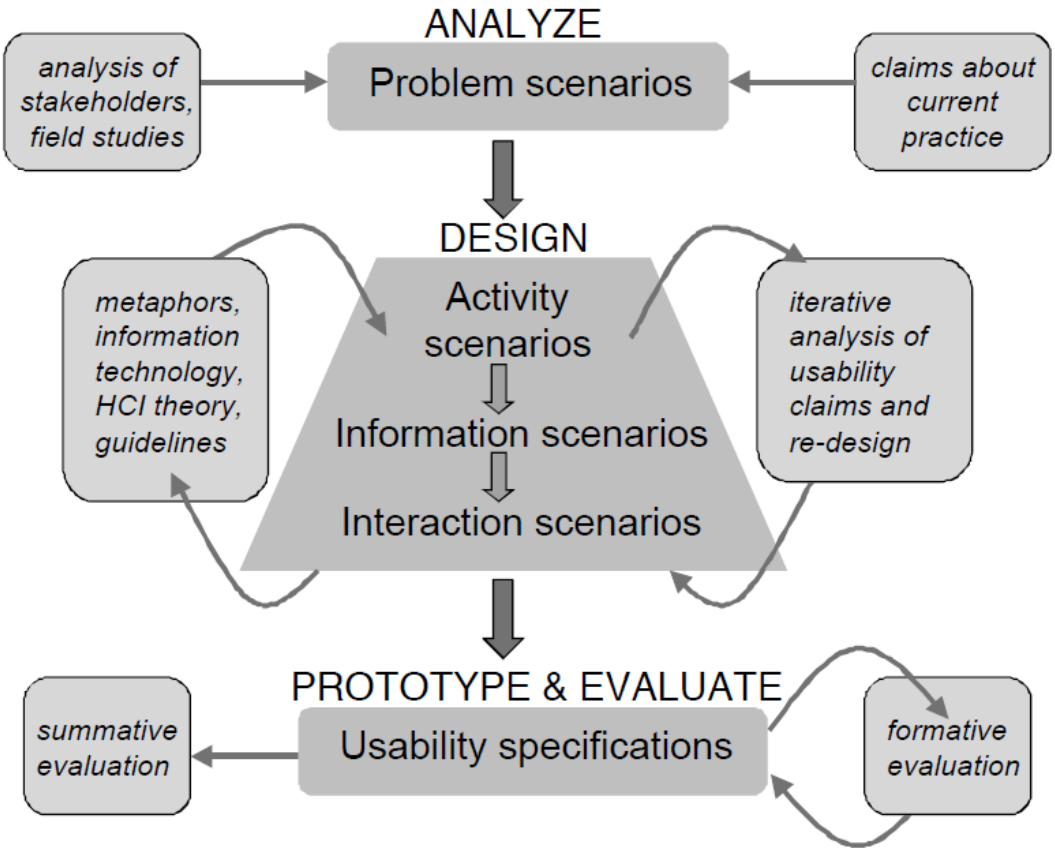

Figure 4-1. Scenario-based design framework overview (Rosson & Carroll, 2002)

Requirements analysis

"In scenario-based design, the initial step toward specifying a design solution is made by envisioning how current activities might be enhanced or even completely transformed by available technologies." (Rosson & Carroll, 2002, p. 14). This is expressed by a root concept, which enlists the key aspects of the starting vision. In some cases a project may be so over determined that system functions are specified in advance and requirements analysis consists simply of analysing user characteristics and preferences. The result of a requirements analysis is a problem scenario.

Activity design

"Scenario-based design is activity oriented, the current practice is analysed at the level of meaningful activities, and build from this to new activities" (Kuutti & Arvonen, 1992).

In activity design the design space is explored with metaphors and technology options to create activity scenarios.

Information design:

Here the underlying activity is elaborated with information and interaction details. Scenarios are created that explain how the information is displayed and used in the system.

Interaction design:

A user interaction scenario is a *sketch of use*. It is intended to vividly capture the essence of an interaction design. In interaction design the concrete exchanges between the users and the system are specified and the scenarios serve as the usage context for considering interaction options. (Rosson & Carroll, 2002)

Usability evaluation and prototyping:

In scenario-based design usability evaluation takes place early on and throughout the process, any representation of a design can be evaluated. User interface prototypes are tested for the specified tasks in order to determine whether they meet the target outcomes. Moreover, scenarios and their associated claims are combined to create usability specifications (Carroll & Rosson, 1985; Good et al., 1986 as cited in Rosson & Carroll, 2002). "A usability specification is a representative task context that has been analysed into critical subtasks, with each subtask assigned target usability outcomes." (Rosson & Carroll, 2002, p. 25)

4.2 Case Study

The software "Projektur" has been called many names – "Timeliner", "iCoworker" and "Projektur". There have been made several designs of the same software in order to test the prototype with real users. Currently there is a prototype of the software available online at http://htk.tlu.ee/projektur/. It was initially developed as "Timeliner" (Lamas, Tomberg, & Laanpere, 2012; Tomberg, Lamas, Laanpere, Reinhardt, & Jovanovic, 2011) for the use on computers to support scientific collaborative writing and serve as a connecting and sharing platform for the scientists. The software uses a timeline to display a project from its starting date until the deadline. Onto the timeline layers of data and community are added. The system works like a project management software, which allows to add users, tasks, add external documents through the use of links and APIs and internal documents and assign them to users. The system has an internal chat and activity log system. Timeliner was created as an Internet based application.

The following iterations of the Timeliner were "iCoworker" for collaborative work and "Projektur" for project work in the Estonian schools. The design sessions in the thesis have been made keeping in mind the purpose of the "Projektur" iteration – to create a system that

supports collaboration in school and university project work for both students and teachers across multiple platforms.

In the design sessions the software is re-created with a cross-platform point of view to see what the biggest issues and challenges are and to bring forth a reflection of a case study on cross-platform interaction design.

4.3 Results of the Design Sessions

The design sessions were conducted on three separate days. The first day the activity and information design sessions were held with three participants. Thereafter, a few days later after abstracting and generalizing the results, the interaction design sessions were conducted in order to determine the functionalities needed for the software. Additionally, information was gathered, with the use of interface sketches, on how people would want to interact with the software on a computer and on a mobile device. The third meeting took place with the purpose of usability evaluation of the design.

To begin with, the initial idea of the software and the preferences and requirements of the users served as a basis for establishing the requirements analysis. The software is meant for project writing in the university/school context, therefore, the typical user is often writing or carrying out projects and the person would like to use the software both on the computer and on a mobile device. Table 4-1 presents the root concept of the software.

Component	**Contributions to the root concept**
High level vision	Project teams collaborate anytime, anywhere, on any device and share information
Basic rationale	Online project work system overcomes barriers of place and time; a cross-platform service will ease collaborative project work
Stakeholders:	
Project leader	Good overview of activities, easy to handle cross-platform system
Project member	Good support for project work, combine all relevant data
Starting assumptions	Open participatory design process; there is a possibility to include/link external data into the system; system should not duplicate services used traditionally outside of the system

Table 4-1. Root concept of Projektur

We can see that the problem is to create a system that is consistent and facilitates the needs of both the stakeholders, provides the possibility to combine all the relevant data into the system without duplicating it and that works across all devices.

All the participants agreed that the idea of adding resources into the system via the use of links, APIs (Application Programming Interface) and an upload system should be kept as it was in the initial vision of the software. Thus, the matter of how to combine data into the system was solved early on.

In activity and information design sessions participants were asked to explain how are project teams formed, whether people come together voluntarily or they are assigned, and how the roles are divided. Following is the summary of the answers of the respondents.

If the project is a university and school related project, then it seems that the teams are mostly formed on voluntary basis. The teams are combined of individuals who have different skill sets, different approaches and ideas in order to get a better synergy and thereby a better output. The experienced group members or the project leader usually create the plan for the project work and all others later comment and add to it. The roles in the team are divided according to the level of expertise people have and their specialities, seldom also upon personal initiative. More commonly, the project leader has been pre-defined or the person is the initiator of the project in the first place. The downside with project work is that it is commonly the second priority. Therefore, tasks tend to be delayed and one cannot always choose the best people, instead the project leader has to choose the people who are available. On smaller projects, it can happen that actually the project leader is the one doing most or all of the work and the rest of the team is there to help out occasionally.

Thereafter, the respondents were asked to create activity flowcharts from post-it notes and later on improve them with their information needs – i.e. all the material they require in order to fulfil the project from the planning to the execution phase. The pictures from the activity and information design sessions can be found in Appendix A.5. The results from the activity and information design sessions were generalized and taken into interaction design sessions. In addition, participants were asked for insights into how they would like to work with the system and how they would like the objects to be displayed to get some preliminary ideas into the interface design. The results of these questions have been grouped together with the results from the interaction design sessions and will be explained later.

In the interaction design sessions respondents were asked to structure the functionalities that they had felt a need for in the activity and information design sessions. They had the possibility to add or remove some functionality if they felt the need for it. Thereafter, they were asked to create an interface sketch for the computer and the mobile device and to explain how they would interact with the functionalities and objects on the interface. The pictures of

the structured functionalities of each participant and a list of overall functionalities for the software can be found in Appendix A.5. The functionalities have been categorized as tasks, users, timeline, resources, chat and other. The section "other" consists of functionalities that the respondents did not know where to place or for which the need became apparent later on in the discussions.

Figures 4-2, 4-3, 4-3, 4-5 are the user interface sketches from the interaction design sessions of the computer interface of the redesigned Projektur.

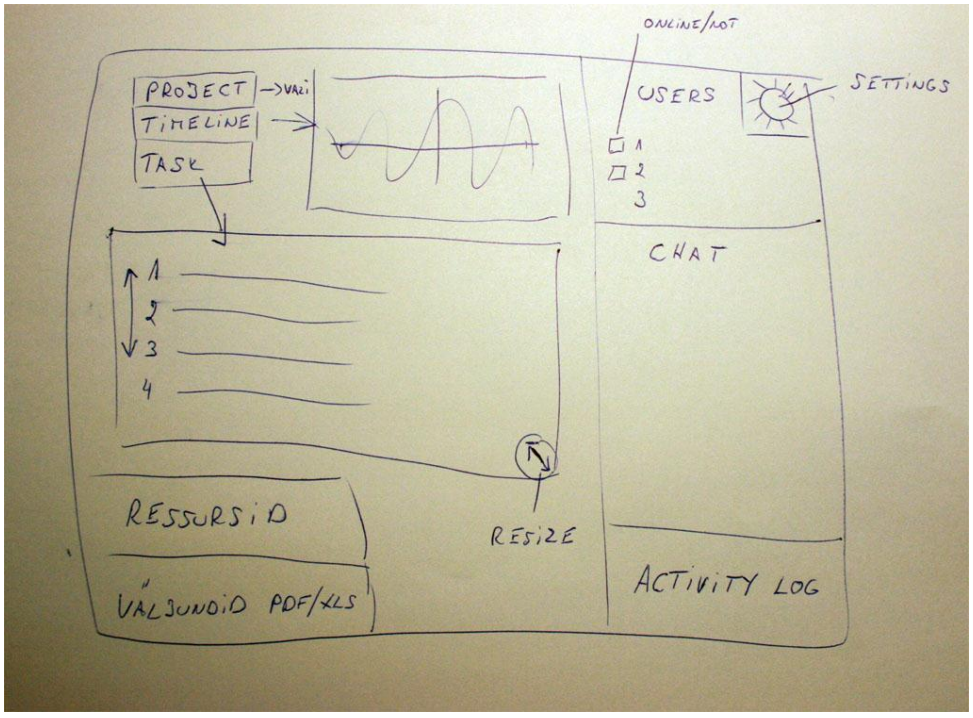

Figure 4-2. Computer interface sketch No. 1

Participant 1 created an interface, which is quite clear and concrete and offers good control of the system and flexibility at the same time. The system would mainly work with pop-up windows and expandable menus, which will open once a button is clicked. Clicking on elements is a representation of direct manipulation, whereas the use of menus and selecting and applying a command is an indirect command-oriented manipulation. A direct manipulation interface presents its' user with objects, which can be directly manipulated – resized, moved, dragged, etc., whereas an indirect (command-oriented) manipulation interface uses menus to deliver commands (Jacob, 1987; Rosson & Carroll, 2002; Thomas & Calder, 2001). Consequently, the interface uses a combination of the two manipulation methods.

The focus of this design has been put on tasks instead of timeline that was initially the focus point of the original Projektur. Timelines are graphical displays, but they are not working tools according to the participant. The focus should be on tasks, current milestones and the chat area. The general idea is to have a good overview and control over the interface.

A good overview is achieved by using metrics like "% complete" on the task and timeline level and colour coding. The colours could be grey, green and red. People are used to having grey for irrelevant areas like completed tasks, green for "OK" and red for critical aspects. This would help highlight the problematic issues with a blink of an eye.

The system should be created so that it constantly provides helpful information like cross-references for instance. If one looks at users, one can see what tasks and timelines the person is working on. If one looks at tasks, the users assigned and the task leader can be seen.

A key aspect of the system is roles. Not everybody should see everything related to the project. For a simple user there is too much excessive information. Roles could be created on the project level. Furthermore, there should be an activity log in the system. The activity log has to provide general information of the activities in the system. However, a more detailed log should be available somewhere in case needed.

With resources people should be able to choose whether they are public or personal. Also there should be the possibility to drag and drop resources into the system from the computer folders. One can separately upload but a drag and drop support would be good as well according to the participant.

The participant noted that in the initial design all the important areas were too small and the timeline too big. Therefore, the areas should be resizable as well as editable. A user should have the possibility to drag the timeline and task area wherever they want to have it and also resize it according to their needs. The need for adaptability was confirmed also by the literature overview previously. Once resizing, other areas would go smaller/bigger in size accordingly. Moreover, the user should have the possibility to hide some irrelevant area from the system menu that the person does not use.

Finally, the software should provide a solution to create reports, both detailed and overall reports from chat, users, tasks, logs, etc. Reports are necessary if one wants to send an overview to an external party or to save data in the computer.

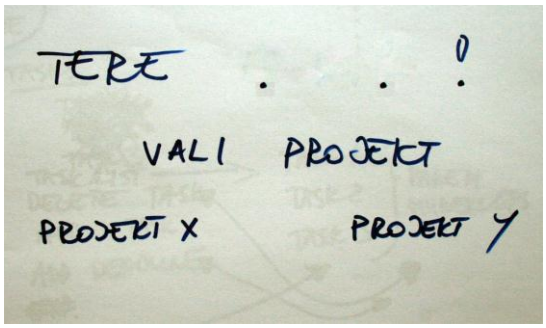

Figure 4-3. Computer interface sketch No. 2-1

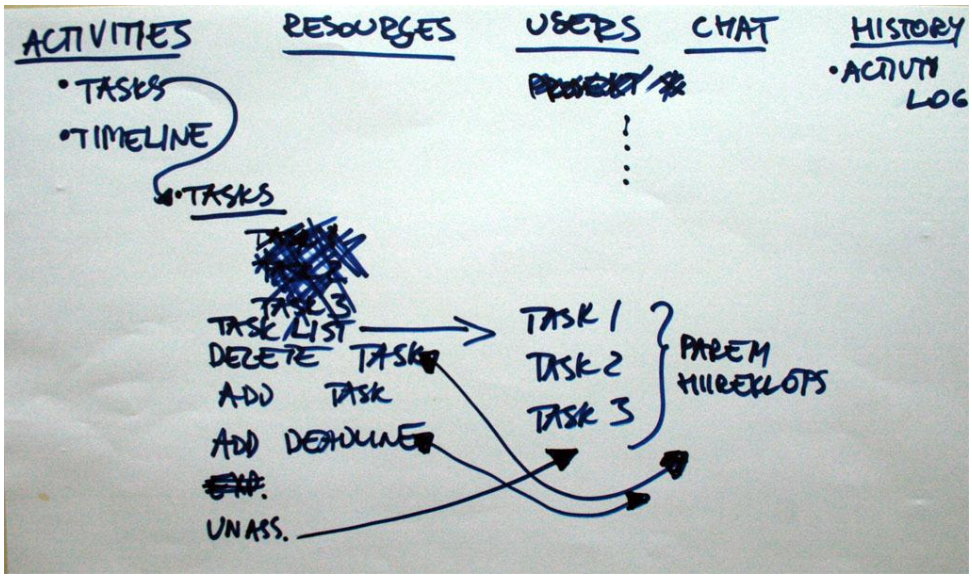

Figure 4-4. Computer interface sketch No. 2-2

Figures 4-3 and 4-4 are the computer interface sketches of participant 2. The first is a system welcome screen where one chooses a project and the second figure displays the working area. Just as the previous one, this system is a combination of a direct and indirect manipulation system. Contrary to the previous one, where everything is displayed on one dashboard, this design example uses top menus to navigate in the interface and a combination of pop-up windows and right click menus to create/assign activities. As a side note, the participant likened to the idea of having a fully direct manipulation interface before creating the design, yet, still designed a combined interface. Therefore, we can assume that people would like to have the more intuitive ways also in the computer interfaces, however, the use of menus is strongly rooted in us and as they provide a better control and flexibility to the interface, then indirect manipulation is more natural to the interactions on the computer.

The participant also mentioned colour coding to be a good way to distinguish between completed/uncompleted/overdue tasks and milestones. Moreover, the respondent added an

important feature, the possibility to track changes, to the system. The idea would be to be able to go back to the previous editions of the project in case some major mistakes have been made and also to see in the activity log the history of who the last editors were.

The structure of the design itself is fairly simple; the top menu has all the activities and materials. All menus are opened in simple bullet point lists and on the left hand side there are additional menu related activities, whereas concrete task (or timeline, user, resource) based activities are called in with a right click menu. Additionally, timeline should have the possibility to zoom in and out to specific timeframe or back to overall picture. The timeline would display resources, users and tasks beside it.

The participant also mentioned the need to assign roles to users, however, wanted to have the possibility to assign them on the timeline level, because people can have different roles on different timelines in the same project.

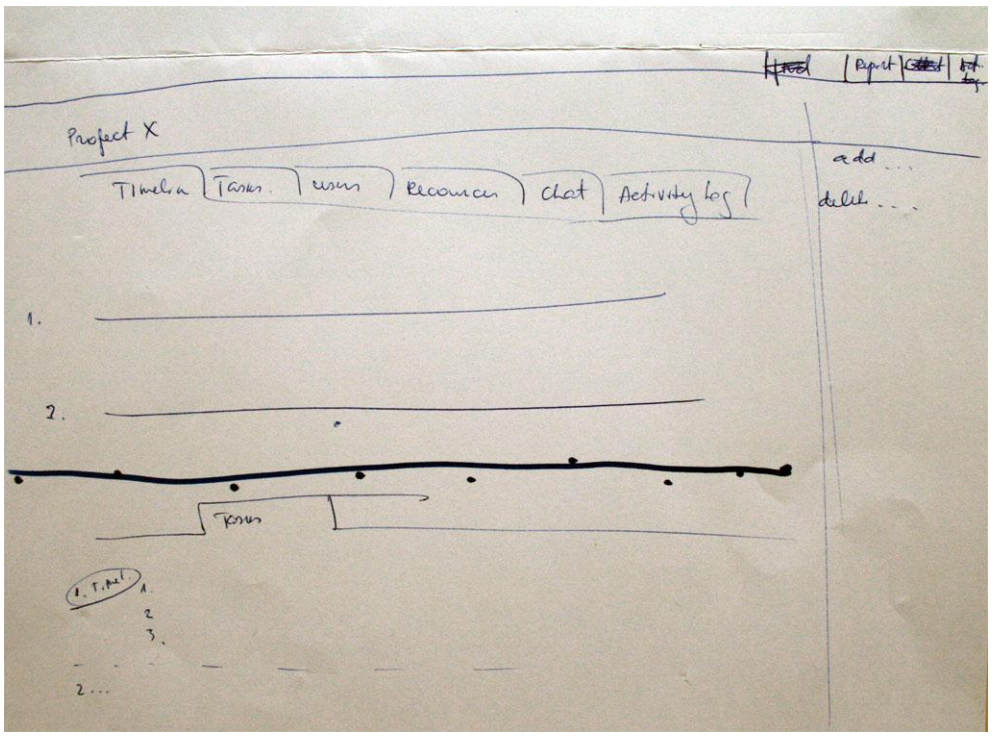

Figure 4-5. Computer interface sketch No. 3

Figure 4-5 displays the design example of the participant 3. The interface is a direct manipulation interface and similar to the previous example in the sense that it works on a menu based system and pop-up windows, but has excluded command-based manipulation. The design uses the main area to display the tasks, users, etc. in bullet point lists according to the timeline.

The right side toolbar is used for menu tab specific activities. Concrete single task or user based activities are done with a click on the item, which opens up a pop-up window.

The participant also mentioned the need to be able to zoom in and out of the timeline to a more concrete timeframe. Likewise, the timeline should use colours when there are some critical matters to be displayed, like a late task or milestone. The thoughts on the colour codes were the same as previously – red, green and grey.

Additionally, the participant mentioned a need to create project templates or to be able to clone a project, because creating new projects from scratch is troublesome. Also, the possibility to search/add users through the whole projects database and not a single project was considered important.

Figures 4-6, 4-7, 4-8 display the user interface sketches from the interaction design sessions on the mobile device interface of Projektur. Mobile device interfaces are all based on a direct manipulation interface, where the user uses the finger to manipulate the system with taps.

All participants agreed that for the mobile devices the system would be mainly used in the portrait view, and less in the landscape view. However, a timeline or chat would be more convenient to use in the landscape view.

The design on Figure 4-6 is based on a simple list of activities displayed on the screen, where the user taps the screen to open an activity. The service should be developed so that it is native to the device being used – i.e. slight changes in the design for Android and iOS systems. Also the buttons of the phone should be incorporated to add/edit/remove tasks, users, etc.

The participant thought that the mobile devices should actually support the full list of features and functionalities that are also available on the computer. The reason for it being, that today project leaders often use a tablet instead of a laptop, and therefore the device has to support all activities. Even though, it can be more comfortable to work on a laptop, people do not always have access to the laptop and would still want to use the service to its' full extent. This contradicts with the findings from the survey and literature. In practice, the tasks that are used on the devices are not the same, which is why a full set of functionalities on each of them does not make sense. Yet, survey participants admitted that the functionalities for tablets and smartphones on websites/applications today are commonly too limited, so a compromise should be found.

Similarly to the computer version, the mobile device should support adapting the design according to people's needs as was also confirmed by the literature. Not all users may want to have the activity log or the resources visible in the screen, so there should be a possibility to hide features. The interface has no need for a timeline view or the activity log according to the participant. Therefore, it would be justified to have possibility to hide these functionalities, or if they are considered irrelevant by the designer, then remove them.

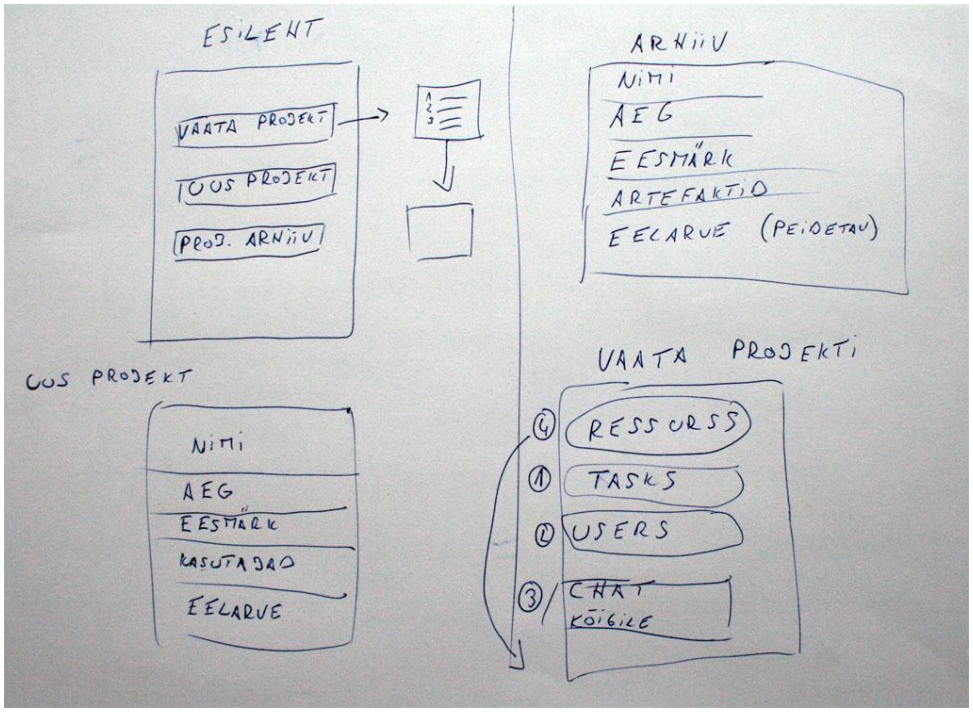

Figure 4-6. Mobile device interface sketch No.1

In the design sketch on Figure 4-6 the participant differentiated between the views of the archived/new project and a project in process. The displays for them would be different because in the working process one has different information needs than during project set up or during viewing archived projects. The system should also be able to connect to other features that are available on the tablet or the phone. For instance, in the users view one would want to directly call or email somebody or copy some information.

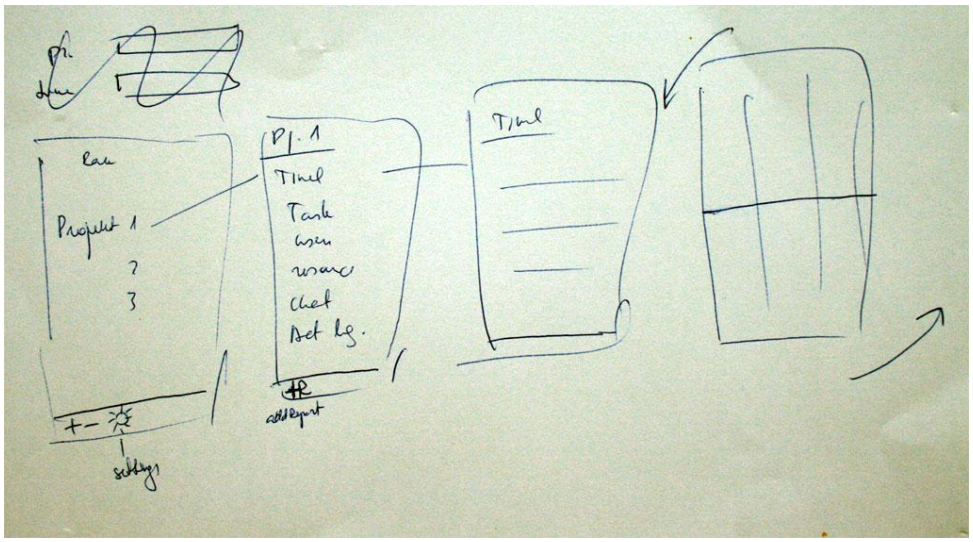

Figure 4-7. Mobile device interface sketch No.2

The author of Figure 4-7 considered the need to have a landscape view for the timeline, however, it was not clear what would be the purpose of having a timeline on the mobile version of the service. For this participant the idea of having a design with a list of activities from top down and not icons for instance was most suitable. However, it was confirmed yet again that there is a need to adapt the activities in the lists according to the user.

The participant mentioned that she would mainly use the tablet or smartphone version of the service in order to get a quick overview of the process of the project, and not necessarily for editing. However, the possibility to edit should be there in case needed. The person would want to see all the critical and late issues of the project on the display, therefore, colour coding should be used to make critical issues stand out. The person did not see a need to distinguish functionalities between smartphone and tablet. The functionalities ought to be the same, just adapted to the typical design of the software on the device. According to the findings in chapter 2 the usage patterns of tablets and smartphones differ and they are used in different contexts. Hence, the users are not going to be using the same functionalities on both the devices even when they are available.

The participant also noted the need to send materials via the mobile version to other devices and call directly through the system. What is more, there was a need to be able to create reports on the phone or tablet using the same template that the system has for the computer. One might not want to read it, but would want to send it and not have to open a computer for it.

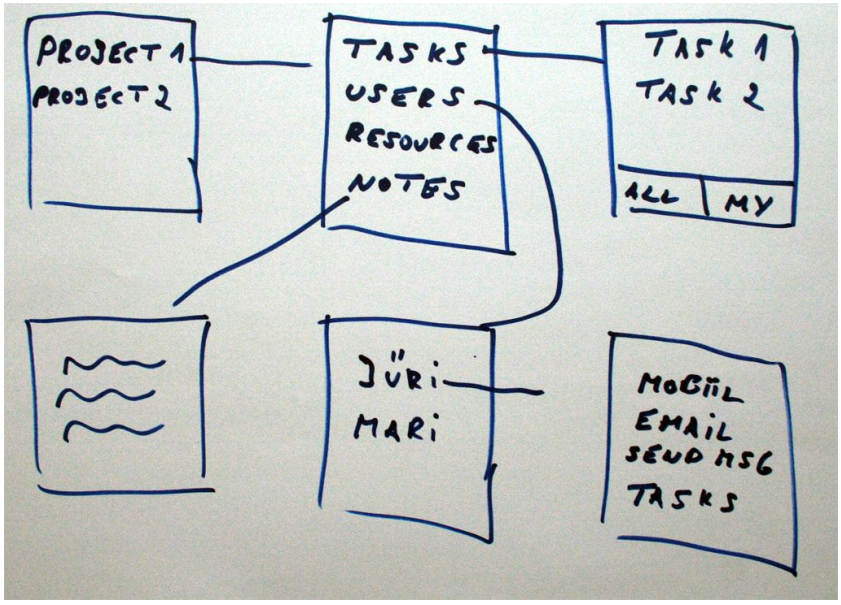

Figure 4-8. Mobile device interface sketch No.3

In Figure 4-8 contrary to the previous design examples, the participant was confident that the mobile version would only be used for viewing and not for editing or creating new projects or tasks. So the version would not need a full functionality support. This result is well in line with the findings from the survey and literature.

Similarly to the previous examples, it uses lists that are manipulated with taps. The participant felt a need to have a new functionality called notes in the mobile version, which would be synchronized with the computer version to avoid double work. The notes should be personal and there should be also a possibility to delete them on all devices.

Finally, in usability evaluation the participants were asked to point out the tasks and activities they would want to do with the software. This was complemented by the tasks they had pointed out in the previous sessions. Thereafter, they were asked which task they would actually want to do on each of the devices to see if their preferences are different. And thirdly, they were asked to evaluate whether their current proposed user interface supports the activities and tasks they would like to do with the system.

The tasks and activities the people wanted to do with the service are listed in Appendix A.5. The tasks and activities are in disorder because the people did not specify whether they refer to something as an activity or task and therefore it is not known if they considered something to be just a task or an activity that consists of tasks related to it. Additionally, participants came up with their own lists instead of the author predefining a list of tasks and activities.

Overall, we can see that the tasks people would want to do with the service are different across devices. Also that tasks that require more editing, a good overview or digging in are preferred on computers. Participants suggested that they actually use desktops and laptops identically and that they should support the full set of functionalities, whereas smartphones are rather the viewing device and tablets a compromise between smartphones and laptops, i.e. they should support a wider list of functionalities than smartphones, but less than laptops. However, when distinguishing tablet and smartphone functionalities, it became evident that people would become quickly confused on what functionalities they can do on a smartphone and on a tablet and this would decrease user experience. Therefore, even though the literature and survey results confirm that tablets are used differently from smartphones, it is worth considering to have the same set of functionalities there, and to differentiate the list of functionalities from laptops and desktops. Additionally, the perceptions of the users in the extent of the functionalities they would use on a mobile device differ greatly, so a generalization on the needs of the users should be made by the designer in order to determine the final list of functionalities that each device should support.

According to the results of the usability evaluation, it was clear that the participants had not considered all the tasks they wanted to achieve with the service on their user interfaces and that there was plenty of room for improvement both on the mobile and on the computer interface sketches in order to facilitate all the tasks that the interfaces should afford. This suggests that constant evaluation in the design process has to be made in order to take into account all the aspects and get feedback and guide the design.

This is as far as the scenario-based design approach was used. Usability specifications could not be created in the format proposed by the scenario-based design approach due to not having used scenarios and claims related to them. However, this was enough to be able to answer the research question and evaluate to what extent an existing design approach supports cross-platform interaction design.

4.4 Closing Remarks of Design Sessions

The problem motivating the design sessions was to create a system that is consistent for both the stakeholders, provides the possibility to combine all the relevant data into the system without duplicating it and that works across all devices.

The design sessions provided a good test case on how to develop a new cross-platform service. The computer design focused on a combined manipulation method of an indirect and direct manipulation, which uses both menus to deliver commands and direct clicks and dragging and dropping to manipulate elements. Indirect manipulation is more flexible and gives the user more control, however is disadvantaged in a sense that the user does not get constant feedback when manipulating objects on screen. A direct manipulation is simple, intuitive and pervasive, but can limit functionality. Opinions differed in whether the system should operate with top navigation menus or should everything be displayed in one dashboard-like screen.

The mobile design used direct manipulation methods and the ability to tap on the elements of the screen to manipulate them directly. Moreover, the mobile design was thought to have to take into account the design principles used for the different operating systems like Android and iOS. The system should be as native to the device as possible.

For both designs colour coding for displaying the relevant or critical data was considered important. Especially project leaders are in a need to quickly grasp the main issues in the project and this should be afforded by the system. Additionally, it was pointed out that both, the computer and the mobile version of the software, should have the possibility for the user to adapt the screen layout according to their own needs. This was also suggested by the literature as an important trend nowadays. Both designs were strongly based on bullet point like lists to display content like users, tasks, resources. As opposed to the original vision of Projektur, participants put less emphasis actually on the timeline and more on other data. One participant commented: *"Timelines are graphical displays, but they are not a working tool"*. Instead, the participant put the focus on tasks, current milestones and a chat area. However, in order not to duplicate functionalities in the system, it should be reconsidered whether a chat area is relevant or an external tool can be used.

There were two other important aspects mentioned, to be able to assign roles to people, which would keep excessive information from project participants, but also to keep the interface consistent and the possibility to create reports of the various data in the project. Roles and role based view got too little attention in the design sessions conducted, however, they play an important role in the design of a project management software.

The results of the design sessions revealed that the tasks people would want to perform with the service are different across platforms, the computer version of the software is preferred for working on the project and the mobile devices are used mostly for viewing purposes as was

also confirmed by the literature and the survey results. The participants mentioned using laptops and computers identically, this is most probably due to the reason that the interfaces on both devices are the same and both are mostly used in stationary environments. In regards to mobile devices two out of three participants felt a need for having a full set of functionalities for both the devices, which however contradicts with the findings from the survey and literature. With the increasing role of tablets in project work the design session participants felt a need to be able to modify, add, delete, etc. the content of a project, because a computer is not always at hand. This means that a wider selection of functionalities should be supported by at least a tablet, if not a smartphone. On the other hand, it was evident that the tasks they would use the devices for are different from each other. Also that when tablets, smartphones and computers all support different functionalities, then users would quickly become confused and easily forget, which device affords which functionalities and this would result in a decreased user experience. Obviously a compromise has to be found, where cross-platform consistency in functionalities should be taken into account on the one hand, and the different usage patterns and contexts of use on the other hand. A potential solution could be to have the same limited list of functionalities for both the mobile devices, which provides the possibility for some editing.

According to the results of the usability evaluation, it was clear that the participants had not considered all the tasks they wanted to achieve with the service on their user interfaces and that there was room for improvement both on the mobile and on the computer interface sketches in order to facilitate all the tasks that the interfaces should afford. This suggests that constant evaluation in the design process has to be made in order to take into account all the aspects and get feedback and guide the design. This is as far as the scenario-based design approach was used.

To conclude, it seems that this scenario-based design method used in the thesis is suitable for cross-platform interaction design. The critical aspects that enabled the method to succeed were:

- The potential scenarios of use were discarded, instead the users were asked for their contexts of use and the tasks and activities that they would use a project management system for. By having representative users participate in the design process the overall result will be better, which is also confirmed by Rosson & Carroll, 2002, however, a designer should not let the user influence the end result too much. It remains to be seen in the future research, whether a full scenario-based approach would have

sufficed too for the development onto multiple platforms. That being the case, there should have been scenarios developed to display the usage on all platforms.

- It is crucial to focus on tasks, because as long as tasks per device are taken into account the cross-platform interactions will emerge. With the focus on tasks, however, constant evaluation throughout the design process has to be considered.
- Interface sketches or prototypes were developed prior to interaction design sessions. This enabled users to better explain how they would interact with a system and what tasks they would use on which device. Having now visuals would have made the cross platform approach too complex for the users, as they would have had to focus on too many interactions with all the devices.

Conclusion

The purpose of this thesis was to understand how today people use devices that enable cross-platform services and understand how interaction design should be approached from a cross-platform point of view.

In the "Introduction" the research problem, questions and goals were presented. In the first chapter the methodology used in the thesis was given. In the second chapter named "Cross-Platform Devices and Usage" the author looked into the literature and conducted a survey in order to find out how and where different devices are used today and what the typical usage scenarios are. In the following chapter, "Designing for Cross-platforms", an overview of contemporary user interface design and interaction design approaches was given with definitions of interaction design and cross-platform. In the fourth chapter the case study of a single platform software called Projektur was presented that was redesigned into a cross-platform software with the help of scenario-based design. Thereby, a design reflection was created in order to find out whether scenario-based design is a suitable approach for cross-platform interaction design.

The thesis tried to answer three research questions, which are discussed below. Firstly, what the emerging cross-platform enablers and usage scenarios are. The most important cross-platform enablers today are laptops, smartphones, tablets and desktops and this is also the priority list of usage of the devices today according to the results of the survey. Smart TVs are not fit for cross-platform use yet due to their limited functionalities and input mechanisms. Moreover, different devices afford the users different usage patterns. Due to the various contexts of use and shapes and sizes of the devices people have developed different patterns on how they use their devices. The results of the survey and literature overview on the devices indicate that generally people use the devices for the same types of services almost to the same extent. The important aspect here is that the concrete tasks and activities that people use the devices for are different across platforms. Therefore, people are interested in the cross-platform use of the same types of services, which is why the context of use and the tasks people are going to use the device for have to be considered when cross-platform services are designed.

When looking into the usage patterns of all devices we can see that smartphones and tablets are preferred for all sorts of reading and viewing activities, as well as for entertainment purposes. They are less suitable for editing and writing purposes due the small screen and the slower typing speed compared to the computer. People use the devices for quick interactions, which are often influenced by the surrounding environment and contexts like location, time, activity, social interactions, and they are often used simultaneously with other activities. For both devices referred to above the increasing trend is that they are more and more used in stationary environments instead of mobile environments. Additionally, native applications are preferred on the devices and they should preferably have a flat hierarchy, so as to support quick interactions.

Laptops and desktops are used similarly, however, it is evident that desktops have lost their edge over laptops and are becoming less and less used. They are used more than laptops in only a few concrete activities, which have nothing to do with the strengths of the desktop mentioned in the literature. Laptops and desktops are used in stationary environments – at home, at work, at university. When desktops are fading, then laptops are dominating in a variety of activities and where not dominant, there they are almost equally used as smartphones or tablets are. Computers are preferred for thorough and time-consuming work which requires editing, formatting, writing and where a good overview of the activity is needed. It is important to point out that laptops are commonly used as configurations of devices with a keyboard, monitor, speakers, mouse and power adapter, which is why people are reluctant to use them without the external devices or due to the slow booting time. Therefore they prefer to use mobile devices for quick interactions.

The second question that the thesis was trying to answer was what approaches in the Interaction Design community are used for cross-platform interaction design. The widely used cross-platform user interface design approaches include thin client, device-independent design, context-aware systems, adaptive and responsive design. As their focus is on the user interface level and less on the contexts and tasks-activities combined, they are not fit for cross-platform interaction design. The author has listed three possible cross-platform interaction design practices: human-centred design, user-centered design and usage-centred design. It appeared that usage-centred design is best suited for cross-platform interaction design because it focuses on tasks and activities instead of the user. It also requires minimal user input. Users are unpredictable and thereby unreliable whereas activities are stable and thus more reliable. Besides, as was confirmed with the survey and overview of literature in

the usage of cross-platform devices, people use the devices differently for different tasks and in different contexts. That is why the approach which focuses on tasks was taken.

Thirdly, the thesis tries to answer what extent can the existing interaction design approaches be used for cross-platform interaction design. For this purpose the scenario-based design approach was used. Scenario-based design and usage-centered design have many similarities in how they go about the process of designing. They are focused on the tasks instead of the users. Moreover, both apply a form of the use case to determine the tasks. Hence, scenario-based design was considered suitable for the case study, with some modifications. Firstly, the author did not create potential scenarios of use based on the vision of the project management software Projektur, but conducted three design sessions to let the representative users recreate the software according to their own contexts of use and the tasks and activities they would like to use it for. Secondly, the user interface sketches were created prior to interaction design sessions in order for the users to be able to better visualize and explain the interactions they would like to do with the software.

The results of the design sessions revealed that the tasks people would want to perform with the service are different across platforms. The laptops and desktops are used identically and they are preferred for adding and editing related tasks to the project and the mobile devices are preferred for viewing purposes, as it was also confirmed in the survey and literature overview. An issue that arose, is that firstly functionality wise people desire to use a tablet more like a laptop rather than a smartphone, and secondly they would like to have more functionalities available on both mobile devices "just in case", however, this would create a situation where the functionalities differ on all main devices and it would result in confusion for the user to keep in mind the functionalities that each device affords. Therefore, it is suggested to find a compromise that perhaps keeps the same set of functionality on mobile devices, but limits them compared to the computers, because all of them will not be used. Yet, still giving the mobile devices enough functionality for some editing tasks.

In conclusion, the method used supported cross-platform interaction design. The critical aspects that enabled the method to succeed were:

- The potential scenarios of use were discarded, instead the users were asked for their context of use and the tasks and activities that they need to use in a project management system. The design process can be improved by having representative users participate in it. It remains to be seen whether a full scenario-based approach would have sufficed as well in order to develop for multiple platforms. That being the

case, there should be the scenarios developed in order to reveal the usage on all platforms.

- It is crucial to focus on tasks because as long as tasks per device are taken into account the cross-platform interactions will emerge. With the focus on tasks, however, constant evaluation throughout the design process has to be taken into account.
- Interface sketches or prototypes were developed prior to interaction design sessions. This enabled users to better explain how they would interact with a system and what tasks they would use on which device. Having no visuals would have made the cross platform approach too complex for the users, as they would have had to focus on too many interactions with all the devices.

To conclude, cross-platform interaction design requires the focus to be on the usage and the tasks and activities at hand because people use the devices differently. Computers as well as mobile devices come in different sizes and with different screen resolutions, therefore it is crucial to evaluate how a service is going to be used, where, what for and also consider the possibilities and limitations of the device. The results of this master thesis contribute to a better understanding in how cross-platform interaction design should be approached when developing new services or products. Moreover, from the thesis one can get a good overview of the concrete cross-platform enabling devices and their usage, the technical approaches used for cross-platform interface design and lastly insights into improving the software Projektur.

Future research on the use of devices ought to be conducted with a probability sampling method that allows making generalizations on the population level. Furthermore, inferential statistics requires an even higher number of participants in order to draw conclusions and generalize.

Secondly, research could be conducted on how people have merged their activities into digital devices. The current research gives ideas and assumptions, but does not provide data to back the assumptions.

Thirdly, a full case study of a design example from start to finish should be conducted in order to see what outcome a cross-platform approach could have.

Kokkuvõte (Summary in Estonian)

"Platvormiülene interaktsioonidisain" on magistritöö, mis annab ülevaate interaktsioonide disainimisest erinevatele platvormidele, nagu näiteks nutitelefonid, süle-, laua- ja tahvelarvutid. Töös püstitatud probleem on järgmine: tänapäeval kasutab iga inimene juba rohkem kui ühte digitaalset seadet, mistõttu interaktsioonide disainimine eeldusega üks inimene-üks seade ei ole enam ajakohane. Kahjuks aga enamik tänapäevaseid lähenemisi on just sellel põhimõttel üles ehitatud. Seetõttu on vaja aru saada, milliseid muudatusi on tarvis disainiprotsessi sisse viia, et käia kaasas uute väljakutsetega.

Käesoleva magistritöö uurimisküsimused on järgmised:

1) Millised on peamised tänased platvormiülese interaktsioonidisaini protsessis kasutatavad platvormid ja nende kasutuslood?
2) Kas ja milliseid lähenemisi kasutatakse interaktsioonidisaini kogukonnas platvormiüleseks interaktsioonidisainiks?
3) Mil määral saab tänaseid interaktsioonidisaini lähenemisviise platvormiüleses interaktsioonidisainis kasutada?

Lähtudes ülalnimetatuist on töö peamisteks eesmärkideks:

- kus ja kuidas kasutatavad inimesed oma digitaalseid seadmed tänapäeval
- milliseid tehnilisi lahendusi kasutatakse tarkvara platvormiüleseks mugandamiseks
- milline on interaktsioonidisaini kogukonna lähenemisviis platvormiülesele interaktsioonidisainile
- esitada disainināide ühe platvormi tarkvara ümberdisainimisest mitmele platvormile
- platvormiülesest kontekstist tingituna peegeldada võimalikke vajalikke muudatusi interaktsioonidisaini praktikates.

Magistritöö on jaotatud järgmisteks osadeks: sissejuhatuses esitatakse põhjendused, miks käesolev teema on oluline, ning uurimisprobleem, -küsimused ja -eesmärgid. Esimeses peatükis antakse ülevaade töös kasutatud metodoloogiast. Peatükk sisaldab nii kirjanduse läbitöötamisel, uuringu tegemisel kui ka disainisessioonides kasutatud metoodikaid. Teine peatükk toob välja kaasaegsed platvormiülest interaktsiooni võimaldavad seadmed ning tuginedes kirjandusele ja uuringutulemustele, annab ülevaate, kuidas paremini luua mitmele platvormile uusi teenuseid ja tarkvara.

Kolmandas peatükis antakse ülevaade nii platvormiülest interaktsiooni disaini kui ka kasutajaliidese disaini käsitlevast kirjandusest, samuti selgitatakse mõisteid "platvormiülene" ning "interaktsioonidisain". Neljandas peatükis toob autor välja disainisessioonide tulemused, kasutades stsenaariumipõhist disainimeetodit, et taasluua mitme platvormi peale algselt arvutitele loodud rakendus "Projektur". Kokkuvõttes antakse ülevaade magistritöö tulemustest ja nende vastavusest uuringu eesmärkidele ja uurimisküsimustele. Samuti tuuakse välja võimalikud edasised uurimisvaldkonnad.

Peamised magistritööst tulenevad järeldused on järgmised:

Põhilised platvormiüleseks disainiks kasutatavad platvormid on nutitelefonid, süle-, laua- ja tahvelarvutid. Inimesed kasutavad nendel seadmetel sarnaseid teenuseid peaaegu ühesuguses mahus, kuid oluline on märkida, et seadmetega tehtavad konkreetsed tegevused on erinevad. Seetõttu põhineb platvormiülene interaktsioonidisain tegevustel, mida inimesed tarkvaraga teevad. Tegevused koos kasutuskontekstiga (nagu näiteks asukoht, aeg, ümbritsevad inimesed, jne) määratlevad, kuidas tarkvara peab olema loodud. Seepärast on platvormiülese interaktsioonidisaini puhul soovitav kasutada tegevustest lähtuvaid metoodikaid.

Ilmneb, et nutitelefone ja tahvelarvuteid kasutatakse peamiselt vaatamise ja lugemisega seotud tegevusteks ning meelelahutuseks, laua- ja sülearvuteid eelistatakse aega ja süvenemist nõudvateks ülesanneteks, olgu need siis tekstide kirjutamine, muutmine, vormindamine, vms.

Samuti, stsenaariumipõhise disaini kasutamine platvormiüleseks interaktsioonidisainiks on sobiv, kuni keskendutakse tegevustele, mida teenus või tarkvara hakkab pakkuma. Ühtlasi kaasates disainiprotsessi tarkvara reaalseid lõppkasutajaid, on võimalik saavutada parem tulem. Pakkudes kasutajatele võimalust näha süsteemist visuaalseid kuvandeid võimalikult varakult, on nad võimelised paremini ette kujutama erinevatel platvormidel interaktsioone süsteemiga.

Töö on kirjutatud inglise keeles.

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Appendixes

A.1 Glossary

Activities, tasks, actions, operations – a four level model developed by Don Norman based on Activity Theory, where activities are on the highest level, followed by tasks, actions and operations. For example, an activity is setting up a project. Tasks are adding project description, deadline, budget, etc. Actions are typing in the budget, description and operations are clicking on the description field, clicking on the save button, etc.

Computer – laptop or desktop computer

Cross-platform – across different platforms, will be used synonymous to multi-device and cross-device in the thesis. The cross-platform settings in focus are desktop, laptop, smartphone and tablet.

Direct manipulation – an interface object manipulation method, which affords direct interaction with the object and gives constant feedback to the user as the object is manipulated.

Feature phone - a mobile phone that has Internet access and media capabilities, but lacks the advanced functionalities of a smartphone

Indirect manipulation – is an interface object manipulation method, which affords indirect (command-oriented) interaction. It encompasses the usage of menus to deliver commands.

Interaction design – is an interaction between people and any digital artifacts with the purpose of offering a more useful and enjoyable experience. Interaction design is considered to be the umbrella term, for concepts like user interface design, software design, user-centered design and user-experience.

Mobile device – a smartphone or a tablet

Tap – a "click" made on the smartphone or tablet

A.2 Explanatory Letter for Facebook and Emailing Lists

Letter for emailing lists:

Hello,

Are you using a smartphone, a tablet, a laptop or a desktop computer? Then I would like to ask you to participate in a survey. This survey is the basis for a doctoral thesis of Ilya Shmorgun on ubiquitous mobile interactions and a master thesis of Mattias Saks on cross-platform interaction design.

Our goal is to understand the habits of people who use different devices (smartphones, tablets, laptop and desktop computers, smart TVs) in their everyday life; what they use these devices for, where, etc.

Your contribution in answering the survey is of great help and will result in guidelines for better development of services for these devices.

It takes about 20 minutes to answer the survey and it can be found here:

http://minitorn.cs.tlu.ee/limesurvey/index.php?sid=36755

We are looking forward to receiving your answers by 18th October 2012.

Thank you!

Letter for Facebook:

I would like to ask you to participate in a survey.

It is a joint survey with Ilya Shmorgun and Mattias Saks. Our goal is to understand the habits of people who use different devices (smartphones, tablets, laptop and desktop computers, smart TVs) in their everyday life; what they use these devices for, where, etc.

It takes about 20 minutes to answer the survey and it can be found here:

http://minitorn.cs.tlu.ee/limesurvey/index.php?sid=36755

We are looking forward to receiving your answers by 18th October 2012.

Thank you!

A.3 Results of the Survey

Total complete records in survey: 101

Age	Total	Female	Male
under 26	53,5%	51,9%	48,1%
26 and over	46,5%	29,8%	70,2%

Gender	Count	Percentage
Female	42	41,6%
Male	59	58,4%
No answer	0	0.00%
Not displayed	0	0.00%

Country of residence	Count	Percentage
Angola	1	1,0%
Austria	1	1,0%
Belgium	1	1,0%
Cape Verde	26	25,7%
Estonia	60	59,4%
Ethiopia	1	1,0%
Finland	4	4,0%
Germany	2	2,0%
Italy	1	1,0%
Netherlands	2	2,0%
United Kingdom	2	2,0%

Occupation	Count	Female	Male	Percentage	Female	Male
Employee	65	20	31	64,4%	19,8%	30,7%
Student	51	30	35	50,5%	29,7%	34,7%
Entrepreneur	15	3	12	14,9%	3,0%	11,9%
Housewife / household	3	1	2	3,0%	1,0%	2,0%
Retired	0	0	0	0,0%	0,0%	0,0%
Other (unemployed, serving in the army, etc)	2	1	1	2,0%	1,0%	1,0%

Devices people use	Count	Percentage
Laptop	91	90,1%
Smartphone	77	76,2%
Desktop	54	53,5%
Tablet	32	31,7%
Smart TV	10	9,9%

Devices ranked based on the frequency of usage	Rank 1st	Rank 2nd	Rank 3rd	Rank 4th	Rank 5th
Smartphone	29,9%	48,1%	28,6%	6,5%	5,2%
Tablet	9,4%	31,3%	68,8%	50,0%	15,6%
Laptop	59,3%	34,1%	14,3%	1,1%	0,0%
Desktop	38,9%	33,3%	40,7%	22,2%	5,6%
Smart TV	0,0%	30,0%	20,0%	120,0%	230,0%

The services people use regularly	Count	Percentage
Communication tools	96	95,0%
Social networking	89	88,1%
Office applications	86	85,1%
File sharing	66	65,3%
Calendars	53	52,5%
Reading	47	46,5%
Blogging	43	42,6%
Note-taking	41	40,6%
Task management	35	34,7%

The services people use regularly across devices	Smartphone	Laptop	Desktop	Tablet
Communication tools	96,1%	94,5%	94,4%	96,9%
Social networking	90,9%	87,9%	90,7%	84,4%
Office applications	84,4%	85,7%	85,2%	90,6%
File sharing	71,4%	65,9%	70,4%	68,8%
Calendars	62,3%	54,9%	61,1%	68,8%
Reading	51,9%	47,3%	48,1%	62,5%
Blogging	48,1%	42,9%	40,7%	46,9%
Note-taking	48,1%	42,9%	44,4%	43,8%
Task management	40,3%	37,4%	37,0%	46,9%

Which functions of note-taking services (Evernote / Simplenote / etc) are used on which device.

	Smartphone	Tablet	Laptop	Desktop
Adding plain text	31,2%	28,1%	35,2%	27,8%
Adding formatted text	5,2%	9,4%	31,9%	25,9%
Reading notes	37,7%	28,1%	34,1%	25,9%
Creating checklists	20,8%	21,9%	25,3%	20,4%
Adding images	23,4%	15,6%	28,6%	24,1%
Adding videos	18,2%	12,5%	23,1%	18,5%
Adding links	23,4%	15,6%	33,0%	24,1%
Adding location	23,4%	9,4%	14,3%	3,7%
Searching by location	26,0%	12,5%	15,4%	5,6%
Adding any file type	11,7%	12,5%	25,3%	16,7%
Optical Character Recognition (OCR)	3,9%	3,1%	9,9%	5,6%
Highlighting text	3,9%	15,6%	23,1%	16,7%
Creating notebooks	9,1%	12,5%	19,8%	13,0%
Adding tags	16,9%	9,4%	17,6%	11,1%
Adding web pages	9,1%	9,4%	18,7%	14,8%
Synchronization between devices	29,9%	21,9%	31,9%	22,2%

Which functions of reading services (Kindle / Google Books / iBooks / Readability / Instapaper / etc) are used on which device.

	Smartphone	Tablet	Laptop	Desktop
Highlights	15,6%	25,0%	16,5%	16,7%
Bookmarks	14,3%	25,0%	20,9%	22,2%
Notes	18,2%	18,8%	20,9%	22,2%
Search	23,4%	25,0%	31,9%	29,6%
Dictionary definitions	18,2%	25,0%	29,7%	22,2%
Sharing to social networks	23,4%	21,9%	33,0%	29,6%
Reading both e-books and PDFs	20,8%	50,0%	39,6%	29,6%
Checking time to read through a chapter or article	13,0%	12,5%	17,6%	22,2%
Synchronization between devices	24,7%	25,0%	31,9%	20,4%

Which functions of office applications (Microsoft Office / Google Docs / iWork / etc) are used on which device.

	Smartphone	Tablet	Laptop	Desktop
Text processing	29,9%	25,0%	87,9%	77,8%
Spreadsheets	15,6%	18,8%	68,1%	57,4%
Presentations	7,8%	21,9%	78,0%	64,8%
Sharing	33,8%	31,3%	72,5%	55,6%
Commenting	26,0%	31,3%	65,9%	40,7%

Tracking changes	14,3%	21,9%	53,8%	46,3%
Synchronization between devices	35,1%	31,3%	56,0%	35,2%

Which functions of task management services (Things / Remember the Milk / Google Tasks / etc) are used on which device.

	Smartphone	Tablet	Laptop	Desktop
Adding tasks	28,6%	28,1%	27,5%	20,4%
Adding tags	15,6%	12,5%	16,5%	13,0%
Reading tasks	31,2%	25,0%	26,4%	20,4%
Marking a task as complete	23,4%	25,0%	22,0%	14,8%
Creating lists	18,2%	18,8%	22,0%	14,8%
Adding specific dates	23,4%	18,8%	23,1%	18,5%
Assigning specific location	14,3%	12,5%	15,4%	13,0%
Searching tasks by specific location	13,0%	15,6%	12,1%	11,1%
Notifications	27,3%	15,6%	16,5%	16,7%
Synchronization between devices	22,1%	18,8%	18,7%	13,0%

Which functions of calendaring services (Google Calendar / Outlook / iCal / etc) are used on which device.

	Smartphone	Tablet	Laptop	Desktop
Creating events	46,8%	28,1%	47,3%	42,6%
Viewing events	58,4%	40,6%	46,2%	40,7%
Editing events	45,5%	25,0%	46,2%	40,7%
Adding alerts	45,5%	31,3%	35,2%	29,6%
Setting recurring tasks	23,4%	15,6%	30,8%	29,6%
Sharing calendars	16,9%	15,6%	34,1%	25,9%
Subscribing to calendars	16,9%	15,6%	31,9%	27,8%
Synchronization between devices	42,9%	31,3%	38,5%	29,6%

Which functions of file sharing services (Dropbox / Skydrive / Google Drive / Box.net / etc) are used on which device.

	Smartphone	Tablet	Laptop	Desktop
Adding files	23,4%	15,6%	65,9%	53,7%
Downloading files	35,1%	25,0%	67,0%	55,6%
Managing file versions	11,7%	12,5%	49,5%	38,9%
Sharing files	29,9%	15,6%	64,8%	53,7%
Managing sharing permissions	13,0%	12,5%	59,3%	46,3%
Synchronization between devices	32,5%	31,3%	48,4%	37,0%

Which functions of social networking services (Facebook / Twitter / etc) are used on which device.

	Smartphone	Tablet	Laptop	Desktop
Monitoring friends' activity	77,9%	59,4%	82,4%	70,4%
Adding posts	64,9%	46,9%	78,0%	66,7%
Adding comments to posts	66,2%	53,1%	81,3%	68,5%
Sharing photos	64,9%	40,6%	81,3%	70,4%
Sharing videos	31,2%	28,1%	57,1%	61,1%
Sharing links	41,6%	43,8%	75,8%	64,8%
Adding location to posts	50,6%	28,1%	42,9%	35,2%
Checking in at specific locations	51,9%	31,3%	37,4%	24,1%
Searching for friends in specific locations	32,5%	25,0%	38,5%	22,2%
Managing friends	39,0%	43,8%	72,5%	57,4%
Sending direct messages	76,6%	43,8%	76,9%	64,8%

Which functions of blogging services (Wordpress / Blogger / Livejournal / etc) are used on which device.

	Smartphone	Tablet	Laptop	Desktop
Writing posts	13,0%	9,4%	41,8%	27,8%
Formatting text	3,9%	6,3%	37,4%	29,6%
Adding links	3,9%	9,4%	39,6%	29,6%
Adding images	7,8%	9,4%	41,8%	27,8%
Adding videos	2,6%	6,3%	34,1%	22,2%
Adding tags, categories	5,2%	6,3%	37,4%	24,1%
Editing existing posts	5,2%	6,3%	39,6%	27,8%
Managing authors	3,9%	9,4%	33,0%	22,2%
Managing comments	9,1%	3,1%	36,3%	24,1%
Viewing statistics	7,8%	6,3%	38,5%	24,1%

Which functions of communication services (Email / Instant messaging / etc) are used on which device.

	Smartphone	Tablet	Laptop	Desktop
Reading emails	96,1%	62,5%	96,7%	87,0%
Answering / composing emails	76,6%	56,3%	93,4%	79,6%
Saving draft emails	46,8%	43,8%	84,6%	72,2%
Attaching files	26,0%	28,1%	90,1%	74,1%
Flagging emails (as important / junk)	36,4%	37,5%	72,5%	63,0%
Searching through emails	62,3%	46,9%	89,0%	77,8%
Sending SMS messages	98,7%	15,6%	24,2%	18,5%

Receiving SMS messages	96,1%	18,8%	20,9%	11,1%
Saving draft SMS messages	76,6%	15,6%	14,3%	5,6%
Instant messaging	68,8%	43,8%	69,2%	59,3%
Voice calls	76,6%	46,9%	59,3%	40,7%
Video calls	31,2%	50,0%	65,9%	40,7%

Is it important for you to be able to use a single service on different devices?	**Count**	**Percentage**
Yes	88	87,1%
No	13	12,9%
Not displayed	0	0,0%

Have you experienced any limitations in doing something on your smartphone?	**Count**	**Percentage**
Yes	55	54,5%
No	22	21,8%
Not displayed	24	23,8%

Have you experienced any limitations in doing something on your tablet?	**Count**	**Percentage**
Yes	22	21,8%
No	10	9,9%
Not displayed	69	68,3%

Have you experienced any limitations in doing something on your laptop?	**Count**	**Percentage**
Yes	22	21,8%
No	68	67,3%
No answer	1	1,0%
Not displayed	10	9,9%

Have you experienced any limitations in doing something on your desktop?	**Count**	**Percentage**
Yes	11	10,9%
No	42	41,6%
No answer	1	1,0%

Not displayed	47	46,5%

Have you experienced any limitations in doing something on your smart TV?	**Count**	**Percentage**
Yes	4	4,0%
No	6	5,9%
Not displayed	91	90,1%

A.4 Script of the Design Sessions

The purpose of this design session is to understand how people go about planning and working on their university/work related projects, how they organize teaching and learning activities. Our goal is to understand how you in your everyday context plan and fulfil projects for students/university projects/school projects. Also what materials/resources you occasionally need for planning the projects and fulfilling them.

The information will be used for the development of a university project called "Projektur". It will be a cross-platform software on computers and mobile devices which gives its users the possibility to work collaboratively in one environment. One can set up a timeline for the project, add different resources to the timeline, like images, videos, text documents, presentations etc., and also assign milestones to users. It is like project management software where everything comes together onto a single timeline.

The meetings will be recorded and I'll be taking photos during some point. The data will be used in an abstract format, so no names or connection with you personally. Please let me know if you agree to these terms.

[Present iCoworker PowerPoint presentation]

Activity scenario:

Please tell me how you find the colleagues who you are working together in a project. How does the team come together and take on the project? Is it assigned/voluntary? How roles are divided and deadlines set?

Let's do a small design exercise. I would like you to tell me how you go about making a project. How do you plan a project with your colleagues and what is the whole line of activities you do? What are the tasks you do? Here are post-it cards and I would like you to talk aloud and at the same time make a flowchart out of them both in planning phase and the execution phase. Please write each activity on a separate card. (I.e. assigning tasks, collecting data, having meetings, writing draft, presenting final version, etc.)

- Do you see any alternative methods in how a project could be done? Please use the same cards for rearranging for alternative process.
- If this is the perfect model, what can be skipped, or if not how to make it perfect?
- Where do you make meetings if you cannot meet in person?

Information scenario:

Now that we have it clear what the workflow is to complete a project I would like you to write on the cards what resources, materials you need to carry out the project. What has to be supported by the users and software to make it happen? What information you need to fulfil the tasks? Please be detailed and include everything you can come up with (documents, images, laws, assignments, restrictions, regulations, update reports, etc.).

How would you like to have them structured on the visual design - the activity list and the documents? How would you like the objects to be displayed? Display users as avatars? Documents as icons? Roles? What kind of notifications should the system provide – upcoming tasks, message that have been sent to you, new roles assigned, task assigned. Do you want to write notes there? Do you need a local chat system and log of latest activities?

The goal of this exercise is to understand what data you need to have on the timeline to write the project but as well to monitor the **on-going process** and **keeping up to date** with the project and colleagues.

Interaction scenario:

How do you interact with the whole line of tasks (flowchart) and objects on each platform?

1) These are the functionalities derived from the previous interviews. Let's have a look at them and see if we have left something out or if something important should be added. Please structure the functionalities how you feel right.
2) Please draw an initial sketch of the user interface of the computer. What is the opening screen, how do you navigate the screens. How do you interact with the objects?
3) Please draw an initial sketch of the user interface of the mobile device. What are the functionalities you want to have? How should the interaction change? What is in the focus now?

How do you interact with objects? Object-action interface

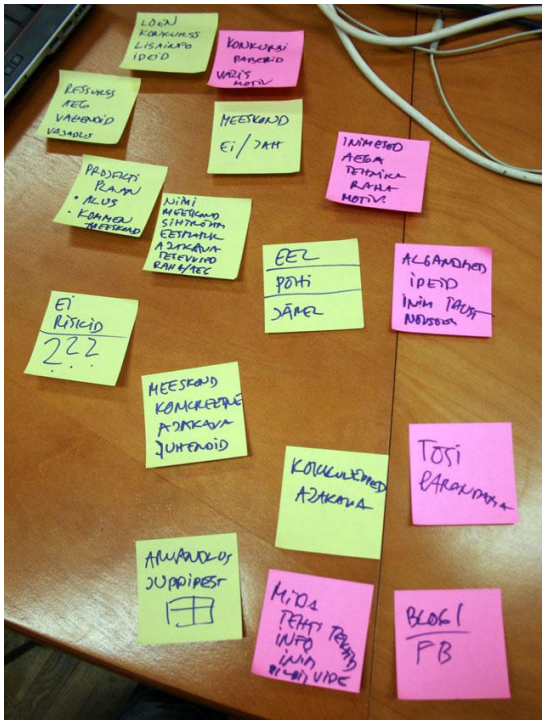
a) Direct manipulation - drag-drop vs. double click, ease of execution
b) Indirect command-oriented manipulation - menu based, control and flexibility, right click and assign

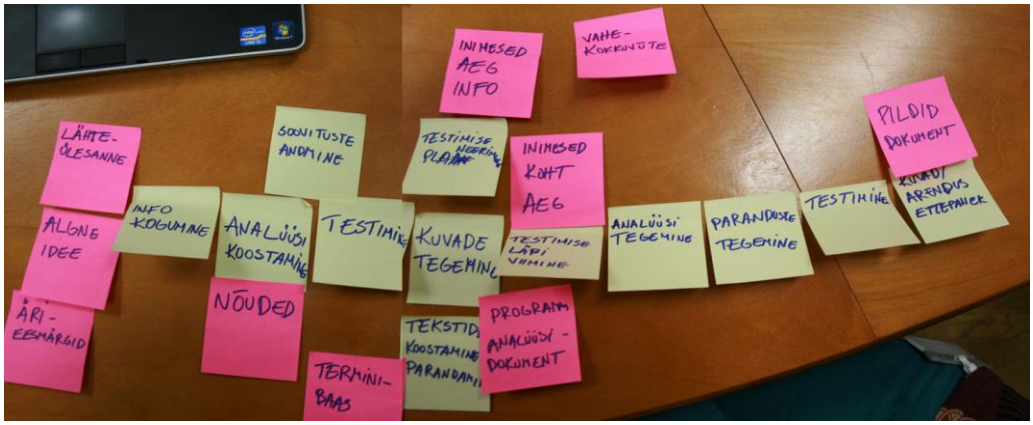
Usability evaluation:

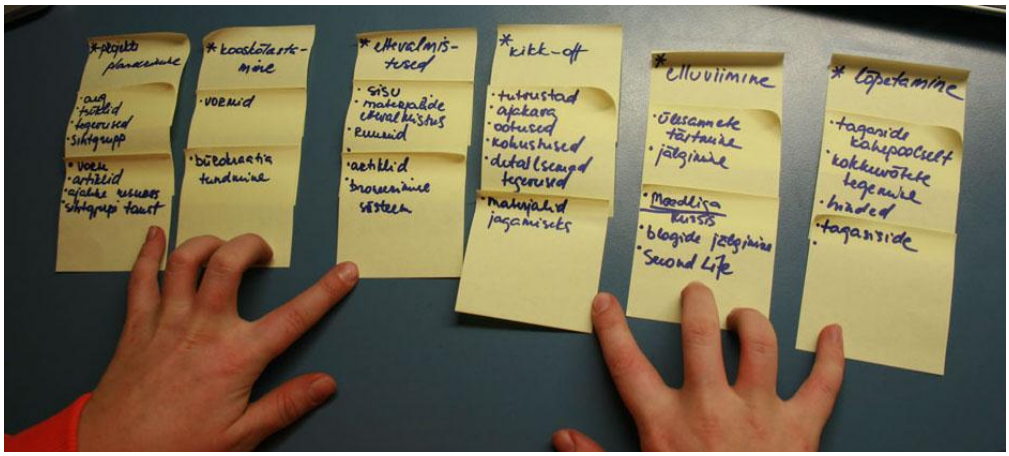
1) What are the concrete tasks you would like to do with the device?
2) Which tasks you would prefer to do on which platform? Which not on which platform?
3) How does your interface afford to do these tasks?

A.5 Summary of the Design Sessions

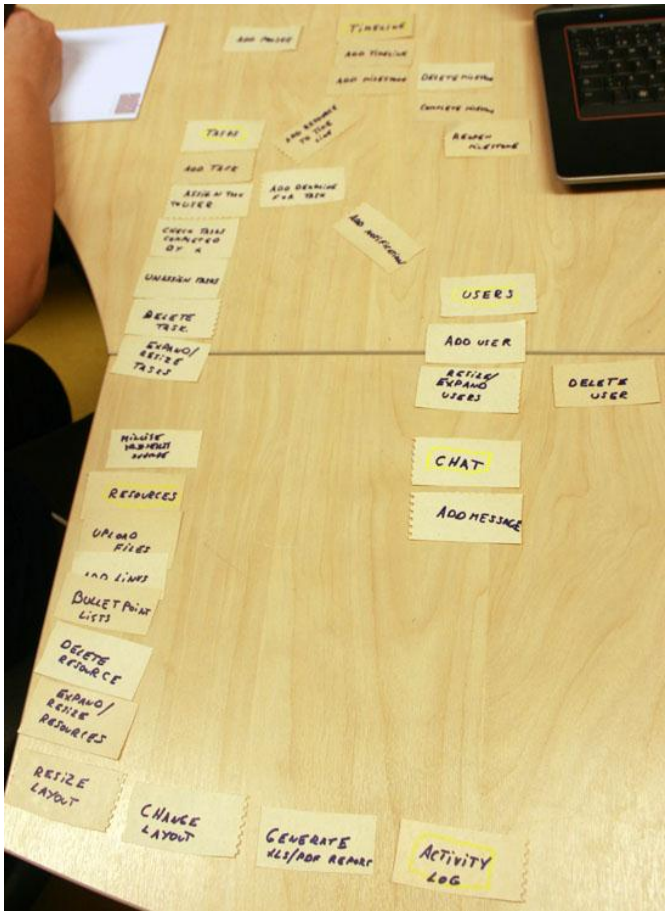
Pictures of the activity flowcharts:

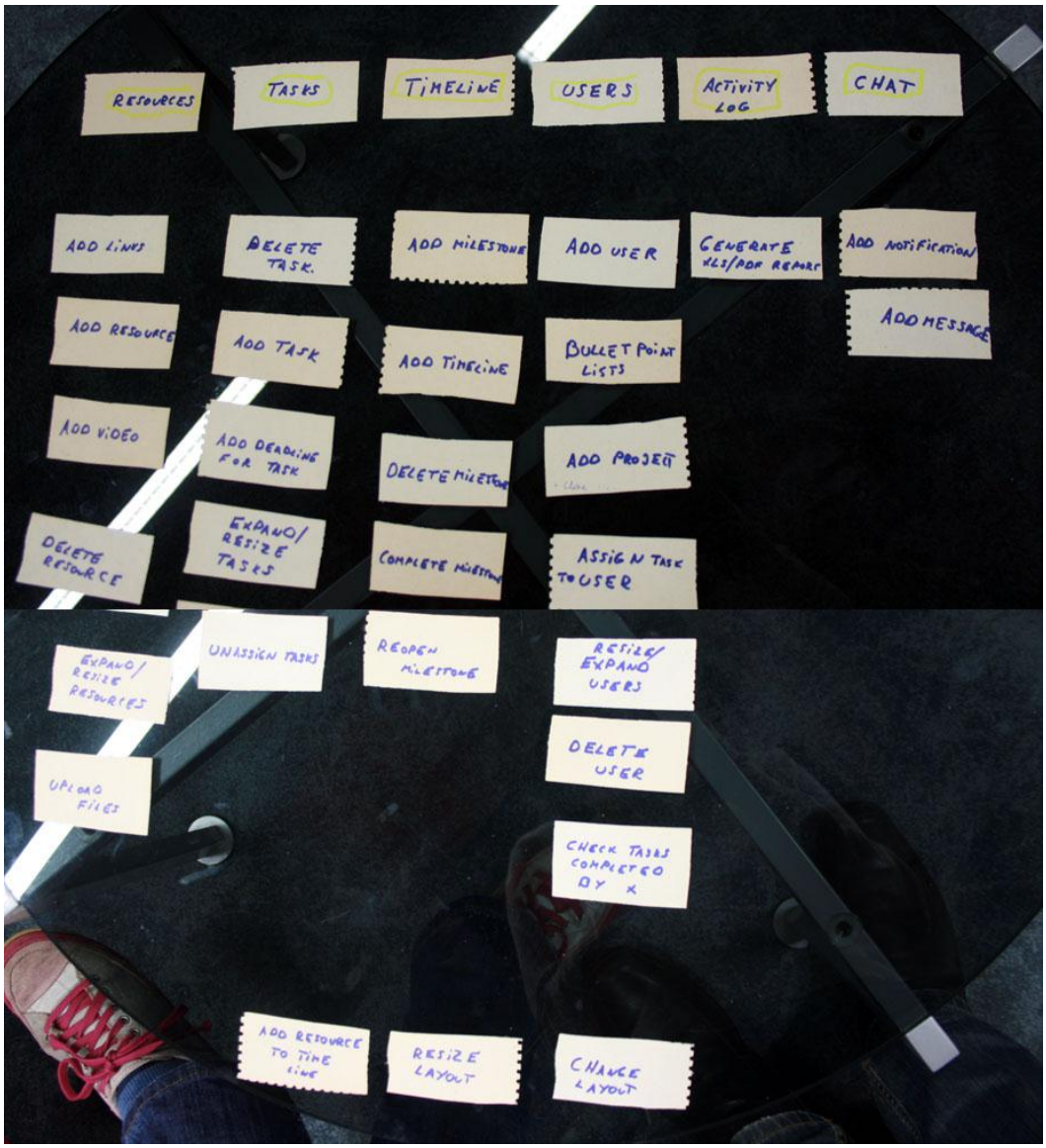




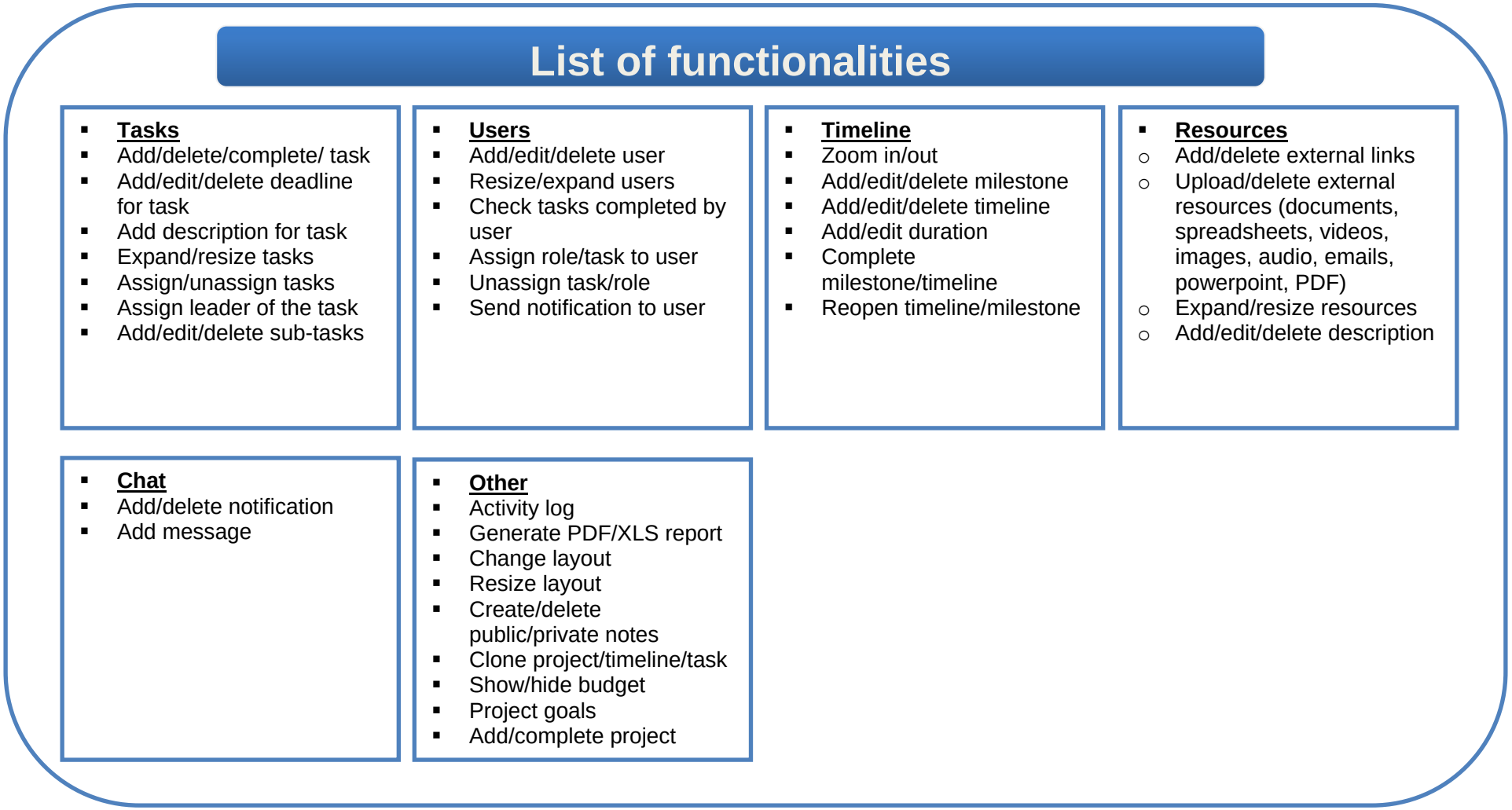


Pictures of the functionality structure proposed by participants:




RESOURCES
TASKS
TIMELINE
USERS
ACTIVITY LOG
CHAT
ADD LINES
DELETE TASK.
ADD MILESTONE
ADD USER
GENERATE XLS/PDF REPORT
ADD NOTIFICATION
ADD MESSAGE
ADD RESOURCE
ADD TASK
ADD TIMELINE
BULLET POINT LISTS
ADD VIDEO
ADD DEADLINE FOR TASK
DELETE MILESTONE
ADD PROJECT
DELETE RESOURCE
EXPAND/ RESIZE TASKS
COMPLETE MILESTONE
ASSIGN TASK TO USER
EXPAND/ RESIZE RESOURCES
UNASSIGN TASKS
REOPEN MILESTONE
RESIZE/ EXPAND USERS
DELETE USER
UPLOAD FILES
CHECK TASKS COMPLETED BY X
ADD RESOURCE TO TIME LINE
RESIZE LAYOUT
CHANGE LAYOUT

List of functionalities for Projektur:



List of tasks and activities for Projektur:

	Participant 1				Which tasks doesn't your interface afford:	
	Smartphone	**Tablet**	**Laptop**	**Desktop**	**Computer**	**Mobile device**
Set up a new project	x	x	x	x		
Edit project details						
Monitor project completion						
View archived projects						
Show archived projects to clients	x	x	x	x	x	
Create a new project from an old one	x	x	x	x	x	
Enter a budget	x	x	x	x		
Monitor the budget and spent/earned	x	x	x	x		
Manage a project timeline/create/edit/delete	x	x	x	x		x
Monitor the on-going processes on a timeline	x	x	x	x		
Add/edit/delete a milestone on the timeline						
Zoom in/out on the timeline						
Manage tasks/create/edit/delete	x	x	x	x		
Mark tasks as complete	x	x	x	x		
Assign tasks to users	x	x	x	x		
Check my own notes about a task	x	x	x	x	x	x
Check for overdue tasks	x	x	x	x		
Check for today's tasks	x	x	x	x		
Check for critical tasks of the project	x	x	x	x		
Check for who does which tasks						
Check my tasks/all tasks	x	x	x	x	x	
Add/delete various resources			x	x		x
Check whether resource X is in the system	x	x	x	x		
Check for recordings/minutes of meetings	x	x	x	x	x	
Add/delete users						
Check for user's task completion						
Check for contact details of users	x	x	x	x		
Call a user through the system	x	x	x	x		
Record the call made through the system	x	x	x	x		x
Assign/unassign roles to users	x	x	x	x		x
Send notifications to users	x	x	x	x		
Chat with users in the system	x	x	x	x		

Create chat groups	x	x	x	x		
Share window in the chat			x	x	x	x
Check activity log for recent updates	x	x	x	x		x
Generate a project report			x	x		x
Add/edit/delete notes						
Modify the user interface according to own needs			x	x		x
Edit project notification settings						
Generate all projects report			x	x	x	x

	Participant 2				Which tasks doesn't your interface afford:	
	Smartphone	**Tablet**	**Laptop**	**Desktop**	**Computer**	**Mobile device**
Set up a new project			X	X	x	x
Edit project details						
Monitor project completion						
View archived projects			X	X	x	x
Show archived projects to clients						
Create a new project from an old one			X	X	x	x
Enter a budget						
Monitor the budget and spent/earned						
Manage a project timeline/create/edit/delete			X	X		x
Monitor the on-going processes on a timeline						
Add/edit/delete a milestone on the timeline						
Zoom in/out on the timeline	X	X	X	X	x	x
Manage tasks/create/edit/delete		X	X	X		x
Mark tasks as complete						
Assign tasks to users			X	X		x
Check my own notes about a task						
Check for overdue tasks						
Check for today's tasks						
Check for critical tasks of the project						
Check for who does which tasks						
Check my tasks/all tasks	X	X	X	X	x	
Add/delete various resources						
Check whether resource X is in the system	X	X	X	X		
Check for recordings/minutes of meetings						

Add/delete users	X	X	X	X		
Check for user's task completion						
Check for contact details of users	X	X	X	X		
Call a user through the system			X	X	x	
Record the call made through the system						
Assign/unassign roles to users			X	x		x
Send notifications to users	X	X	X	X		
Chat with users in the system			X	X		x
Create chat groups						
Share window in the chat						
Check activity log for recent updates			X	X		x
Generate a project report						
Add/edit/delete notes	X	X	X	X		
Modify the user interface according to own needs			X	X		x
Edit project notification settings	X	X	X	X		x
Generate all projects report						

	Participant 3				Which tasks doesn't your interface afford:	
	Smartphone	**Tablet**	**Laptop**	**Desktop**	**Computer**	**Mobile device**
Set up a new project			x	x		
Edit project details		x	x	x		x
Monitor project completion	x	x	x	x		x
View archived projects			x	x	x	
Show archived projects to clients						
Create a new project from an old one						
Enter a budget						
Monitor the budget and spent/earned						
Manage a project timeline/create/edit/delete			x	x		
Monitor the on-going processes on a timeline						
Add/edit/delete a milestone on the timeline			x	x		x
Zoom in/out on the timeline						
Manage tasks/create/edit/delete	x	x	x	x		
Mark tasks as complete	x	x	x	x		x
Assign tasks to users		x	x	x		x
Check my own notes about a task						

Check for overdue tasks	x	x	x	x	x	x
Check for today's tasks						
Check for critical tasks of the project						
Check for who does which tasks	x					
Check my tasks/all tasks	x	x	x	x	x	x
Add/delete various resources			x	x		
Check whether resource X is in the system						
Check for recordings/minutes of meetings						
Add/delete users			x	x		x
Check for user's task completion	x					x
Check for contact details of users						
Call a user through the system	x				x	
Record the call made through the system						
Assign/unassign roles to users						
Send notifications to users		x	x	x		
Chat with users in the system						
Create chat groups						
Share window in the chat						
Check activity log for recent updates		x	x	x		x
Generate a project report			x	x		x
Add/edit/delete notes						
Modify the user interface according to own needs						
Edit project notification settings						
Generate all projects report						

Transcripts of the design sessions:

Kuidas pannakse kokku projekti meeskond? – Vastaja 1

Oleneb mis projekti tehakse. Üks on IT projekt, siis ma mõtlen, mis on meie riiklik kava, millised on meie kooli eelistused, siis ma vaatan, mis inimesed mul koolist võtta on. Me ei saa endale lubada seda, et ma vaatan, mida ma tahan, vaid peab ikkagi vaatama, et mis inimesed ma saan. Pean paratamatult vaatama, et millistel inimestel on piisavalt vaba aega ja millistel mitte ja samuti millised inimesed on midagi juba selles vallas teinud või andnud mõista, et nad on nõus seda tegema. Ja nii sa moodustadki projekti meeskonna, kellega sa saad ise hästi töötada, siis leiad need inimesed kellega sa ei oska hästi koos töötada, aga nad vajaksid edasi arendamist ja siis sa paned selle meeskonna kokku, kellel on erinevad arvamused ja kompetentsid.... ja siis vahel õnnestub kirjutada projekt koos nendega, vahel tuleb ise ära kirjutada enamus tööd ja siis nad lihtsalt kommenteerivad sinna vahele midagi ja sellest keegi koostab ajakava ja alusplaani, mida siis teised muudavad.

Ja kui me teeme näiteks IT projekti, siis praegusel juhul olen mina otsustanud mida keegi tegema hakkab, aga kui me teeme näiteks õppekava arendust, siis igaüks ütle, mida ta on nõus tegema ja kui mõned tegevused jäävad puudu, siis leitakse uusi inimesi juurde, kes siis võtavad teatud ülesanded. Vahel võib tulla niimoodi, et on projekti siseseid ja väliseid osalisi, ehk et osad on need, kes projekti juhivad ja korraldavad ja teised on need, kellele antakse väiksed ülesanded, aga nemad ei teagi üldse, et nad projektis on.

Märkmed tegevuse ja informatsiooni disaini sessioonist

Oluline on, et taskidest on hea ülevaade. Värvidega võib eristada, et näiteks tehtud projektid on halliks läinud ja tegemata on tavalised. Samuti on oluline, et näitaks %-selt kui palju on taskist ja/või timelinest tehtud. Samuti võiks värve kasutada, a la et asjad on punased kuni nad pole tehtud. Punane värv ärritab silma ja siis on inimesed motiveeritumad asju ära tegema. Taske peaks olema võimalik jagada ka väiksemateks ala taskideks.
Minu jaoks ajateljed ei ole niivõrd olulised. See on visuaalne kuvand lihtsalt, aga mite töövahend. Pigem on oluline tasklist. Kui on vaja vaadata projekti üldist timeline, siis see oleks eraldi leht, see pole avaleht. Timeline peal ei ole olulist infot minu jaoks.
Kui vaatad kasutaja põhist vaadet, siis näed mis talle on suunatud. Mis osas ta teeb koostööd kellegagi. Kas ta on peavastutaja või grupi liige lihtsalt.
Linkimine teiste dokumentide suunas peaks olema võimalikult lihtsaks tehtud. Et viitad ja lingid teise süsteemis oleva dokumendi juurde. See on vajalik selleks, et vältida duubeldamist ja korduvalt sama jutu kirjutamist.
Rolle on kindlasti vaja määrata projekti juures. Kes on vastutaja, kes on kaasvastutaja, kellel mingi ülesanne projekti juures on. Tüüprollid võiksid olla olemas, aga et saaksin ka lisada. Vajalik on aru saada, et millises rollis ma antud projektis olen, et inimestel oleks selgus kui ta käib erinevate projektide vahel.
Tegevuse logi on vajalik. Samas seal ei tohi olla liiga palju informatsiooni. Ei ole vaja liiga detailselt. Oluline on, et kes mingi faili juurde lisas, kes märkis taski tehtuks, jne. Võib juhtuda, et on vajalik mõne kasutaja kohta saada vahel ka detailne logi, seega süsteem siiski peaks meelde jätma ka iga kasutaja detailsed tegevused juhuks kui on vaja mõnel juhul süüdlast leida. Materjalide puhul võiks olla võimalik määrata linnukesega, et kas materjal on oluline, et teistele näidata või on ta personaalne. Kui avalik, siis peaks seda activity logis näitama.
Chati osa powerpointi presentatsioonis oli liiga väike. Kui vestlema hakkan siis tahan seda oluliselt suuremana näha.
Peamine ala kus ma tööd teen on jooksvad eesmärkid, tänased taskid, foorum või chat. Kui mingi ala peale klikid, siis tuleb see suurelt ette ja samamoodi läheb ka tagasi.
Hea oleks kui saaks inimene ise tõsta oma aknaid. Disaini peal võiks olla muutmisnupp, et saad asju suurendada/vähendada vastavalt oma soovile. Samuti, et saad väliseid dokumente sisse tõsta süsteemi.

Märkmed interaktsiooni disaini sessioonist

Soovin jagada vahel ka faili võib-olla mitme projekti vahel. Iseasi küsimus, et kas ta on shortcutina süsteemis või upload file. Failidele on ka vaja märksõnu juurde lisada. Kui vaadata ressursside üldvaadet, siis peaks seal juures olema ka täiendava informatsioonina, et mis projekti ja mis taski juurde ta kuulub. Süsteem võiks olla niivõrd tark, et kui on samanimeline fail sees olemas, siis ta juba ütleks seda mulle. Või võiks süsteem näiteks projekti nime kohe algusse kirjutada igale uuele failile, siis on selge, millise projekti juurde ta kuulub ja ei teki ülekirjutamise ohtu, sest inimestel on tavaks faile alati sarnaselt nimetada.

Ma kõigepealt määran ära, mis on tegevused ja siis määran nad ajateljele, mitte vastupidi. Seega fookus peaks olema tegevustel. Vanas Projekturi disainis olid asjad nii väikesed. Peaksid suuremad olema, et näeks ja saaks paremini aru.
Raporteid tahan ma genereerida useritst, chatist, taskidest, logist. Samuti peaks olema võimalik genereerida raporteid detailselt ja ülevaatlikult.
Akende suurendamine vähendamine toimub nurgast. Seda teed jooksvalt süsteemis sees, selleks ei pea olema eraldi muutmisvaadet settingute alt. Väljundid on see ala, kust genereerid raporteid. Kui ma tahan chatile suuremat pinda, siis ma lohistan seda laiemaks. Teised aknad ise muutuvad väiksemaks. Lohistamine mulle meeldib. Mõned asjad toimivad lohistades, samas mõned asjad tunduvad loogilised, et vajutad nupule ja ta avab akna, kust siis valid järgmise tegevuse.
Graafilisi asju on lohistada vaja. Tekstilisi asju assignida ja määrata. Valin tegevuse ära ja siis määran kellele mille. Enne võtad tegevuse ja siis objekti.. Kui ma lähtun objekti põhiselt inimesest, siis võivad mõned tegevused ära ununeda. Üks task võiks koosneda veel ala taskidest. Taski järgi võiks olla ka %, et ma näeksin palju tehtud on. Need mis on tehtud taskid neid võib kuvada värvidega erinevalt. Samuti võib süsteem kasutada hüpikaknaid, mis hüppavad ette kui vaja mingeid tegevusi valid. A la vajutad taski peale ja hüppab ette, kust saad muuta taski, tähtaega jne.
Kui tahad kasutajale taski määrata, siis taski järgi on mingisugune nupp assign, mille peale klikkides tuleb loetelu inimesi või võimalus eraldi otsida projekti väliselt inimesi. Kui mul on palju projekte, siis tekib juba teatav andmebaas inimesi kah sinna. Iseasi, kas ta avab selle eraldi aknas või nagu windowsil on parema clickiga seal samas kõrval.
Kui lisan uut kasutajat, siis tema saab kõigepealt mailile teate, seejärel ta logib sisse ja süsteem näitab talle kutset, mille ta peab kinnitama. Ta näeb, et selline ülesanne, selle ajakuluga on vaja ära lahendada. Vajalik on siis kasutajate juures määrata tema roll, et kui palju materjali ta antud projektist näeb. Kui ta on inimene lihtsa jupi peale, siis ma tahan et ta näeb ainult oma jupikest. Kasjutajate juures peab süsteem näitama, kas inimene on online või mitte.
Ajateljel võiks näidata ka probleemseid kohti, et kui ülesanded hakkavad üle aja minema, siis see info jookseb ka ajateljel kokku, kuidagi teise värviga näiteks. Ja taskide alla toob siis eraldi ette kohe, et need on tegemata taskid.
Seadete alt võiks saada ka mõningaid aknaid ära peita, mida ma üldse ei kasuta.

Nutitelefonide ja padide kuvad

Telefonist ja tabletist on vaja minu arvates kõike saada sisestada. Kui ma saan kliendiga kokku ja me teeme uut projekti, siis on mul vaja vahendit kuhu ma saan kõik asjad sisse kirjutada. Üha enam projekti juhte kasutab tabletiteid. Mul otseselt ei ole vaja ressursse ja kasutajaid seal määrata, aga samas võib-olla. Seega ei tohiks seda funktsionaalsust piirata. Samamoodi siin peaks saama seadetest muuta aknaid/funktsionaalsusi ära peita või tagasi tuua. Telefoniga võib-olla tahan ka pilti teha ja lisada süsteemi kohe.
Arhiivis pole vaja detaile kuvada, vaid eelkõige on vaja näidata seda sama üldist infot projekti kohta – aeg, eelarve, eesmärk. A la kui ma tahan seda infot kellelegi teisele näidata. Arhiivi vaates pole oluline vaadata konkreetseid ülesandeid ja materjale jne.
Kui kliendile mõni asi meeldib, siis on nupp, et alusta nende andmetega uut projekti. Saan kopeerida projekti vanade andmetega ja seejärel seda muutma hakata. Või luua selle template toorikust.
Kasutajate vaates tahan saata teavitusi inimesele. Kasutajate all peaks olema nähtav inimese kontaktinformatsioon, et saan talle kohe helistada või kirja saata.

Chat on kõigile kirjutamiseks. Ja kui sul on lugemata sõnumeid chatis, siis chati aken on teise värviga või mingisuguse märkusega, et seal on lugemata sõnumeid.
Taski pigem vaatan, aga vajadusel pean saama muuta kah. Näppu peal hoides või nurgast vajutades pean siiski saama seda muuta.
Vaate osas kasutan süsteemi pigem püstipidi. Kui siis chati jaoks kasutan laiupidi.
Nuppude alt võib vajadusel saada lisada, või muuta või kustutada, mingit vastavat taski või asja. Nutifoni nuppudega siis. Ta peab siiski olema vastava toote padi, iphone või Androidi spetsiifiliselt ehitatud süsteem.

Kuidas pannakse kokku projekti meeskond? – Vastaja 2

Meil on hästi palju ette määratud, mitte et ise valid, mida tahad teha. Et projekti juht valib keda ta kaasab sinna. Ise vaatab, kas talle tundub et tehniline oskus on vajalik või mida ta soovib. Samuti mõnikord näitavad inimesed ise initsiatiivi. Projektijuht määratakse ette ja valdkonna põhiselt tekivad rollid ja ülesanded osalistele üldiselt. Üldiselt on nii, et inimesel ei ole igas projektis eri roll, vaid üldiselt siiski samad rollid.

Märkmed tegevuse ja informatsiooni disaini sessioonist

Taskid, mis on tehtud, on mitteaktiivsed, hallid. Ajateljel on mingid asjad hallid ja mingid asjad värvidega, siis tekib kiire ülevaade, et mis on tehtud ja mis mitte. Ajatelge saad sisse suumida, kui soovid mingit ajavahemikku täpsemalt uurida. Kui ajatelg on näiteks 1 aastane siis ei mahu kõik sinna ära. Seega on vaja sisse suumida. Kui ajatelg on tänase peal ja leidub tegemata asju siis ajatelg läheb punaseks näiteks.

Märkmed interaktsiooni disaini sessioonist

Bullet point listiga loetletud ülevalt alla taskid, timelined, kasutajad jne. Paremalt menüüst käiksid lisategevused nagu uue projekti lisamine, kustutamine jms, tegevused. Kui tahad inimesele taski assignida, siis valid hüpik menüüst, mis avaneb peale vajutades. Kui vaadata taskide vaadet, siis taskid on jagatud timeline kaupa, seejärel teine timeline jne. Paremal oleva add nupu puhul viskab uue akna lahti ja saad määrata uue taski ja sellele kogu sisu, mida soovid.
Timeline peal on kuvatud ka ressursid ja taskid ja userid, suurendades saad neid lähemalt uurida.
Vajalik oleks salvestada ka projektide toorikuid või võimalus kloonida projekti. Ja kui teed uue projekti, siis saad näiteks ka kasutajaid otsida kogu süsteemi andmebaasist, et ei pea alati uuesti lisama kui mõnes teises projektis kasutaja sees juba.
Raporti tegemine on projekti ülene. Teed kogu projekti kohta. Minu arust detailseid raporteid ei ole vaja. Asjade määramiseks kasutad nuppude alt erinevaid käsklusi, hüpikaknad + paremal pool olevat menüüd. Clickimine toimub ühe kliki põhiselt. Drag and dropi ei ole vaja süsteemi.

Nutitelefonide ja padide kuvad

Vaade peaks olema püstipidine. Kui siis timeline'i vaatan laiupidi, seega vajalik oleks igaks juhuks vist ikkagi teha mõlemapidised vaated. Tuleks kasutada telefoni põhiseid süsteeme, iphonel alumist menüüd uue projekti lisamiseks, ära kustutamiseks, samuti settingute jaoks [Segaseks jäi timeline vajadus reaalselt telefonis/tabletil].

Vaadetes on üldiselt kõikide tegevuste/projektide loetelu ülevalt alla. Samas kuva peab olema võimalik muuta. Kui sul on projekt lahti ja üldiselt sind activity log ei huvita, siis seadete alt pead saama selle ära kaotada.
Telefoni või padi üldiselt kasutaksin selleks, et saada ülevaade. Tahan näha mis põleb, kiirelt infot saada, mitte seda muuta. Taskides näen punaselt neid asju, mis tänaseks tegemata on. Kollased on tegemisel, aga pole tähtaja kriis. Ja rohelised on OK. Peamiselt käivad projektijuhid ikkagi tabletitega ringi ja kogu info peab olema seal kiirelt kättesaadav. Minu arust mingit vahet tableti ja telefoni versioonil olema ei pea.
Kasutajatele ülesannete määramine peaks ka telefonis võimalik olema.
Ressursid on listi kujul, sinna saab vajadusel ka juurde panna materjale telefoni kaudu. Ja vajadusel neid sõnumiga kohe telefonitsi edasi saata.
Activity log – võib-olla on vaja koosolekul kontrollida, et kas keegi ikka tegi midagi või jättis ülesande tegemata, siis sealt saab kiiresti vaadata.
Reporti võib ka tahta telefoni teha, sest telefoniga on hea seda saata. Teeb tüüpfaili nagu arvutiski.

Kuidas pannakse kokku projekti meeskond? – Vastaja 3

Inimesed tulid vabatahtlikult kokku ja oskuste järgi pandi tiim kokku. Kuna mina olin vähem kogenenud, siis ekspert pani esialgse kondikava kokku ja ma vaatasin üle ja lisasin oma ideid. Ja niimoodi koostöös sai see valmis. Minu konkreetne roll projekti juures oli võrdväärne juhendaja nagu kõik teised liikmed, kes olid kursuse läbiviimisel juures. Aga ettevalmistavas faasis olin ma pigem selline õpipoisi rollis.

Märkmed tegevuse ja informatsiooni disaini sessioonist

Mina kujutaksin projekti ette mindmapina, kus üleval on projekti nimi ja sealt alla tulevad siis projekti faasid ning külgede peale jooksevad projekti tegevused. Esimene tegevus oleks projekti plaanimine. See jaguneks külgede peale kastikesteks. Värvidega värviksin ülesandeid, et kes mis ülesannet teeb. Igal inimesel on mingi värv, suuremate projektide puhul on värvid valdkonna põhiselt, sest seal igale inimesel erinevaid värve ei jaguks.
Chat süsteem ei ole väga oluline, sest sellega duubeldaks skype või muud samalaadset, pigem üksikute sõnumite saatmise vajadus on.
Logi on kindlasti vajalik. Kui mitu inimest muudavad, siis on ka hea kui on võimalus "track changes". Et saad eelmise versiooni juurde tagasi minna. Ja activity log võiks näidata, kes viimasena muutis, siis teab inimesega ühendust võtta, kui mul tekib segadus.
Ise peab saama vastavalt enda vajadustele ja vaatamise mugavusele muuta seda, kuidas süsteem asju kuvab.

Märkmed interaktsiooni disaini sessioonist

Minu arust oleks loogiline, et süsteem kasutaks drag and drop'i. Peaks olema võimalikult intuitiivne. [Samas joonistas interface'i mis on menüüde põhine ja kasutab paremat hiire klõpsu].
Menüüs vajutad ühe klikiga ridade peale ja need avanevad. Kui valid activities siis tuleb valida kas tasks või timeline järgnevalt. Kui valid resources, siis avab kohe kõik ressursid ülevalt alla listina. Chatiga avaneb lihtsalt vestlusaken. Chat võiks olla nii individuaalne kui projekti ülene, et läheb kõigile. Teade võiks automaatselt emaili peale tulla inimestele.

Oluline oleks taske värvidega eristada, et on selgelt näha, mis on tehtud, mis on üle aja läinud jne. Punane on tegemata ja roheline tehtud. Samuti võib ka nii, et punane on kriitiline, või tähtaeg üle läinud. Roheline on tehtud juba. Kollane hakkab kriitiline aeg kätte jõudma.
Vajutan taskile paremat klõpsu, avaneb menüü, kust saan taskiga tegevusi teha, just nagu Windowsis. Vasakul on üldisemad tegevused, mitte ühe taski põhised. Vasakult saad uue lisada ja kustutada näiteks. Parema klickiga saaks teha konkreetsemaid tegevusi ühele taskile.
Timeline võiks olla selline, et on üks pikk ajajoon või paralleelsed ajajooned, aga saan märkida ära konkreetse perioodi ja seal sisse nö suumida. Ja timeline kõrval on tegevused, kui tahad timelinega midagi teha, a la et add milestone. Ja samuti nagu taskidelgi, klikid timeline peal paremat hiire klõpsu ja lisad milestone'i.
Rollid ja õigused on vaja saada kasutajatele määrata. Kõik ei pea saama vaadata kogu projekti. Inimesel võib ühe timeline peal olla üks roll, teise peal teine roll. Kasutajate rollid on seega erinevate timelinede põhiselt teha. Et ta oma taske saaks muuta, mitte kõike.
Ressursid võivad olla kategoriseeritud nii, et video, links, images, jms.
Kasutajate juures võiks saada ka ülevaate, et kes mis projektiga seotud on.

Nutitelefonide ja padide kuvad

Telefonis on vajalikud vaatamisfunktsionaalsused, mitte muutmine. Üldiselt teed läpakas täiendavaid asju.
Nimekirjad võiksid olla loeteludena üksteise all. Inimene võiks saada pealkirju liigutada, nende järjekorda liigutada ja või ära peita seadete alt näiteks.
Esimene kuva peaks olema, et vali projekt, seejärel tasks, users, resources ja notes.
Notes funktsioon peaks olema kindlasti ja see võiks sünkroniseerida ennast arvuti süsteemi, ebamugav oleks arvutisse lihtsalt ümber kirjutada. Uute lisamise, ega editimise funktsiooni ei ole vaja telefonis või tabletis. Ja märkmeid võiks saada ikka kustutada kah.