Supporting Usability Studies in Uganda
A case study contributing to the planning phase of usability facilities

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Abstract

Usability studies are conducted as a part of the usability engineering process, ensuring the usability of a developing product. Such usability studies can be conducted in a usability laboratory, or at the anticipated context of use. At the School of Computing & Informatics Technology (CIT) at Makerere University in Kampala, Uganda, plans for usability facilities are being evolved.

This study maps what facilities are beneficial for CIT at Makerere University to adapt in order to fulfil the potential stakeholders’ needs, as well as enabling the stakeholders to conduct wanted usability studies. Furthermore, the study presents various usability engineering methods, to be compared with the needs of the stakeholders.

26 potential stakeholders of the usability facilities answered two different surveys. The result shows that the stakeholders’ conceptions about usability studies in some cases are misconceptions, why educational activities about usability and usability studies should be planned alongside the development of the facilities. Further the study shows that the facilities must support usability studies conducted in field as well as studies conducted in a controlled laboratory environment. Moreover, the facilities need to provide facilities for testing mobile services, web applications, user interfaces, and provide for stress and load testing.

Keywords: usability engineering, usability studies, user involvement, usability facilities, laboratories, in-field studies, controlled laboratory environment
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1. Introduction

In the field of Human-Computer Interaction (HCI) usability is an important aspect, to which all HCI practitioners should strive (Leventhal & Barnes 2008). Computer-based interactive systems benefit from being developed with a human-centred perspective, enhancing usability.

“Computer-based interactive systems vary in scale and complexity. Examples include off-the-shelf (shrink-wrap) software products, custom office systems, process control systems, automated banking systems, Web sites and applications, and consumer products such as vending machines, mobile phones and digital television.” (ISO 9241-210:2010 p.1)

As pointed out in the citation above, computer-based interactive systems can mean various products or systems. In this study such computer-based interactive systems will be referred to as systems or products.

As claimed in the ISO standard for Human-centred design for interactive systems, systems with high usability bring both commercial and technical benefits to the users as well as the organization developing the system, the suppliers of the systems and more (ISO 9241-210:2010). Usability engineering, which is further explained in Chapter 2, makes sure that a high degree of usability is ensured throughout the whole development cycle of a product. Usability studies are an important part of the usability engineering, used to reach the point where the usability and therefore the success of a system or a product are ensured. Usability studies can be conducted in both laboratories as well as in the context of anticipated use.

1.1 Background

Makerere University is the biggest university in Uganda, situated in the capital city, Kampala. At Makerere University plans of facilities for usability studies are being developed. The facilities are thought to be situated at the School of Computing & Informatics Technology (CIT) at Makerere University, working as a part of the education for the students taking courses at CIT. Usability testing is a subject that the students get in contact with in theory, but they never get an opportunity to perform usability testing in a controlled laboratory environment. Local organizations, companies and other universities in Kampala are thought of as potential users of the usability testing facilities as well. Therefore, the facilities must be accommodated to fit the needs of Makerere University, other universities and the organizations and businesses in Kampala as well. The present study has aimed to find out what needs prospective stakeholders of the usability facilities have, their conceptions as well as misconceptions of usability studies, and what the facilities should consist of in order to fulfil the stakeholders’ needs.

1.2 Scope

The main purpose of this study is to find out what kinds of usability facilities are beneficial for CIT at Makerere University to have. The university educates students for the society in large and the facilities must be relevant for many parties outside the university to be valid to
include in the education curricula and research. Therefore, the facility should also be of interest to such parties. Because external parties are potential stakeholders in addition to CIT, and the facilities might need to be adapted for the use of such partners, two research questions were formulated:

a) What conceptions or misconceptions of usability studies do the potential stakeholders have?

b) What needs do the stakeholders have for usability facilities?

This study focuses on usability facilities adapted to a specific geographical (and thus economical) context (Kampala, Uganda), why other locations logically may be excluded. This study might be possible to adapt to similar geographical and economical contexts as the one it was conducted in, but as will be obvious from the account of the (potential) stakeholders which we have not only identified but also managed to get responses from, much of the wisdom of the present report lies in the sensitivity for the specific contextual circumstances. For the possibility to generalize the results, the reader will have to be equally context-sensitive in his or her specific research setting. Probably, it is as much the different considerations for gathering data that are of interests as it is the results in themselves.

This study is not focused on accessibility (testing). Where usability concerns the use of a specified user, accessibility is about “usability of a product, service, environment or facility by people with the widest range of capabilities” (ISO 9241-171).

Nor are cost calculations for establishing usability facilities included in this study, since they can vary widely from country to country and from time to time.

**1.3 Target groups**

This study can be of use to CIT at Makerere University and to others, such as organizations or universities, who are planning to adopt usability facilities in a certain context. Especially helpful could this study be for those who are planning for usability facilities in similar contexts as the one in this study.

**1.4 Structure of this thesis**

In order to gather data about what needs, conceptions and misconceptions the stakeholders have, two surveys have been used. The first survey was put together and handed out to 17 potential stakeholders by Dr Baguma. The analysis of the first survey showed that additional information was needed in order to map the needs of as many potential stakeholders as possible. Therefore a second survey was put together and sent to 25 additional potential stakeholders. The methodology of this study is presented in Chapter 3.

In order to form the second survey as well as to compare and validate the data collected from both surveys, an extensive review of theories about usability engineering, usability facilities and usability testing were conducted. The review therefore gives a background needed to understand and validate the results from the surveys. The result from the review is presented in Chapter 2. Chapter 4 contains the results from the surveys. In
Chapter 5 the results from the surveys are compared with the literature presented in Chapter 2. The conclusions reached in the analysis are finally summed up and presented in Chapter 6.
2. Working with usability

The aim with this study is to answer what kinds of usability facilities would be beneficial for CIT at Makerere University to have and provide. Therefore various usability engineering methods and techniques are presented in this chapter, as well as what usability facilities can contain, where, when, how and why usability studies are conducted. The usability facilities are to be adapted to a geographical (thus economical) context, why information about the context is also presented in this chapter.

2.1 Introduction

To test a product can mean that you test different aspects of the product. Functionality is one example of a feature of a product that can be tested. “Functionality refers to what the product can do,” explains Dumas and Redish in their guide to usability testing (1999, p.4). Functionality is the functions or the tasks that can be performed by using the product. But according to Dumas and Redish functionality is nothing without usability. The authors mean that a product can have several functions but if the user does not know that the functions exist or how to use them then the functions are useless. Since how to use the product is important, usability comes to mind. Usability is another aspect of a product, system or service that can be tested, according to the authors (ibid.). But what is usability?

2.2 Definition of usability

In this study the definition of usability as developed by International Organization of Standardization will be used. Usability means the “extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use” (ISO 9241-210:2010).

This means that if a product, system or service should have a high degree of usability, its ability to allow the intended person interacting with the product to complete goals with effectiveness, efficiency and satisfaction must be met to a high extent. Effectiveness means the “accuracy and completeness with which users achieve specified goals” (ibid.). Moreover, efficiency is defined as the “resources expanded in relation to the accuracy and completeness with which users achieve goals” (ibid.). The definition used in this study for satisfaction is: “Freedom from discomfort, and positive attitudes towards the use of the product.” (ISO 9241-11:1998)

Usability can be planned for, measured and incorporated throughout the whole product’s development cycle (ISO 9241-11:1998). This process is called usability engineering. Usability tests are a tool used to help with that process, ensuring that a high degree of usability is met. (Dumas & Redish 1999) How usability is engineered and tested is further explained in section 2.4.
2.3 Why should usability be ensured?

“Usability is an important consideration in the design of products because it is concerned with the extent to which the users of products are able to work effectively, efficiently and with satisfaction.” (ISO 9241-11:1998)

Dumas and Redish (1999, p.10) argues that usability must be striven for if the product that is being developed are going to be successful: “In short, to have a successful product, the design must be driven by the goal of meeting users’ needs.”

Nielsen (1992) argues that the work with products usability should be conducted iteratively, allowing changes to the product throughout the whole development cycle. Further the author mean that “It is much too expensive to change a completely implemented product, especially if testing reveals the need for fundamental changes in the interface structure.” (Nielsen 1992, p.13) Thus, usability should be tested or engineered into a product as a way of ensuring the product success as well as saving both time and money (Nielsen 1992; Dumas & Redish 1999). Usability engineering can also be conducted as a way to find out what kind of attributes and functionality the product should have (Nielsen 1992). This can help with pinpointing what functionality the product really should have. The users of a product probably won’t complain of too much functionality, but if the users won’t use the functionality since it’s redundant, the time spent developing the functionality is wasted. Thus, money is wasted on developing functionality that isn’t needed or wanted by the users. Usability studies and engineering therefore can help in the development of a product to focus on the right things. (Nielsen 1993)

Nielsen (1992) argues that users of today won’t put up with bad design, since better functionality can be found in other products, as the supply of today is wider than in the early days of computers. Some users interpret the user interface as the whole product. Imagine if the user interface isn’t usable – then the whole product becomes useless to the user. (Leventhal & Barnes 2008) Dumas and Redish also stresses that usability is a major part of a products success, and that “Ease of use has become a major point of competition.” (Dumas & Redish 1999, p.10). Therefore the conclusion of that usability and the users’ point of view really do matter today can be drawn.

Dumas and Redish mean that usability is good for everybody, from the users of the product to the company providing the product.

2.4 Usability engineering

In the early days of software development, the development process often did not follow an iterative cycle but a sequential time line, later called the waterfall model. The sequential development process follows a number of phases, where each phase contributes to the next phase. Each phase is finalized before moving on to the next phase, and the previous, finalized phases are never returned to. (Leventhal & Barnes 2008)

Royce (1970) presents this model for software development, which is following a sequential line. Though, the author also provides models including iteration and stresses that if not including steps beyond analysis and coding, bigger software projects are condemned to fail. When Royce (1970, p.329) presents the sequential development process (nowadays
called the waterfall model) he also argue that this model is “risky and invites failure”. Further Royce means that errors and problems (that cannot be found during the step of analysis) found in the second last step, testing, will bring the development back to the first step, and therefore increasing time schedules and/or costs by 100 per cent.

According to Leventhal and Barnes (2008, p.57) there are some problems with the waterfall model, problems that are “especially significant when developing a user interface”. What the waterfall model lacks, according to the authors, is called iteration (though, as stated above, the sequential model were from the beginning argued to benefit from iteration). Iteration means that the phases of the development sometimes are returned to, if or as it mostly is when needed, during the development process. Leventhal and Barnes mean that in reality the sequential development process is not beneficial, just as Royce stated in 1970. Leventhal and Barnes state this since the early phases of the development process often needs to be returned to, for example when the requirements change (as they usually do in a project). Nielsen (1993) argues that the user interface won’t be finished and available for user tests until the very last minute, when everything else has already been developed, when using the waterfall model. Further the author means that user tests cannot be conducted earlier without (a prototype of) the graphical interface, since users do not understand technical specifications on a system or interface. Gould and Lewis (1985) recommend iterative design as one of the three principles needed for a successful design (along with the other two principles: “Early Focus on Users and Tasks” and “Empirical Measurement”). Nielsen (1992, p.13) argues that it is “nearly impossible to design a user interface right the first time, we need to test, prototype and plan for modification by using iterative design”.

The development process needs to be iterative if the developed product or system is going to be successful (Gould & Lewis 1985; Nielsen 1992, 1993; Leventhal & Barnes 2008).

“Usability engineering is not a one-shot affair where the user interface if fixed up before the release of a product. Rather, usability engineering is a set of activities that ideally take place throughout the lifecycle of the product, with significant activities happening at the early stages before the user interface has even been designed.” (Nielsen 1993, p. 71)

Nielsen (1993) also suggests that usability must be taken care of throughout the whole developing process of a product, if the result should be as good as possible. This process is called usability engineering. This model is explained below, in the following section.

### 2.4.1 The Usability engineering lifecycle model

Ensuring usability is a big part of a product’s success (Dumas & Redish 1999). As stated in the end of section 2.1, ensuring usability can be a part of the whole development cycle. But it is not enough to think about usability when the product is almost or completely finished. “Usability is not a surface gloss that can be applied at the last minute. [...] Therefore, usability has to be built in from the beginning.” (Dumas & Redish 1999, p.8) The authors mean that usability has to be considered during the whole development lifecycle. Nielsen (1992, 1993) also argues that usability should not be ensured just before the final release of the product, but throughout the whole lifecycle of a product. A lot of work with a product can be done before starting the implementing, making sure that the right functionality gets implemented
and therefore costly changes to the final product can be avoided (Nielsen 1992, 1993). Nielsen (1993, p.72) states that “The life cycle model emphasizes that one should not rush straight into design.” and further describes the usability engineering lifecycle model. The usability engineering life cycle model is developed from Gould and Lewis (1985) three design principles, expanding them into a model of a number of defined stages (Nielsen 1992; Mayhew 1999). Gould and Lewis (1985, p.300) advise that three main principles are in focus when designing a product and engineering usability: “Early Focus on Users and Tasks”, “Empirical Measurement” and “Iterative Design”. Mayhew (1999) mean that the usability engineering lifecycle model is used to apply an engineering perspective to the process of developing user interfaces with high usability. Mayhew (1999) contrasts the usability engineering to the software engineering, meaning that the processes are the same though the tasks and models may differ. Further Mayhew argues that both the software and usability engineering is about defining requirements and goals, working iteratively with design and tests in order to reach and fulfil the goals.

Mayhew (1999, p.5-6) describes the usability engineering lifecycle containing the following steps:

- “Structured usability requirements analysis tasks
- An explicit usability goal setting task, driven directly from requirements analysis data
- Tasks supporting a structured, top-down approach to user interface design driven directly from usability goals and other requirements data
- Objective usability evaluation tasks for iterating design towards usability goals”

Mayhew argues that the usability engineering lifecycle model is a structured engineering technique that helps the team developing a product or system, and ensuring usability in the process. Further the author mean that specific tasks are supposed to be executed during the development process, tasks that are all striving to fulfil requirements and goals that are set to ensure usability. Mayhew also points out the importance of an iterative developing process, where the usability evaluation of the product are supposed to be conducted iteratively, making sure that each iteration gets the product closer to the usability goals.

**Nielsen’s usability engineering lifecycle model**

1. Know the user
   a. Individual user characteristics
   b. The user’s current and desired tasks
   c. Functional analysis
   d. The evolution of the user and the job
2. Competitive analysis
3. Setting usability goals
   a. Financial impact analysis
4. Parallel design
5. Participatory design
6. Coordinated design of the total interface
7. Apply guidelines and heuristic analysis
8. Prototyping
9. Empirical testing  
10. Iterative design  
   a. Capture design rationale  
11. Collect feedback from field use

Table 1. The usability engineering lifecycle model (Nielsen 1993, p.72, Table 7).

Nielsen presented one usability engineering lifecycle model in 1992, and another slightly altered usability engineering lifecycle model in 1993 (see Table 1). The later model is used in this study, though the main characteristics of the two models are the same.

All the steps in the lifecycle model might not be crucial (or possible because of time or financial constraints) to go through in all development projects, and the steps don’t have to be followed in numerical sequence (Nielsen 1992). Nielsen (1992,1993) argues that not all development teams can afford conducting the whole usability engineering lifecycle model, but argues further that all teams at least should get to know their users by visiting the users workspace (see step 1 of the usability engineering lifecycle model), let the user participate throughout the design process (see step 5), design iteratively (step 10), use prototyping (step 8) and conduct user tests (step 9). How the user tests and other usability engineering methods can be conducted is explained in section 2.4.

Predesign stage
The first stage is the predesign stage, where the first step is getting to know the user (see Table 1). Listing the a) user characteristics (such as computer experience etc.), b) analysing what the goals the users have (and what they need in order to achieve these goals), c) how users conduct specific tasks (and if the execution can be improved in the system), and d) how the users change while using the system (for example turning into experts) and how the system should handle this “evolution”, are all part of the first step in the usability engineering life cycle. Step two (2) in the lifecycle is to analyse already existing products in the same field as the system being developed. The analysis consists of identifying the existing systems strengths and weaknesses. This can be done by testing the existing systems on users (more about user tests under section 2.4.2) or comparing systems if several systems exist. Step three (3) in Nielsen’s model is about defining when the system fulfils the required usability, how to measure if the requirements are fulfilled and what attributes that should get the biggest attention while developing. Depending on what the system are supposed to be used for, Nielsen (1993) mean that different attributes should get different amount of attention. In this step the author mean that a “Financial Impact Analysis” should be performed as well. This analysis should give a picture of what benefits, financially, the system will contribute to the company adapting the system. Next step (step number four) in the usability engineering lifecycle model is to get a range of interface design suggestions from the designers on the developing team. The thought with Parallel design is that designers should work individually with developing rough drafts of how the interface should be designed. Having a couple of designers work individually and independent will, according to the author (1993, p.86), give as “much as diversity as possible”. Nielsen (1993) means that when the drafts then
are finished, the best features can be merged into one interface to be evaluated, or if the drafts are so different that they can’t be merged: further develop the designs so that a few prototypes can be developed (see section 2.4.2) and the evaluated. The author means that the Parallel design is good cost-wise, since the developers are working on several design ideas parallel.

**The design stage**
Stage two in Nielsen’s (1993, 1992) usability engineering lifecycle model is the design stage, where step number five (5) is to include the users in the development team (more about participatory design, see section 2.4.2). To coordinate the Total Interface means that all the different parts of the product (such as guides, different releases, documentation, the product itself) should be consistent. Nielsen (1993, p.90) means that this can be done by having one person “coordinate the various aspects of the interface” and by developing a sharing mentality (such as code sharing) throughout the project. “Apply guidelines and heuristic analysis”, step seven (7) in Nielsen’s model, is about letting experts evaluate and analyse the system by using standards and guidelines (see section 2.4.2). Next step in the model is prototyping, a method where a prototype of the product or interface are developed (for example sketched on a piece of paper) and then tested on a user (see section 2.4.2). Step nine (9) is where tests are carried out with real users. The test are conducted either to evaluate the (developing) interface against the usability goals (earlier established) or evaluating if the interface works or not for the users, and why. Methods commonly used in this step are according to Nielsen (1992) Thinking Aloud, Constructive interaction, questionnaires, observation and logging (for further information about these methods, see section 2.4.2). Step ten (10) is to conduct the design iteratively, which means for example that the usability problems that were recognized in the previous step should be somehow dealt with and then tested on users again. Nielsen (1992) argues that it is important not to over use the test subjects, conducting tests on every single design detail. Instead the author (1992, p.19) means that users “should be conserved for the testing of major iterations”.

**Post design stage**
“Collect feedback form field use” is the last step in Nielsen’s usability engineering lifecycle model. It is conducted in order to collect data about the system’s usability for further developments (either for the same system or other, future projects). (Nielsen 1993)

### 2.4.2 Testing usability

“Some type of usability testing fits into every phase of a development lifecycle.” (Rubin & Chisnell 2008, p.27) Usability testing is not only to be conducted when the implementation and development is finished. Usability testing can and should according to Rubin and Chisnell (2008) be conducted during the whole development lifecycle. This means that usability tests should be performed from the start to the end of the development.

“Usability testing is appropriate iteratively from predesign (test a similar product or earlier version), through early design (test prototypes), and throughout development (test different aspects, retest changes).” (Dumas & Redish 1999, p.26)
According to Dumas and Redish (1999) tests should be conducted during the whole development lifecycle, therefore testing should be conducted iteratively throughout the development of the product.

“Testing usability means making sure that people can find and work with the functions to meet their needs.” (Dumas & Redish 1999, p.4) By conducting usability tests, the usability of the product can be measured and evaluated. The usability test shows if people can use the product’s functions to perform a task.

“[…] we use the term usability testing to refer to a process that employs people as testing participants who are representative of the target audience to evaluate the degree to which a product meets specific usability criteria.” (Rubin & Chisnell 2008, p.21)

Since the usability concerns the user and the user’s needs, then the usability testing should also focus on the user. Therefore Rubin and Chisnell (2008) mean that the contemplated user should be included in the usability test as a test person. Dumas and Redish also points out the importance of having the expected user (or the ones already using the product) represented in the usability tests. Otherwise the test will not show credible results.

Since the expected user should be involved in the tests, if no current users exists, the testing can go on already before the products is fully developed.

Though, usability testing is not just about conducting a test, usability testing involves a lot of different techniques, methods and tasks (Dumas & Redish 1999). Conducting this research, the word testing has been found to mean several methods and techniques, such as: experimenting, exploring, prototyping, evaluating, inspecting, all in order to improve the products’ or the systems’ usability.

**User tests**

User tests are tests that are performed involving the intended end user of the system or product. During the user tests it is the user who reveals usability problems comparing to for example evaluations made by experts, and “is the most fundamental usability method” according to Nielsen. According to Dumas and Redish the user tests is the best way for finding major usability problems in a system. User tests can sometimes be described just as usability testing, but usability testing can also be methods and techniques where the users are not involved in the actual test. Below a variety of such usability testing and usability engineering techniques and methods will be explained.

**Usability engineering methods and techniques**

**Participatory Design** is a method where the actual user of the system participates in the design process as a part of the design team (Nielsen 1993; Rubin & Chisnell 2008; Leventhal & Barnes 2008). In order to get substantial feedback, the design ideas need to be presented to the user in such a way that the user can comprehend, since the user is not a designer. Nielsen (1993, p.89) suggests that “Instead of voluminous system specifications, concrete and visible designs” should be presented to the user. There is a danger with the participatory design, that the user might become too much a part of the development team, making the user hold back
negative feedback and other input valuable to the development (Rubin & Chisnell 2008). Mayhew (1999) also suggests that the technique doesn’t really involve the user in the “initial design process”, which is, according to the author, a bad thing.

**Observation** is described as a way to gather information about how the users normally perform tasks. The technique is conducted by going to the users normal workplace and without interfering observing them performing their daily work. By observing the user unpredictable user scenarios and tasks can be discovered. (Nielsen 1994) Mayhew (1999) predicates that the user better can explain how and why a certain task is performed while it is carried out, than explaining the actions at another time, as during an interview. Mayhew (1999) also suggests that the user isn’t always aware of how a task is performed, why asking about it during an interview would just contribute with falsely data. Rubin and Chisnell (2008) describe the Observation technique as Ethnographic Research. Observations can also be done in a controlled laboratory environment, for example watching the user use the system, but is then to be seen as a part of a user test.

**Card sorting** can be used to group and categorize content, and for using the right wordings and labels in the user interface (Rubin & Chisnell 2008). Nielsen (1993) describes the technique as inexpensive. Further the author (1993, p.127) describes how the technique is carried out: “each concept is written on a card, and the user sorts the cards into piles”. Rubin & Chisnell (2008) suggests that the user can be given cards that are not sorted into categories, and the assignment to write a label for the cards. Further the authors suggest that the technique also can be carried out by letting the user sort the cards into already existing categories.

**Questionnaires, Interviews and Surveys** does not study the user using a system, but asks about what the user thinks about using the system or the system, interface etc. it self (Nielsen 1993). Rubin and Chisnell (2008) mean that the method is good for getting a generalised view. Though, further the authors argue that since the method only asks for the users views and does not study the user using the system, it should not replace the user tests.

**Focus Groups** are used to gather information from a group of users, their opinions and feelings about certain topics. The focus groups always contain a group of users; Nielsen suggests 6-9 users per group. Rubin and Chisnell (2008) claims that the focus groups shall be used in the early stages of the development cycle, while Nielsen (1993) states that the focus groups can be used both during the early stages of development but also after the system has been used for a period of time. Rubin and Chisnell (2008) argues that the users in focus groups only tell what they want to tell, why the method should not be used instead of user tests.

**Logging actual use** is according to Nielsen (1993) usually used after a system is already in use by users, but this technique can also be used during the development process. The technique is conducted by letting the computer automatically log data about how the user uses a system. The log file then can show how the system is used (such as how often tasks are performed, how long time tasks takes to perform etc.). The data can be used to evaluate for example if certain functionality is used etc. But as the author argues on page 221 “A major problem with logging data is that it only shows what the users did but not why
they did it”, why the data it self might not be tellingly about the systems actual usability. If the data is going to be used as a part of a bigger evaluation where the user are asked to explain the data, for example why certain tasks where performed in this particular way, the author argues that it must be done very carefully.

**User Feedback** can be collected in different ways, Nielsen (1993) exemplifies that it can be collected directly in the system itself, when conducting beta testing or by providing the users with a specific email address where feedback can be sent. Further the author argues that user feedback is an easy way to gather data about the system in use, since it is the user themselves who takes the initiative of sharing their thoughts and feelings.

**Thinking Aloud** is used in order to getting to know what the user (test participant) is thinking and feeling while performing tasks (Rubin & Chisnell 2008). Therefore the users conceptions and misconceptions of the system or interface easily can be identified (Nielsen 1993). Nielsen (1993, p.195) describes the technique as maybe being the “single most valuable usability engineering method”. The method is carried out by asking the user or test participant to verbalize his or hers thoughts and feelings while using a system. This can feel unnatural to the user, why it might distract the user from the actual task. Also the method might simplify the task that the user is performing, since how the task is being performed is getting so much more attention than it normally would. (Rubin & Chisnell 2008) Dumas and Redish (1999) suggests that the user gets to practice the thinking aloud-technique before the actual test start, just to get the user to “warm up”.

**Constructive interaction, codiscovery learning** is used just as Thinking Aloud (see the section above), where the test participant verbalizes thoughts and feelings throughout the test. The difference between the two methods is that constructive interaction uses two test subjects, who perform the tasks together (and talks to each other). Nielsen (1992) argues that the technique though demands additional test subjects, but in the same time the method can feel more natural for the test subjects (especially if the test subjects are children). (Nielsen 1992)

**Follow-Up Studies** is the most reliable method giving the most correct data for evaluating usability according to Rubin and Chisnell (2008). The authors state this since when the follow-up studies are conducted, all the contributing aspects and characteristics are in place, and why an accurate picture and view of how usable the system are can be measured.

**Eye-tracking** is a technique that can be used to evaluate where a user looks at a screen (i.e. an interface) (Nielsen 1993). According to Benyon (2010) the eye-tracking, or eye-movement tracking, can show what in the interface that attracts the user’s attention, and what parts that are completely overlooked. Eye-tracking software can be used to record what the screen was showing while the user was looking at it (Nielsen & Pernice 2010). Nielsen and Pernice (2010) stresses that the eye-tracking technology cannot explain why some parts are looked at and why some are not, neither can the eye-tracking show what the user was feeling or thinking when looking at a certain thing. Therefore the eye-tracking technique cannot show why certain parts of the interfaced were looked at and why some parts were overlooked.
Rubin and Chisnell (2008) argue that eye-tracking devices are expensive, and that the data can be hard to interpret.

**Prototyping** is a technique where a prototype is being used to evaluate a system or a product. A prototype means a “representation of all or part of an interactive system, that, although limited in some way, can be used for analysis, design and evaluation” (ISO 9241-210:2010). A prototype can be a product with fully working interactivity, but less developed functionality, a simple paper sketch or a “static mock-up” (ISO 9241-210:2010).

The main characteristic of the prototype is that it’s interactive, according to Benyon. Further Benyon (2010, p.184) describes that “Prototypes may be used to demonstrate a concept (e.g. a prototype car) in early design, to test details of that concept at a later stage and sometimes as a specification for the final product.” The author claims, “The point is to explore ideas, not to build an entire parallel system or product.” (Benyon 2010, p.95). This means that prototypes are supposed to be developed as a part of the process of understanding what is to be developed, and to evaluate the design and ideas with both the development team as well as with the costumers and users.

Nielsen (1993, p.94) states “The entire idea behind prototyping is to save on the time and cost to develop something that can be tested with real users.” The strength of prototypes is that the prototype can give an insight in how the system will feel, what it can do, or how it will look when it’s finished. The advantage of prototyping is that just a part of the system is being prototyped and then letting the user, the team, the stakeholder etc. see, try and evaluate the prototyped part. Benyon (2010, p.185) states that prototypes are especially beneficial to show for “clients and ordinary people”, since they will not understand technical descriptions and such. Nielsen (1993, p.94) describes that there are “two dimensions of prototyping: Horizontal prototyping keeps the features but eliminates depth of functionality, and vertical prototyping gives full functionality for a few features.” These two dimensions mean that prototypes that show the features of the system can be constructed or prototypes that shows the systems functionality. Nielsen (1993, p.95) claims that the horizontal prototyping will show how “well the entire interface “hangs together” and feels as a whole”. Further Nielsen states that the vertical prototypes show a specific function in whole, and enables that specific function to be fully evaluated and tested. Therefore, depending on where in the usability engineering lifecycle the system is at, different types of prototypes are beneficial to develop.

Benyon (2010, p.185) claims that there are two types of prototypes: “low fidelity (lo-fi) and high fidelity (hi-fi)”. Further Benyon states that the high-fidelity prototypes often looks like what the final system will look like, but is not having all the functionality that the finished system will have. The low-fidelity prototypes are according to Benyon (2010, p.187) often made from paper and are concentrating on basic ideas of how the finished system should be when it’s implemented, such as “content, form and structure, the ‘tone’ of the design, key functionality requirements and navigational structure”.

According to Leventhal and Barnes (2008), the horizontal prototype is a high-fidelity prototype on a wide range of features, but is low-fidelity in terms of functionality. Further they state that the vertical prototype is “high-fidelity on only a portion of the final product”, i.e. some of the features are in high-fidelity.
High-fidelity prototypes
The high-fidelity prototypes focus on the details of the system or design, and can sometimes function for showing the “final design” for the user or customer (Benyon 2010). Examples of high-fidelity prototypes are video prototypes or prototypes using the Wizard of Oz technique (though, important to point out is that Wizard of Oz prototypes can also be seen as low fidelity prototypes, described in a later section, since they do not need to feel or look “finished”). Below the Wizard of Oz technique will be further described.

Wizard of Oz

The Wizard of Oz-technique is a method where the functionality of the system is being controlled and handled by a human (the “wizard”), instead of the system it self. This means that the functionality does not have to be implemented in order to be tested on users. (Nielsen 1993) The user who interacts with the prototype is unaware of that the input and output from the prototype are handled by the “wizard” (Leventhal & Barnes 2008). The technique requires that the “wizard” has some experience so that the prototype and the possible interaction are held at a reasonable, manageable level, so that the prototype work in a way that the user is “fooled” to believe that the user is in “control” and that the interaction is real (Nielsen 1993; Leventhal & Barnes 2008). The roles can also be switched by letting the user be the “wizard”, and letting the developer be the user. Then the developer gets to see what kind of output the user thinks that the system should give, depending on what interaction is carried out. (Pettersson 2003)

At Karlstad University in Sweden a laboratory called Ozlab has been set up, where a system based on the Wizard of Oz-technique are used. The Ozlab system makes it possible to test the interactivity of multimedia products, before any programming is done. This is a beneficial strategy especially where paper prototypes are not suitable for testing the interaction between the user and the system. (Molin & Pettersson 2003) To be able to use the Ozlab only a few pictures and some “wizard”-supporting functions need to be set up. This enables the Ozlab system to be used for “explorative experiments” (p.78), where improvisation is a part of the development work, and further as an aid in the requirements work. The requirement work for multimedia products is according to the authors a complicated job, since the requirements for multimedia products for example can be hard to explicitly express and make measurable. The Ozlab can, according to the authors, be used for showing layout alternatives to the client, including interactivity. Therefore the client can be a part of the requirement work, without the costly need for the development team to develop a set of product alternatives. The requirements then are visualized instead of just written, and possibly loose ideas and thoughts can be clearer presented.

"Admittedly, even if this method makes it impossible for the designer / developer to fool her- or himself, the whole set-up is built on fooling someone else” (Pettersson 2003, p.163) Since the Wizard of Oz technique is built upon “tricking” the test subject into believing that the interaction is real, the technique comes with some ethical obligations. The test subject should, according to Pettersson, be informed about how the test were carried out after the test is finished, and if the test subjects want the collected data to be deleted, the test leader should agree.
Though Pettersson argue that fooling the test subject isn’t always required in order to use the Wizard of Oz technique successfully. Depending on what kind of product being tested, the interactivity can be tested without fooling the test subject. For example if a mobile interface is being tested on a computer screen, it may be clear to the test subject that the interface and the interaction is not real. According to Pettersson the Ozlab then rather become a tool for communication for the development team.

Disadvantages with high-fidelity prototypes
There are some disadvantages with high-fidelity prototypes according to Benyon. “A problem with developing hi-fi prototypes is that people believe them!” (Benyon 2010, p.185) Benyon mean that the high-fidelity prototypes looks so real and fully implemented that the user or costumer can be tricked into believing that that is the case. “Another problem with hi-fi prototyping is that it suggests such a system can be implemented.” (p.196) Further Benyon holds that some things that are implemented in the prototype using techniques in animation programmes etc. can fool the customer into believing that the implementations are possible for the actual system. But some functions might not be able to be implemented in the actual programming language used for the actual system.

Another aspect of the prototypes is the time delays. “If you can anticipate the length of any delays, build them into the prototype.” (Dumas and Redish 1999, p.75) The response time that will be present in the actual system might be missing in the prototype. This might make the users interpretation of the prototype more positive than for the actual system, since the time delays might be shorter. Dumas & Redish argues that the prototypes should contain such response times, if the user feedback should be accurate.

Low-fidelity prototypes
Low-fidelity prototypes can be, and often are, made of paper. They are then called paper-prototypes or paper mock-ups (Nielsen 1993). The main characteristics of the low-fidelity prototypes are, according to Benyon, that they are fast developed, fast used and quickly thrown away. Since they are developed so easily and quickly, they are also cheap to use as a usability engineering tool (Rubin & Chisnell 2008). Benyon means that the low-fidelity prototypes focuses on design ideas rather than details of the design and system.

“"The value of the paper prototype or paper-and-pencil evaluation is that critical information can be collected quickly and inexpensively. One can ascertain those functions and features that are intuitive and those that are not, before one line of code has been written."” (Rubin & Chisnell 2008, p.18)

Rubin and Chisnell mean that paper-prototypes are cheap to use as a part of the usability engineering, and that the results is easily collected, even though it’s “critical information” that is very important for the products success. Further the Rubin and Chisnell mean that this critical information can be collected before any time (and money) have been used for implementing features and functions of the product.

Nielsen states that prototyping can be used for designing the interface, and that user tests can be performed on those prototypes adding understanding and information of how the interface and system should be implemented.
Disadvantages with low-fidelity prototypes

Disadvantages, according to Benyon, with low-fidelity prototypes are that they can be fragile, and when shown and used by a lot of people the prototype may be worn, impaired or shredded. Further Benyon mean that a risk with low-fidelity prototype also can be that too much detail are included into the prototype, making it hard to understand. Though, if too little details are included, the users might add the details them selves, or just “simply watch low-fidelity prototypes since they have only limited interactivity.” (Leventhal & Barnes 2008, p.198), and therefore decreasing the users feedback.

To assess, inspect or evaluate usability

Usability inspection is a term used by Mack and Nielsen (1994) to group together different usability engineering methods. Leventhal and Barnes describe these techniques as usability assessment. Usability evaluation is another term used for the same methods and techniques (Rubin & Chisnell 2008). These methods are not used in the earliest parts of the usability engineering life cycle (see section 2.4.1) since they inspect and assess the interface. To be able to inspect the interface, it has to be somewhat developed, although not implemented. (Mack & Nielsen 1994) Leventhal and Barnes (2008) state that the evaluation techniques conducted by experts (see methods below) can be used early in the development cycle, nipping some of the usability problems in their buds. Though, further the authors mean that some techniques are better used later in the development cycle. When to assess and inspect an interface therefore depends on what technique or method that is used.

Methods for usability assessment, inspection or evaluation

According to Mack and Nielsen (1994) usability inspection methods beneficially are used as a part of an iteratively focused development cycle, as well as combined with user tests. The usability inspection methods can be used first, then after the design has been updated and revised, the interface can go through user tests as well. Dumas and Redish also suggests that the techniques and methods are combined with user tests, since the severances of the problems found vary between the techniques and methods. The heuristic evaluation for example, as stated earlier in this section, often maps the local and less severe problems, while the user tests maps the problems that can have an actual effect on the usability and the users’ experience.

Leventhal and Barnes (2008) as well as Mach and Nielsen (1994) list a couple of usability evaluation techniques:

Analytic Evaluation can be used in order to foresee or describe how an interface will or should perform. Leventhal and Barnes (2008, p.214) explains that the Analytic Evaluation can predict “how long it will take users to operate a screen”, which then can be used to assess different interfaces against each other.

Evaluation by Experts or Heuristic evaluation is a way for a group of usability experts to find usability problems within an interface. The problems are found by the experts, working individually, by looking at the interface using a set of principles (i.e. heuristics). (Mack & Nielsen 1994; Leventhal & Barnes 2008) Nielsen (1993) mean that more usability problems can be found if the experts are allowed to, after theirs evaluations are done, to
communicate their findings to each other. Further the author mean that it is recommended to use 3-5 experts, maximising the findings.

The disadvantage with the heuristic evaluation is that the experts usually just find minor and less severe problems. This means that the problems found may not be severe problems from the user’s point of view, and the problems found might not even be worth spending time fixing, since they might not improve the usability of the system. (Dumas & Redish 1999)

**Guideline reviews** means when the interface is checked if it is unison with usability guidelines. Such documents can, according to Mack and Nielsen (1994), contain 1000 guidelines each, why the authors mean that the method is not commonly practiced since it demands such a high level of knowledge and expertise in guideline documents. Nielsen (1993, p.91) though argues “In any given project, several different levels of guidelines should be used”. The levels are “general guidelines”, “category-specific guidelines”, and “product-specific guidelines”. These different levels will add a more specific advice the deeper level you apply guidelines from. An interface can also be reviewed through a set of standards. Nielsen (1993, p.92) differentiates guidelines and standards, where a standard “specifies how the interface should appear to the user” and a guideline “provides advice about the usability characteristics of the interface”.

**Pluralistic walkthroughs** is conducted by walking through a specific scenario and discussing usability problems related with the scenario and interface, with people associated with the product being developed, such as users and developers. (Mack & Nielsen 1994)

**Standards inspections** infer that an expert evaluates an interface according to given standards. This method aims for getting all similar systems on the market obtaining the same standards. (Mack & Nielsen 1994)

**Cognitive walkthroughs** simulates and evaluates the ease of learning an interface, which is a process that can be seen as a problem solving process or as a “complex guessing strategy” (Dumas & Redish 1999, p.68). The user prefers to use this process, or guessing strategy, since the user then can learn the interface while using the interface (Wharton et al. 1993; Mack & Nielsen 1994; Dumas & Redish 1999; Leventhal & Barnes 2008) Dumas and Redish argues that the cognitive walkthrough isn’t as good for finding usability problems as other methods, such as heuristic evaluations and user tests.

**Formal usability inspections** are a formalized method for engineers and inspectors to find and describe usability problems in an efficient and time effective way. (Kahn & Prail 1993)

**Feature inspection** is a technique where the features of a system are being inspected and evaluated after how well they help the users reach the intended goals and perform their tasks. (Mack & Nielsen 1994)

**2.5 What can be tested?**

Dumas and Redish (1999) argues most if not all products benefits from usability studies and usability engineering, since everything that is used or read by a user has a interface that can be improved.
An interface, or user interface (UI), is the part of the product that the user interacts with (even though the user interface wasn’t interactive from the beginning according to Nielsen, 1993). The UI can, according to Leventhal and Barnes (2008) by some users be interpreted as the system itself, even though the UI is just the visual representation and boundary between the user and of the functional part of the system.

Human-Computer Interaction (HCI), sometimes called CHI (Computer-Human Interaction), is a huge field of study which usability and UI is a part of (Leventhal & Barnes 2008). Today the acronym HCI is more commonly used, since the field of HCI focuses on how humans interact with computers (systems). Usability is a common goal in the field of HCI. (ibid.)

Dumas and Redish (1999, p.27) suggests that usability testing can be used to ensure the usability of for example questionnaires, “interviewing techniques”, “instructions for non-computer products”, hardware, documentation, or software. The authors argues that the products or techniques tested can be medical products, consumer products, application software, engineering devices or from other areas like “voice response systems” or navigation systems. Further the authors argue that the usability tests are always supposed to be conducted as a way to ensuring an improvement of the products usability.

2.6 Who can ensure usability?

As earlier established (see section 2.4) a product’s usability should be analysed by asking and evaluating if the product’s intended user if the product fulfils the user’s needs and conceptions. Therefore the user must be included in the usability engineering process. Since the usability engineering is an iterative process consisting of a set of different tasks, how the user is involved differs from cycle to cycle and from task to task (for more information about these tasks, see section 2.4.1).

Though it is important to acknowledge that the user does not always know what is best for her or him, the user does not always know what she or he wants. Neither can the development team put the work with the design into to the users hands (for example through a possibility for the user to adapt the user interface in the finish product as she or he wants), since all user groups will not have the confidence or knowledge enough to use such feature. The later aspect also goes hand in hand with the previous, the user would not always know what is right for her or him why such design decisions should not be put in hers or his hands. Though it is not beneficial to fully exclude the user from the development process, just putting all the design decisions into the hands of the designer. (Nielsen 1993)

The designer is blind to flaws of the system, since the designer’s knowledge of how the system works (or should work) fills the gaps. For the designer and the team involved in the development of the system or the product all such gaps will be filled – making them believe that the system or product is perfect. A user lacks such knowledge of the system or product and will not be able to fill in the gaps, why the system will be hard to use or hard to understand. The designers and developers therefore are not suitable to participate as test participants in user tests, nor are they suitable to make all design decisions based on their own liking and feeling. (Nielsen 1993)
The same goes with letting a powerful person in the organization or company review the system, the manager is not representing the user and the user’s needs any more than the developer and the designer does. (Nielsen 1993)

To be able to ensure usability a couple of different resources are needed, beyond the activities of the usability engineering lifecycle model. Conducting user tests are endorsed as a complement to activities such as heuristic evaluation. (Mach & Nielsen 1994; Dumas & Redish 1999) To be able to conduct user tests a test team is needed. A test team can consist of just one person, but a few more persons are preferred (Dumas & Redish 1999). Below the test team and the roles included will be explained.

**Putting together a usability test team**

Depending on the type of test conducted different roles need to be casted. Dumas and Redish (1999) argues that the test team members should adapt the following roles: test administrator, briefer, camera operator, data recorder, help desk operator, product expert and narrator (these roles are explained below). Further the authors mean that each team member can adapt a couple of these roles each, since the authors argue that three people are the most beneficial test team size to have. A bigger test team would require a big space where the test is conducted, while a smaller team would demand the people on the test team to be very experienced. Dumas and Redish (p.234) argues that “some usability groups can only afford to have one usability specialist conducting each test” and they then argues for the disadvantages of this set up. The authors mean that when conducting tests with this one-person-set up some compromises must be done, since one person can’t shoulder all roles. According to Dumas and Redish this compromise often comes in collecting data. The authors mean that some data might be missed or even collected since it’s hard to observe, take notes, assist the test subject (if needed), log data and take care of the cameras (if used during the test) etc. all at the same time. After the test the observations and data cannot be compared with data collected by someone else. Also the authors mean that a much longer time might be needed for analysing recordings from the test if observations couldn’t be done during the test.

Dumas and Redish argues that the test administrator leads both the team as well as the test. The test administrator has the responsibility of seeing through that the test runs as planned, why the test administrator has the responsibility of handing out tasks and work to the rest of the team. The authors mean that the test administrator often is “the project leader for the entire testing project” (p. 242).

The briefer takes care of the test participants. This includes for example welcoming the test participant and explaining how the test will be conducted as well as what obligations (and rights) the test participant have. (Dumas & Redish 1999)

Camera operator is a role that handles the equipment that records audio and video. According to Dumas and Redish it is important that the camera operator understand what is supposed to be recorded, what to focus on.

The data recorder is a very busy role to shoulder according to Dumas and Redish, and the most time consuming one. The data recorder is responsible for taking notes of
everything of interest during the test, from for example what the test participants says to how many times the test participant “incorrect field entries” (p.245).

The one shouldering the role of the help desk operator will have to assist the test participant when needed during the test (how much help the participant is allowed to get during the test must be decided on before hand, too little or too much help will make the collected data less accurate). (Dumas & Redish 1999)

The product expert is responsible for that the product being tested is up and running. During a test the product may crash, and the product expert is supposed to handle this so that the test can continue as soon as possible.

Dumas and Redish argues that the narrator’s responsibility is to interpret what the test participant is doing and maybe saying, and then communicate this information to the data recorder who then logs the information.

Rubin and Chisnell (2008) argue that the test moderator is the most important role of the usability test team. According to the authors the test moderator is responsible for taking care of the test participant before, during and after the test. The responsibilities of the test moderators also include collecting data, as well as compiling and comparing the data after the test. The authors mean that the test moderator should be someone that is not deeply involved in the product’s development, since “it is almost impossible to remain objective when conducting a usability test of your own product” (p.45). Though, if there is no one else that can do the usability testing, a person that is involved in the products development is better as a test moderator, than conducting no test at all.

2.7 Where can usability be tested?

Usability studies can be conducted in either a controlled laboratory environment or in an uncontrolled environment, so-called field testing, testing “in the wild” or “in-situ studies” (Rogers et al. 2007).

Rubin and Chisnell (2008, p.93) argues that “Rather, a commitment to user-centered design and usability must be embedded in the very philosophy and underpinning of the organization itself in order to guarantee success.”. The authors mean that just because an organization implements a usability laboratory, it does not mean that the usability will be present in all developed products by it self. The usability laboratory must be used, and the organization it self must adapt their processes so that usability is concerned and engineered throughout the development process. Further the authors mean that the most important thing is that the person(s) conducting the usability tests and evaluation have the right understanding and knowledge about methods and techniques. The authors mean that if that knowledge is missing then the usability laboratory, no matter how advanced and well equipped, will be useless.

Nielsen (1994) also argues that the first action towards engineering usability is not to invest in and to build a usability laboratory. Further the author claims that:

“Once a company has recognized the benefits of the systematic use of usability methods to improve its products, management often decides to make usability a permanent part of the development process and to establish resources to facilitate the use of usability methods by the various project teams. Two such typical
This means that the organization first should make the effort of making the usability engineering a part of the development process. The usability laboratory is the second step.

Capra, Andre, Brandt, Collingwood and Kempic (2009) discuss what should be a part of the usability laboratory, and if a “standing lab” is necessary or not. Capra et al. (2009) discuss if some organizations benefits from having a portable laboratory set up instead. The authors further discuss what facilities the both setups should or could contain.

Rubin and Chisnell argues that the usability laboratory can be expensive to set up, but that an expensive laboratory is not needed for conducting usability tests. Further the authors argue that all usability tests do not have to be conducted in a laboratory. Some tests are better conducted in other environments. Rogers (2011) argues that more and more usability studies are conducted outside of the controlled laboratory environment, in field, such as in the streets or in people’s homes.

Rubin and Chisnell discuss the possibility of conducting remote usability tests. This technique is good if collecting data from test participants far away from where the team is situated. When conducting remote usability tests the Internet is mostly used.

Though, the laboratories do not have to be only for user tests. Nielsen (1994) argues that the laboratory can be used for more than just conducting usability tests. Other activities that have to do with usability engineering can also be conducted in the usability laboratory. Nielsen (1994) claims that activities such as focus groups and task analysis as well as participatory design also can be valuable to perform in the usability laboratory. The later is especially beneficial if the set up includes video cameras. Further the author mean that heuristic evaluation also can be conducted in the laboratory.

During this study it have been found that there are few “recipes” for how the usability laboratory should be set up, what it should contain etc. (see section 3.4). Though, there are a few facilities that are common in usability laboratories, both in permanent and portable labs. In the following section such facilities for usability laboratories and field-testing will be explored and explained.

2.7.1 Usability facilities

When conducting usability tests with users it is common to conduct the tests in a usability laboratory. Nielsen (1993) argues that a laboratory set up specifically for conducting user tests is not obligatory in order to conduct tests. Further the author argue that the laboratory can make the test procedures easier, and conducting the user tests as a part of the development process stand a better chance of being a part of every development cycle and project.

Below a couple of facilities that are commonly used in usability laboratories will be explained.
Common facilities in usability laboratories

Figure 1. A usability laboratory, according to Nielsen (1993, p.201, Figure 20)

Many usability laboratories consist of at least two rooms, one room where the test participant participates in the usability test and another room where the usability test team is situated (called either the observation room or the control room) (see Figure 1). Some usability laboratories also have an executive viewing room that overlooks the test room as well as the observation room, as seen in Figure 1. (Nielsen 1993, 1994; Dumas & Redish 1999; Pettersson 2003)

Nielsen (1993) argues that the usability laboratory often is sound proof so that the test team can talk with each other without disturbing the test participant. If the usability laboratory consists of at least two rooms, the observation room and the test room is often separated by a one-way mirror, allowing the test team to observe the test and test participant (Nielsen 1993, 1994).

Computers are used both in the test room and the observation room. Depending on how flexible the laboratory needs to be either stationary computers or laptops can be used. In the observation room additional monitors can be available, showing the test participants screen and the view of the cameras. (Nielsen 1993; Pettersson 2003; Capra et al. 2009)

Cameras are common in the usability laboratory and are used to record the usability test. The cameras can be either portable or mounted, depending on how flexible the usability laboratory needs to be (Nielsen 1993; Capra et al. 2009). The cameras usually can be controlled via the observation room, enabling the test team to focus on different things throughout the test. Nielsen (1993) argues that the cameras in the lab often show a view of the whole test room, the participants face, and the parts that the test participant interacts with during the test (such as the computer screen, instructions etc.).
When conducting usability tests it can sometimes be suitable for the team in the observation room to talk to the test participant or give instructions. When conducting tests using the Wizard of Oz-technique, the output from the system sometimes can be in audio (Pettersson 2003). For this a microphone is needed in the observation room, as well as speakers in the test room. A microphone can also be suitable to have in the test room so that the test participant can be recorded (Pettersson 2003).

Pettersson (2003) argues that a voice disguiser can be suitable when conducting Wizard of Oz-tests, allowing the test moderator to work as both a “wizard” and a test moderator. Since the interview after the test can contain questions about the audio feedback, the test moderators voice then should be disguised during the test, so that the test participant does not hesitate on giving honest feedback.

For logging data during the test data-logging software can be used (see the role data recorder under section 2.6) Software that records the screen can also be used in order to log data during the test. (Dumas & Redish 1999; Pettersson 2003; Capra et al. 2009)

Eye-tracking devices are not common in usability laboratories according to Nielsen (1993) but are sometimes available (see section 2.4.2 for more information about eye-tracking). Other facilities that can be usable to have in the laboratory is: a printer, audio mixer, portable wall (if the laboratory consists of only one room) and headphones (Dumas & Redish 1999).

**Common facilities in portable laboratories**

To perform usability studies outside the usability laboratory is becoming more common (Rogers 2011). Some usability studies are better conducted in the context of use (Rubin & Chisnell 2008). Nielsen (1993) argues that a portable laboratory does not need to contain other facilities than a notepad and a laptop where the software being tested is running. Further the author argues that the portable laboratories usually consist of a few more facilities. Common facilities in portable laboratories, or facilities used for in-situ studies, are explained below.

When conducting in-field studies a camera is often used to record the usability test as well as the user’s expressions and reactions (Nielsen 1993; Rogers et al. 2007). If the test runs for a long period of time it is wise to use a stand for the camera (Nielsen 1993). In order to also record the user’s comments at least one microphone is beneficial. Nielsen argues that the built in microphones (in the web camera, USB-camera or other video equipment) often does not provide good sound quality, why external microphones are beneficial to use. Further Nielsen claim that additional microphones can be beneficial if other sounds or comments than the users’ are supposed to be recorded. Capra et al. (2009) argue that test can be successfully recorded with a web camera and the built-in microphone.

Eye-tracking devices can be a part of a portable laboratory, since portable eye-tracking devices are available (Tobii 2011).
2.7.2 Should usability studies be conducted in a usability laboratory or in field?

Rubin and Chisnell (2008) argue that all usability tests should not be conducted in a controlled testing environment such as a usability laboratory, since other environment fits the product being tested better and give more accurate data.

Nielsen (1993, p.205) argues that with a portable usability laboratory “any office can be rapidly converted to a test room, and the user testing can be conducted where the users are rather than having to bring the users to a fixed location.”

Rogers (2011) argues that designing and evaluating outside the laboratory and controlled environments are becoming common, thanks to new technologies, materials and methods. Prototypes can be designed and combined in field by interaction designers rather than just by engineers and scientists as the author mean that the case was earlier. Rogers mean that results from in-field studies differ from test results from studies conducted in a controlled laboratory environment. The author means that the controlled laboratory environment does not include properties of HCI that is present in real life. Rogers mean that HCI in real life is not conducted as it often is in a controlled laboratory, since the laboratory does not present the distractions and disruptions that would normally be present when a user interacts with a computer (system). The author mean that theories about interaction design and HCI that derives from studies conducted in laboratories is not fully applicable, since the theories do not take into consideration the actual context of use. Rogers mean that a part of the solution would be “importing different theories into interaction design that have been developed to explain behaviour as it occurs in the real world, rather than having been condensed in the lab.” (Rogers 2011, p.60). Further the author argues that new theories should be developed from the research conducted in field, and that how the already available theories are used should be developed and adjusted to in-field studies.

Though, according to Kaikkonen, Kallio, Kekäläinen, Kankainen, and Cankar (2005) in-field studies is time consuming, and that testing in a controlled laboratory environment can sometimes replace the in-field testing. This decision should, according to Kaikkonen et al. depend on what is being tested. The authors mean that if it is the interaction in a mobile application that is being tested, a test conducted in the usability laboratory works just as well as in-field testing (the same usability problems are found), and is more effective.

Kjeldskov and Stage (2004) developed various techniques of testing mobile applications in a controlled laboratory environment. They used techniques that were supposed to imitate using a mobile application in a real life environment, which typically demands focus from the user, such as using a mobile application while walking in a street of a city. They found that just letting the test subject sit down at a table and use the talk aloud-technique (see section 2.4.2) showed as much and more usability problems as the techniques imitating scenarios that demands shifting focus. The authors also compared their laboratory techniques to a test done in an actual street. The difference between the techniques was according to Kjeldskov and Stage (2004) that the test subject pointed out the most critical problems when performing the tests that demanded shift of focus, while the test where the test subject sat down showed the most critical usability problems and less critical problems as well.
Razak, Hafit, Sedi, Zubaidi and Haron (2010) compared usability testing in laboratories with in-field studies, where the test participants were children. In their laboratory studies the authors used usability testing guidelines but for the in-field studies the authors mean that no such guidelines exists, why they “applied some techniques suggested from the social studies” (p.104) instead. Razak et al. conducted the in-field studies in a pre-school, where the school’s computers were used. The computers were placed in an area where children that did not participate in the test could “disturb” the test participants. The authors mean that it was “very hard to prevent other children from disturbing the test participants due to its physical location” (p.107). According to Rogers (2011) the whole idea with in-field studies is that such disruptions as Razak et al. describe occur, allowing the test team to evaluate how well (or poorly) the product can be used and understood, despite disruptions and disturbances.

Razak et al. found through their studies that usability problems are not suitable to find during in-field studies with children as test participants, but that the “field study is more suitable for understanding children experience with technology [sic]” (p. 108). The authors suggest that some steps are to be included to the guidelines they used, such as visiting the children in their natural environment (of use) early in the development cycle. This suggestion is similar to the first step of Nielsen’s usability engineering lifecycle model (see section 2.4.1 The Usability engineering lifecycle model). Further Razak et al. mean that a pilot test should be conducted with a “child representative” (p.108) and that the laboratory should be made safe for the children to spend time in.

According to Kjeldskov and Stage (2004), Kaikkonen et al. (2005) and Razak et al. (2010) studies where usability problems are meant to be found are not necessarily beneficial to conduct in field. Rogers, Connelly, Tedesco, Hazlewood, Kurtz, Hall, Hursey and Toscos (2007) though are of a different opinion. Rogers et al. (p.337) argue, “Traditional evaluation methods and metrics, designed for controlled laboratory settings, fail to capture the complexities and richness of the real world in which the applications are placed.” Rogers et al. conducted an in-situ study that “greatly improving both its [a mobile learning device] situated use and usability” (p.338). The in-situ study showed how the mobile learning device was used, rather than how it was supposed to be used. The authors argue that everything should and cannot be collected through in-situ studies; the challenge is to combine techniques that gather data that is needed for the research. Rogers et al. combined data logging, video capturing the use, focus groups (consisting of the users that participated in the in-situ study), and logging users comments throughout the in-situ study. Rogers et al. argues that while the in-situ study were time consuming and demanded a big effort from the test team, the usability problems found in their in-situ study could not have been found in a laboratory environment or anticipated on beforehand. The authors mean for example that the usability problems was not found when conducting a heuristic evaluation on beforehand.

2.8 Uganda

Uganda is one of the fastest growing economies in the sub-Saharan Africa. Though, the industrialization and the service sector are currently held back because of the daily power
outages, caused by the lack of energy that Uganda is suffering from. The lack of power in Uganda is a result of increasing power demand, drought, erratic power distribution system as well as delays in the plans for further expanding power generation. (World Bank & Wagner 2010)

The population in Uganda were estimated to 33,425,000 people in 2010 (United nations 2011). In 2009 the subscribers of telephones in Uganda were 9,617,267 people, of these 9,383,734 people were subscribers of cellular phones, and just 233,533 people were subscribers of fixed telephones, according to statistics from Uganda Communications Commission (UCC) stated and put together by Uganda Bureau of Statistics (Uganda Bureau of Statistics n.d.).

“The short message service (SMS) is popular in Uganda. According to UCC, some 294 million SMS messages were sent during the January–March 2009 period, compared to 190 million in the preceding quarter (October–December 2008).”

(International Telecommunication Union 2009)

The citation above illustrates how big the usage of SMS-services and the communication technique are in Uganda. Ugandans can use their mobile phones for services that let them receive weather forecasts, sports results, other information from databases such as farming techniques and for using their mobile phones for m-banking services (ITU 2009). M-banking is a service that is used for withdrawing money from ATM-machines, transfer money and pay bills via the mobile phone (Wireless Federation 2011b). For low-literacy users some service providers offer voice-sms, making the information available for those who cannot read or write (International Telecommunication Union 2009).

Even though the mobile industry is reported to be big and increasing in Uganda, the Wireless Federation (2011a) reported that the performance of the mobile networks is low, since many calls are blocked or dropped (two service providers were said to have 11,1 versus 15,2 per cent blocked and dropped calls).

According to Uganda Communications Commission (2012), all unregistered SIM-cards in Uganda must be registered during 2012-2013. This also includes Internet modems for computers and mobile fixed lines. The unregistered SIM-cards will not be usable after 1st March 2013. This registration is done to identify mobile phone SIM card owners, “track criminals who use phones for illegal activities” etc. (ibid.)

The Internet connectivity in Uganda is increasing. Earlier Uganda depended on satellites for Internet connectivity, but in 2009 the country were connected to the fibre optics that were installed on the African east coast (BuddeComm 2012b). Though, most of the connection to the Internet is provided by wireless options. Wireless techniques (such as the standards WiMAX (4G) and 3G1) has improved and expanded the Internet connectivity in Uganda. According to the International Telecommunication Union (2009) 12,5 per cent of the population in Uganda use the Internet. BuddeComm (2012a) state that less than 20% of the people in Uganda are connected to the Internet or have bank accounts.

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2.9 Makerere University

Makerere University is along with Mbarara University the biggest in terms of academic research (World Bank & Wagner 2010). At CIT at Makerere University the undergraduate students can attend courses in interaction design, among other subjects.

“Human Computer Interaction” is a course that focuses on different aspects on HCI (such as psychology, ergonomics, human information processing, design principles) and how a user interacts with an interface. (Makerere University n.d. a)

“User Interface Design” is a course focusing on the design, implementation and evaluation of user interfaces such as graphical user interfaces and web sites. The course includes teaching the students how to identify users’ tasks and needs, by using different techniques such as prototyping. Both courses are given at undergraduate level. (Makerere University n.d. a)

On the Master’s level, the course “Web design and Usability” enables students without earlier education in IT, as well as students with earlier IT education to learn about Web Design (languages like HTML, XML, CSS, JavaScript, PHP), multimedia technologies (Flash) and how to create a web site with high degree of usability. (Makerere University n.d. b)

The students at Makerere University do not get any opportunity to conduct usability studies in controlled laboratory environment; as such facilities are not currently available at Makerere University. Though, as stated above, the students do come in contact with usability and activities related to the field of HCI.
3. Methodology

To be able to fulfil the purpose of this study – to find out what kinds of usability facilities that are beneficial for CIT at Makerere University to have, and therefore answering a) What conceptions or misconceptions of usability studies do the stakeholders have? and b) What needs do the stakeholders have for usability facilities? – both primary and secondary sources of data and information have been used. This chapter presents how the topic and methods were chosen, how data has been collected and analysed, as well as how the research has been carried out.

3.1 Choosing topic

Thanks to John Sören Pettersson, professor and dean at Karlstad University, and his contacts with Dr Rehema Baguma, senior lecturer at the School of Computing & IT, College of Computing & Information Sciences at Makerere University the opportunity for me to go to Kampala, Uganda, and collect data for this study came up. Dr Baguma is responsible for the development of the plans of the usability facilities at Makerere University, and before this study started the plans were in an early stage where stakeholders just had been contacted. This study has been a part of developing those plans further.

My interest in usability studies was developed during courses taken at Karlstad University as a part of my education.

3.2 Choosing respondents

The respondents in this study are representatives of the potential stakeholders (for simplicity, sometimes referred to as just “the stakeholders” in this study) of the usability facilities at Makerere University in Kampala, Uganda. The respondents were picked purposively, some for this study in particular. Thus, before my work started, 20 stakeholders were initially picked and invited via email to a consultative meeting. 17 of these 20 invited stakeholders participated, representing 9 different companies, organizations and universities. These companies and organizations are from different sectors such as telecommunication sector, non-profitable organizations dealing with human rights, an organization dealing with information technology, web and application development, and a university. The stakeholders from universities participating in the consultative meeting belong to Makerere University. At the meeting a survey was handed out in order to map the needs of the stakeholders (see section 3.3.1 The two surveys).

My field research started after the consultative meeting were held. The collected data at the consultative meeting were then analysed for this study. The analysis showed that stakeholders from areas such as software developing, economics and health organizations were missing, stakeholders who were seen as crucial for both the plans of the usability facilities as well as this study. Therefore 25 additional stakeholders from 10 companies and organizations were purposively chosen and encouraged to participate in a digitally distributed survey. Some of the respondents were personal contacts to Dr Baguma. These 10
companies and organizations represented sectors of software development (private sector and from Makerere University), banking, health, mobile and telecom.

3.3 Data from primary sources

Data from primary sources means first hand information like observations or answers in a survey (Patel & Davidson 2011).

All respondents (the stakeholders) in this study are sources of primary data, and the method used to gather this data in has been through surveys.

“Surveys can be used at any time in the lifecycle but are most often used in the early stages to better understand the potential user. An important aspect of surveys is that their language must be crystal clear and understood in the same way by all readers, a task impossible to perform without multiple tested iterations and adequate preparation time.” (Rubin & Chisnell 2008, p.18)

According to Rubin and Chisnell (2008) a survey is a tool often used to collect data about the potential user. Since this research has been a preparatory work, i.e. it has been conducted in the early stages of the project; a survey was decided to be a good method for gathering data. Surveys, though, have the disadvantage of being static. Once the survey is handed out to the respondents, little or nothing can be changed. If the questions in the survey aren’t clear enough or aren’t understood by the respondents, little can be done. There is also a risk with surveys that the respondent interprets the questions in another way than intended. (Rubin & Chisnell 2008) The risk with surveys therefore is that the degree of validity\(^2\) is low, since other data than the intended one are collected (Silverman 2010).

Conducting interviews with stakeholders might have been the most obvious method of collecting data for this study, but because of my time in Kampala collecting data was limited (I were in Kampala for four weeks) and none of the additional stakeholders were contacted beforehand for the second survey I did not have the time to conduct interviews. Conducting interviews would have demanded that the data from the first survey were analysed before my arrival in Uganda, so that what additional information needed to be collected was already clear. Such an analysis was not possible to conduct before I arrived in Kampala. In Kampala it was also clear that it would have been hard for me to arrange interviews with the local stakeholders. The bureaucracy of the companies and organizations would hinder me as a student to interview stakeholders about how they conceive their development of products and services.

Thus, handing out a digital survey was considered to be the best option. Since surveys were also a tool used to gather data in the project before my arrival, the data from the second survey could be used to immense the data from the first survey.

3.3.1 The two surveys

The work with collecting data for this study has been done iteratively, where two surveys have been handed out to purposively picked respondents.

\(^2\) Validity: “The extent to which an account accurately represents the social phenomena to which it refers” (Hammersley 1990, cited Silverman 2010, p.439)
The first survey

The first survey was handed out at a consultative meeting that was held at Makerere University in Kampala. The meeting was held with 17 people representing companies, organizations and Makerere University who were thought to be possible stakeholders of the usability facilities (see 3.2 Choosing respondents). The meeting started with an introduction to what usability studies are and what they are conducted for. Then a survey was handed out to all the participants at the meeting, in order to collect the stakeholders’ needs and conceptions (and misconceptions) of the usability facilities. The survey consisted of 11 fill-in questions about what the stakeholder would want to see in the facilities and what the stakeholder would like to use the facilities for (see appendix 1). Fill-in questions are questions that allow the respondents to write the answers themselves, instead of fixed alternatives with checkboxes or scales such as the likert scale (Rubin & Chisnell 2008).

After answering the survey the participants had the opportunity to ask additional questions, which they did (see appendix 1). Dr Baguma was the person holding the consultative meeting and who put the first survey together.

The second survey

It was decided that a second survey was to be handed out to additional stakeholders after an analysis of the initially collected data from the first survey was conducted. As mentioned in 3.2, this decision was made because information from certain stakeholder groups was missing. Because this study aimed to map as much as possible of the stakeholders needs and conceptions, all possible stakeholders needed to be included. The analysis also showed that certain information needed for answering the research questions of this study was missing, such as what conceptions the stakeholders have about usability and usability studies.

What conceptions the stakeholders have about usability studies might affect how to interpret their answers to the rest of the questions in the survey. Therefore the second survey included a question where the respondents were asked to explain what usability studies mean to them, and when, why and how such studies are conducted. Their (mis)conceptions might show that knowledge of usability studies must be disseminated in Ugandan companies and organizations, before the usability facilities would be successful. The stakeholders (mis)conceptions might also show that the usability facilities could be used to educate or train the companies and organizations in Uganda to better understand usability, getting them to realise that usability engineering is a beneficial process for both themselves as well as for the users of their products.

Therefore it was decided that a question about how the requirement engineering are conducted would be included in the digital survey as well.

The choice of method for collecting data meant that no verbally introduction was held to the second survey in contrast to the first survey. Since the data from the first survey showed that the knowledge about usability and usability studies wasn’t widespread among the stakeholders, it was decided that a written introduction would be attached to the survey. This introduction would give the stakeholders just as much information as they need to be able to answer the questions of the survey. By looking at the questions asked at the
consultative meeting, and roughly using the same introduction as given at the consultative meeting, the written introduction to the second survey was phrased and tested in a pilot (see below); the final version looked like this;

Usability testing is a process where products including software products are evaluated by testing them on users. This process can be a part of the whole development cycle, from requirement engineering, to evaluating the finished product. Usability tests can be conducted in a defined laboratory set up or at the place of use. The purpose of usability testing is to measure how a product meets the user’s expectations and needs: if the product is easy and efficient to use, easy to learn and error free. Our interest in this exercise is in testing users’ ability to deal with computer programs, mobile services, and web sites.

The purpose of this survey is to find out from key stakeholders like you, if you would find such a facility useful and what services you would want from it. Please spare for us a few minutes and let us know what you think by filling this short survey.

**Setting up the second survey**

The second survey (referred to as “the digital survey”) was set up using the survey-tool in Google Docs. This is a free tool which is available online, why it was chosen for this study. To distribute the survey a link can be handed out to participants, who then answer the survey and submit it directly in the web browser. The answers are automatically collected and put together in a spread sheet by Google Docs. The data is available for export.

The digital survey consisted of 16 questions. The questions in the digital survey was structured after three thematic groups (except for the demographic data), which were 1) the respondents’ view of usability, 2) the usability engineering processes of the stakeholders, and 3) the stakeholders’ potential use of usability facilities at the university.

Two of the questions were yes/no-questions while the rest were fill-in questions. All questions were on the same page so that the participant easily could scroll down the page to see all the questions. The written introduction was included in the beginning of the survey.

The respondents were invited to participate in the survey via email. In addition to the link pointing to the survey, the email contained a short introduction to what the survey is about. The emails were sent from a CIT-email-address, supposedly adding trustworthiness to the survey itself.

To minimize the errors and bugs in the survey a pilot test on the digital survey was conducted (Rubin & Chisnell 2008,).

### 3.3.2 Pilot testing the digital survey

A pilot test is used to get the errors and “bugs” out of the test (Rubin & Chisnell 2008).

“The importance of conducting one or more pilot tests cannot be overstated.” say Rubin and Chisnell (2008, p.215). They mean that conducting at least one pilot test is of high importance, why the digital survey used to gather data in this study were pilot tested.

“Ideally, you should use a “real” participant, perhaps someone who is on the lower end of the expertise scale for what you are doing in this test.” (Rubin & Chisnell 2008, p.215)

The test subject of the pilot test was thought to be as alike to the stakeholders answering the

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3 Available formats for export from Google Docs survey tool are Excel, OpenOffice, PDF, CSV, Text, HTML.
survey as possible. Therefore the participant of the pilot test of the digital survey was in the IT/web industry, and were said to have good knowledge in English.

The pilot test was conducted by inviting the test subject to the survey via email. In the email information about the pilot test was included, as well as additional questions for the test subject to answer. These questions were:

- “Did you fill out the whole survey?”
- “Did you read the whole introduction? If no: Why?”
- “Did you find anything in the survey hard to understand (phrasing, words, questions, introduction, etc.)? What?”
- “Do you have any further comments?”

Only one pilot test was conducted on the digital survey. Ideally a few more pilot tests would have been conducted after changes was done to the survey, but because of time constraints no more pilot tests were conducted. The pilot test showed:

- That the introduction to the survey was too long – why the respondent didn’t read it all.
- That one question, referring to an earlier question, referred to the wrong question.
- That the test subject wanted to change the order of some of the questions.

After the pilot test the introduction were shortened and the errors stated above were corrected.

3.4 Data from secondary sources

Secondary sources means knowledge already available. Data from secondary sources has earlier been created or collected by someone for another study or research. (Patel & Davidson 2011)

3.4.1 Choosing and collecting data from secondary sources

The result of the literature review is reported in chapter 2. In this study Libris and Ebrary have been used to find books useful for the study in addition from what has been gained from courses taken by the author. Libris is a database over books available at Swedish libraries and it was used to find books available in the library at Karlstad University. Libris can also be used for an inter-library loan, but this service wasn’t used during the study since all books were available at the library at Karlstad University. Ebrary is a service that electronically provides books, and the access is granted via Karlstad University.

The study also includes articles found in databases. The databases that were searched through for this study were listed as databases within Computer Science and Information Systems by the library at Karlstad University. The library at Karlstad University offers full-length articles from some databases, which service where used during this study. The databases where articles were searched for was INSPEC/Engineering Village and IEEE Explore. Some of the articles that were found in the databases were not available as full text articles, why they were searched for in full text in Google Scholar as well. In some of the cases the articles were not available in full length, why they were not a part of this study.

Google Scholar has also been used for searching for other articles, to make sure no articles of interest were missed. Some of the articles found in both the databases and Google Scholar weren’t available in full length and not used in this study.
A number of keywords were used in this study in order to find articles\(^4\). Using keywords followed by an asterisk, which instructs the database to include results that contains the word, started the search for articles. This means that the search results from using for example the keyword “lab\(^*\)”, will include both “laboratory” and “laboratories”. These searches showed that usability is a broad topic, which meant the search needed to be narrowed down. Several keywords were then used to accomplish a more exact search. The keywords used in this study derive from reading some of the abstracts and keywords included in the articles from the first searches. As the search continued and more abstracts were read, more keywords were included and combined.

Much of the literature used in this study is written by big names with a lot of experience in the field of usability and HCI. I decided what articles to use and not to use by reading the article abstracts. This was done since the title isn’t always mirroring the content of the article. Thanks to the bibliography in both books and articles I was able to find more articles and books, as well as being able to rank the literature found. The ranking of the articles and books used as a part of this study was done by looking at how much the articles and books are referred to by other authors. A lot of referrals have been seen as a mark of quality, why the book/article has been included in this study.

3.5 Research model

The intention with this study is to analyse the stakeholders’ conceptions, misconceptions and their needs. This data are then to be compared with the data from secondary sources like articles and books. The result of the analysis is recommendations for the usability facilities.

The research was conducted by collecting data from secondary sources, in order to give a theoretical framework to this study. The data from the secondary sources were used to compare and validate the data from the primary sources. Data from primary sources have been collected in order to map needs, conceptions and misconceptions of the stakeholders. By comparing the secondary and the primary data, the analysis was conducted by interpreting the answers to the questionnaires according to the perspectives given in the literature and to the relevance they have for the plans to set up usability facilities at CIT. The conclusions are recommendations for what usability facilities would be beneficial for CIT to have. The analysis were conducted by reading and putting together the respondents’ answers, by using three thematic groups (except for the demographic data), which were 1) the respondents’ view of usability, 2) the usability engineering processes of the stakeholders, and 3) the stakeholders’ potential use of usability facilities at the university.

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\(^4\) The following search words were used to find articles in the databases: use\(^*\), usa\(^*\), eval\(^*\), lab\(^*\), test\(^*\), equip\(^*\), mobile\(^*\), usability lab, usability engineering, usability studies, usability tests, usability, laboratories, computer software selection and evaluation, testing, mobile, equipment, rural, Uganda, developing, countries, cross-cultural, non-Western countries, usability testing environments, internet, living lab, design engineering, laboratory design, program testing, software usability laboratories, telecommunication equipment, test facilities.
4. Results

Respondents of the first survey

20 persons were invited to the consultative meeting. 17 persons attended the consultative meeting and answered the first survey. The respondents of the first survey and also attendances of the consultative meeting were from the telecommunication sector, non-profitable organizations dealing with human rights, an organization dealing with information technology, web and application development, and one university.

The respondents in the first survey are not referred to with numbers, since the compilation did not include such groupings. The answers to the first survey are available in full length in appendix 1.

Respondents of the digital survey

The digital survey was sent to 25 additional potential stakeholders. 9 persons answered the digital survey. The respondents of the digital survey stated that they were holding the following positions of their organizations: Head of fraud prevention, project manager, senior developer, web administrator (2 respondents), technical manager, applications developer, and software developer. The respondents of the digital survey belong to the following sectors: economics, universities, telecom/mobile, and software development. Two of the respondents from the software development sector belong to the same company. Two of the respondents from universities belong to the same university.

The respondents of the digital survey are referred to with numbers. The answers to the digital survey are available in full length in appendix 2.

4.1 The potential stakeholders’ take on usability

In this section the answers from question four (4) in the digital survey will be presented.

4.1.1 What does usability studies mean to you? When, why and how are they conducted?

As explained in section 3.3.1, the first survey did not include any questions about what conceptions the stakeholders have about usability studies. The second survey included a question where the respondents were asked to explain what usability studies mean to them, and when, why and how such studies are conducted. Below are two examples of what the respondents of the digital survey stated that usability studies are:

“Usability studies refer to the fact finding techniques on how easy a user is able to use something. Which something may be a website, system, phone, car, computer etc.” (R5)

“Usability is the science and art of ensuring that designs can easily be interpreted by first time users, learnt and providing the functionality intended to translate into satisfaction.” (R6)
The stakeholders highlighted that usability studies involve the user or the targeted user. The respondents said that the usability studies are conducted as a process of getting to know how “easy and intuitive” (R2) the system are, how well a product “meets its intended use / purpose” (R3) and how “friendly, efficient, relevant” (R4) the system is to its users. Respondent 6 also included “first time users” in his or hers answer. Another argued that usability studies are about finding out how “easy to learn, easy to use and how stable the product is” (R7).

4.2 The potential stakeholders’ usability engineering processes

In the following section the answers from the question 13 (Are the users of the software you develop involved in the collection and specification of requirements?) and question 14 (If yes: How are the users involved?) from the digital survey will be presented. These answers show how the potential stakeholders conduct their usability engineering processes today.

4.2.1 Are the users of the software you develop involved in the collection and specification of requirements? How are the users involved?

As explained in section 3.3.1, the first survey a question about how the work with collecting and specifying requirements for the software that the stakeholders are developing was not included. The respondents of the digital survey were asked if the users of the software that the stakeholders develop are involved in the collection and specification of requirements. All the respondents stated that the users are involved; all the stakeholders said yes. Then the stakeholders were asked to describe how the users are involved.

Four respondents described how the users of the software being developed are included in the work with the requirements by saying that they conduct interviews, discussions or holds meetings with the users. Another claimed that

“The users are involved during requirement analysis to identify what exactly is needed of the new system and their expectations.

Also users are involved at the testing phase to know whether the designed system meets their needs. [sic]” (R8)

4.3 The stakeholders’ potential usage of the usability facilities

The answers reported in this section are from both the first survey and the second survey. The answers show for what and how the potential stakeholders would like to use the usability facilities, if such facilities were to be established by Makerere University. This section include answers from question number 2-9 in the first survey, as well as question number 5-6, 9-12 in the digital survey.

4.3.1 If a usability lab was established at Makerere University, would you be interested in using it?

All respondents of the two surveys stated that they were interested in using the usability laboratory if it were established at Makerere University.
4.3.2 Where would you want to use the facilities?

The majority of the respondents of the first survey answered that they want to conduct their usability tests in other environments than in a controlled laboratory environment.

The digital survey showed that the respondents wanted to use the facilities both in a controlled laboratory environment as well as in field. Five potential stakeholders stated that they wanted to use the facilities in other places than a laboratory at Makerere University. One respondent said that he or she wanted to use the facilities at the company the stakeholder belongs to. Three other stakeholders stated similar needs, such as “Both at the school and in the field” (R7), “In an environment where customers are and other staff” (R9) and “at various national reseach centres [sic]” (R1). One stakeholder explicitly asked for a portable usability laboratory by stating

“Also, a mobile usability lab might be a good idea (like if the facility could have a mobile unit equipped with means of performing tests “out in the wild”, on the streets or right at the target-user’s premises (e.g for products meant to be used in hospital, the army, factories, etc)” (R3)

The same stakeholder also wanted to be able to use the facilities at Makerere University when stating “Preferably at the University premises (advantage of high concentration of highly skilled stakeholders and a good share of totally un-skilled / green users).”

The answer “CoCIS Block B” (R4) also shows that some of the stakeholders want to be able to use the facilities at Makerere University, since CoCIS is an abbreviation of College of Computing and Information Sciences (at Makerere University) and “Block B” is a building at the campus, where the college is situated. One stakeholder stated that he or she wanted to use the facilities “In the useability lab [sic]” (R8), which is interpreted as that the stakeholder would like to have access to a permanent usability facility at Makerere University.

4.3.3 When would you want to use the facilities?

In the first survey the stakeholders were asked if they had any preferences of when they would like to use the facilities (see question 8 in appendix 1). Five of the eight answers were answers such as “Soon” and “Hopefully this year”. Two respondents gave answers that implicates that they would like to use the facilities when the timing is right, given that their answers were: “During product test launch” and “when I have a new app that I want to launch”. One stakeholder said that he or she wanted to use the facilities first “When it has achieved a good percentage of good testing results”. In the digital survey the respondents were asked the same question, and their answers showed that five of the nine stakeholders answering the digital survey want to use the facilities soon, by giving answers such as “As soon as its available” (R5), “before the end of the year 2012” (R4), “ASAP” (R6), “By October 2012” (R7). Three of them gave answers that shows that when they would like to use the facilities is depending on the project the stakeholder is in, if the price is right or “wherever a need arises” (R8). One stakeholder answered that he or she wanted to use the facilities “any time” (R1).
4.3.4 State services you would want the facilities to provide, and what services your organization would use

Question four was divided in two parts in both surveys (what services the stakeholder would want the usability facility to have, and what services the stakeholder’s organization would use). The answers of the two questions from both surveys are put together and presented as one in this study. The first survey showed that the stakeholders would like the facility to contain:

- Stress testing facilities
- Ability to simulate connectivity challenges in the field
- Relevant audiences for the systems
- Testing for the design
- Cross platform
- Open source
- Back end testing
- Interface testing
- Entire evaluation of the software product
- 3G coverage
- Wifi, computers, GSM coverage
- Experts
- Address grass root users
- Policy on issue of licenses
- Mobility to reach out to the user environment
- Factors in the local challenges such as power cuts
- A way to enable users express their version of the product
- Some level of networking (both wired and wireless)
- Mobile apps testing
- Platform(os) independent
- Mobile testing lab
- Tests to be in a typical working environment
- Training and evaluation reports and design testing
- Load and Stress testing infrastructure
- Virtual environment
- Consultation on user interface prototypes (e.g., discover ability, localization, back trackability), assessment of client’s ability to state their needs
- Web apps ease of use
- Mobile apps ease of use
- Simulation lab
- Training section
- Testing section

The first survey showed that the stakeholders would use diverse testing services. Such services would be used to test functional usability, integration, synergy and networking, stress testing, load times, response time, designs and interface testing. One respondent wanted to test User environment, which I interpret as that the stakeholder would like to test a product in field, performing in situ-studies. One stakeholder wanted that the facilities should supply with experts that can observe the intended (naïve) users.

Two stakeholders answering the first survey brought up the issue of testing “Sms-web based platforms” and “GSM and Data”. Further one respondent of the digital survey wanted to use the facilities for “mobile money services testing” and “internet banking testing”.

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There were not many wishes for certain equipment in the first survey, but one respondent stated that his or hers organization would use “All IT products”, which leads to what the respondents of the digital survey stated. Wishes for equipment and environment were few in the digital survey as well, but two respondents expressed wishes for a well-equipped laboratory when it comes to computers:

“a fully fledged networked computer laboratory with development applications.
[sic]” (R1) “Enough Computers and Peripherals please!” (R3)

One respondent also had wishes about the facility itself, saying that the space should be big enough and dedicated, making it possible for users of the facilities to change the space in order to work as the environment where the product will be used by the end-user.

Another respondent had a wish that the laboratory should be possible to use elsewhere, when he or she stated that it should be possible to conduct field studies on new products. The respondent was arguing that products that are supposed to be used by “the common man in Uganda” also should be tested “on” the common man.

One respondent answered that the facility should have “Client’s version of the product design”.

The digital survey provided answers that show what types of services the stakeholders would use in the facilities. Respondent number 2 answered that the facilities should contain “Data entry operational tools.” (R2).

As brought up by the stakeholders in the first survey, one stakeholder answering the digital survey wanted to use the facilities to “3) Research into new devices (tabs, smartphone) usability” (R2). One stakeholder wanted the facility to supply:

“- A service to explain to users what a new product does.
- Collection of comments and responses from users.
- provide the actual product to users and measure easy of use, ease of learning and error rate.” (R7)

There were some wishes for practicalities of the usability facility as well. One stakeholder wanted to “prevent bureaucracy” (R3) by putting up a remote access service, that is available for external parties. The remote access would be used for external parties that want to book the facilities, monitor, request, and assess the tests.

4.3.5 How are these services your organization would use currently met?

To the question “How are the services your organization would use currently met?” the respondents of the first survey answered:

- Pre-Launch tests
- Pilots
- in house testing
- UI experts
- We do in-house testing by one of the developers with one of the users.
- They are not
- Fitness for purpose verification through Uganda National Bureau of Standards (UNBS)
- External resources hired for the job
- Management review, regular demos
- Interactive development involving client users
The respondents of the digital survey answered the question by stating:
“(example) is relying heavily on the mother organisation for product development, testing and evaluation.” (R1).

“We are not a perfect team (no team is :-), but we try to have on board a wide range of skilled minds. Currently, when someone works on a product, you use principles to do the first set of usability tests, next someone else from the rest of staff can offer to emulate a client / user to further test, and eventually, we push the product out as a beta for the initial set of external users (who might not be the exact end / final users) to test and provide feedback.” (R3)

R3 stated that they perform tests during the early parts of the development cycle by using members of the development team. When the product is somewhat developed, the product is beta tested by users, but these users are not always the intended end-users of the product. Another respondent stated that his or hers organisation also use their team members for developing their products, by holding “scrum discussions” (R5).

One respondent (R6) stated that his or hers organisation follow standards (heuristics) for the design of menus, fonts etc., of their products. Further the respondent argues “but a lot still needs to be done”.

1. We deploy the software before it is widely tested by end users or possible end users and users learn as they use the software.
2. We keep close links with the users through the development process and they keep testing versions and new functionality as they are completed” (R7)

Respondent R7 stated that his or hers organisation educates their users in the use of their software, before it is further tested. Further the respondent said that their users are testing new functionality of the software when such are implemented. Another respondent (R2) stated that their users are involved in the development process by giving feedback, and through this feedback improvement of the software is implemented.

4.3.6 Would your organization be willing to pay (subsidized) for the services?

Only the first survey included this question, and the respondents’ answers were:
- 12 answered Yes
- 1 answered No
- 1 answered Yes and No

The respondent who answered no stated that the reason was:
- Because the cost may be too high for our organization

4.3.7 What might be your issues of concern that you would want addressed before you can trust and use the facility?

The respondents of the first survey stated that their issues of concern that they would want addressed before trusting and using the facility were:
- Intellectual property issues
- non disclosure agreement, a required time frame
- confidentiality, commitment and adherence to completion
- Usability testing goes inline with load and stress testing: The other tests before usability testing should be factored in because if the product is not efficient it will fail
- Mobility
• Human resources
• Harmonize issues of standards with the National Standards Body (UNBS) for ease of enforcement
• Confidentiality of software products provided
• Quality of testing
• Need for confidentiality
• Arrangements of Non Disclosure Agreement where info will not be passed on to competitors
• IP protection and standards

The respondents’ answers to the digital survey showed that the three of the respondents had issues of concern about confidentiality such as stated below:

“Prior to performing usability tests in the provided facility / premises, there should be clear and transparent legal steps taken to safeguard the product owner’s interests from prying eyes and evil intentions / users!” (R3)

“Also, I would be happy if the facility would offer some sort of guarantee that they offer reliable services— as in ability to allow clients to question the methods employed in assessing their products, but this might vary from client to client anyway...” (R3)

The same respondent stated that he or she wanted that the facility could show the respondent’s clients that the services and therefore methods and activities conducted and used in the facility is reliable.

“... The facility should be able to involve an equivalent of end users in the process. (example) is a software is meant for secondary school teachers, the facility should be able to involve a secondary school teacher from (examples)” (R7)

R7 would like to see that the facility could provide the tests with the intended end users of the product being tested, so that the tests contribute with accurate data.

The facility should be adapted, according to R8, to persons with disabilities, by enable access to those who cannot “go to high storage buildings”, and by providing headphones and LCD screens (instead of CRT screens) for those with hearing disabilities and “eye problems” (R8). Further the same respondent wanted the facilities to be air-conditioned.
5. Analysis

This chapter will interpret the answers to the questionnaires according to the perspectives given in the literature and to the relevance they have for the plans to set up usability facilities at CIT. The chapter is structured after the three major thematic groups of questions in the surveys (except for the demographic data), that is, 1) the respondents’ view of usability, 2) the usability engineering processes of the stakeholders, and 3) the stakeholders’ potential use of usability facilities at the university. The third section is the largest as this is the main focus of this study; it is looking ahead and analysing what usability facilities would be beneficial for CIT to have in the future. Finally, a fourth section condenses all the analyses of the two research question that was put in section 1.2: a) What conceptions or misconceptions of usability studies do the potential stakeholders have? and b) What needs do the stakeholders have for usability facilities?

5.1 The potential stakeholders’ take on usability

As explained in section 3.3.1, the first survey did not include any questions about what conceptions the stakeholders have about usability studies. The second survey included a question where the respondents were asked to explain what usability studies mean to them, and when, why and how such studies are conducted. This question was added since what conceptions the stakeholders have about usability studies might affect how to interpret their answers to the rest of the questions in the survey. The analysis of the feedback from the first survey was performed, it showed that the stakeholders’ conceptions of usability studies might be that such studies are conducted first when the product is finalised; that the usability studies are performed as an inspection. If the stakeholders have severe misconceptions about usability studies then it would be hard for them to give accurate answers to what services they would like to use in the facilities, for example. Their (mis)conceptions might also show that the knowledge of usability studies must be extended in Ugandan companies and organizations, before the usability facilities would be successful. The stakeholders (mis)conceptions might show that the usability facilities could be used to educate or train the companies and organizations in Uganda to better understand usability, getting them to realise that usability engineering is a beneficial process for both themselves, the users of their products, and therefore the Ugandan society in general.

According to what Chapter 2 has shown that usability studies are about, and what the stakeholders answering the digital survey stated, the stakeholders have an accurate conception about what usability studies can be and why they are conducted. However, some of the respondents’ conceptions of how and when the usability studies are conducted did differ from what Chapter 2 showed.

One respondent stated that usability studies are performed on “a finished product” (R7). As Chapter 2 explained, usability studies can be conducted on finished products as well, but the work to ensure usability is more beneficial if it is started early in the development process. “Through series of interactions with the intended end-user in meetings, discussion
groups, opening and trying out already existent sites.” (R5) is an answer that indicates that one respondent interprets usability studies to be performed at finished products, and not really by letting the users use the product, but rather study usability through talking with users in focus groups and meetings. These methods can be used for gathering feelings and opinions from users, but should be complemented by user tests as well (Rubin & Chisnell 2008). Three respondents didn’t answer how and when the usability studies are supposed to be conducted at all. Either they do not know, or the question was not phrased well enough.

One respondent stated that the usability studies are performed during “system simulation time” (R1). This indicates that the respondent thinks that usability studies should be performed before the system is fully developed, as a way to find out how the system should work and what functionality it should contain, which the authors reviewed in Chapter 2 agree on.

One respondent stated that “usability studies should be employed during design and construction of a product, and before a product is rolled out to the public / final user domain.” (R3), just as Chapter 2 stated to be a valuable development process.

“Any product designed to be used (regardless of who the user is), can be tested for usability by employing users chosen using stochastic sampling from the possible user domain, to use / interface with the product (or its prototype) in free AND controlled sessions, and notes / scores taken of their satisfaction and efficiency while using it.” (R3)

The same respondent (see citation above) stated that the user tests could be performed either by letting the user use the product, or by letting the user use a prototype of the product. This implies that the respondent is aware of that usability studies can be conducted before the product is fully developed, such as to evaluate the product using a prototype. Though it is unclear to me what the respondent means by free sessions, but I interpret it as that the respondent means that free sessions is the opposite to controlled sessions, i.e. free sessions are such conducted in field.

“conducting usability tests would vary from product to product, mostly depending on the kind of technology under test and the intended user / target domain.” (R3)

Further the respondent is aware of that the usability studies vary from product to product (see citation above).

These answers, even though some of the respondents have accurate conceptions of usability studies, shows that some work can be done in order to get the stakeholders to understand that usability studies and the facilities can be used throughout the whole development process. This would make the facilities used more if established by or at Makerere University, and would further gain the Ugandan society in general as the software and products being developed are made with usability in mind from the beginning.

Since three respondents did not provide any answer to the question, it is possible that it would have been clearer if the questions were divided into at least two parts. One where the respondents was asked what usability studies mean to them and one part where the respondents were asked to illustrate when, why and how usability studies are conducted.

One of the three respondents, who did not answer the question, provided citations from different websites about what usability studies are, why it was hard to interpret
whether the respondent actually understand what usability studies are or not. The chosen
citations from the websites though were accurate. They explained and answered the later part
of question 4, but I will not analyse the answer in this study, since I wanted the respondent’s
conceptions about usability studies; not a website’s conception.

5.2 The stakeholders’ usability engineering processes

In the first survey a question about how the work with collecting and specifying
requirements for the software that the stakeholders are developing was not included, as
explained in section 3.3.1. But after the analysis of the feedback from the first survey was
performed, it showed that the stakeholders’ conceptions of usability studies might be that the
studies are conducted first when the product is finalised; that the usability studies are
performed as an inspection. Therefore it was decided that a question about how the
requirement engineering are conducted would be included in the digital survey.

Two of the respondents said that they visit their users premises. One of these
stakeholders described how their users are being involved in the development process, by
further stating that

“[…] - we conduct interviews,
- we review organizational documents with the help of users
- we document the process, do visual representations and review the process with
the users.
- we involve users thru the development process so as to keep on track. Users
confirm that that is what they want or help us incorporate change before long.”
(R7)

There were two answers that did not describe how the users are involved, these were
“They provide usually 50 - 70% of the system functional requirements” and “Our clients’
participation in the SDLC varies from product to product, but we tend to follow an Agile
approach many times.” (R3) This describes that the users are involved but not really how
their users are involved. Thus, some of the respondents did not actually describe how their
users are involved. Perhaps the question should have asked for details but there is the
possibility that some of the stakeholder representatives answering the digital survey are not
involved in the work with the requirements, why this work cannot be described any further.
The answer “There is a project manager who interacts with them to identify the needs.” (R9)
implies that this can be the case.

By analysing the respondents’ answers I draw the conclusion that the respondents do
not see the work with requirements as usability engineering methods, nor do they see
usability engineering methods as a way to involve their users in the work with specifying
requirements. This implicates, just as the respondents’ answers to the prior question, that the
potential stakeholders do have misconceptions about usability studies. Their misconceptions
must taken care of if the usability facilities are to be successful and used to the fullest.

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5 SDLC is “Software Development Life Cycle” or “System Design Life Cycle” according to Wikipedia. (2012-05-15)
5.3 The stakeholders’ potential usage of the usability facilities

Even though all 26 potential stakeholders have stated that they are interested in using the usability laboratory if one were to be established at Makerere University, it cannot be interpreted as that the laboratory already has 26 clients. Showing interest in a project is not the same as actually paying for and using such facilities. Though, there might be additional potential stakeholders who did not participate in this research who are potential clients. Therefore the conclusion cannot be made that the usability facilities will have 26 clients from the start, or that the laboratory would “only” have 26 clients; there might be additional clients who are yet to be contacted and informed.

Since the majority of the respondents of the first survey answered that they wanted to use the facilities in other places than in a laboratory, most of the facilities need to be portable. The digital survey shows, just as the first survey, that the stakeholders would like the possibility of using the laboratory outside the university’s premises. But because the students of Makerere University are going to use the facilities as a part of their education, the facilities need to be available at the university as well. In addition some of the stakeholders (2 in the first survey, 3 in the digital) would benefit from if the facilities were accessible at the campus premises.

5.3.1 When would the stakeholders would like to use the facilities

It is a positive fact that many of the respondents said that they would like to use the facilities soon, since if the facilities are established at Makerere University, potential “clients” that are aware of the facilities are available from the beginning. Though, the stakeholders raised two issues that need to be addressed if establishing usability facilities.

Respondent number 3 of the digital survey said that he or she wanted to see some results from the usability tests conducted in the usability facilities before using it him- or herself, seems to somewhat have misinterpreted the facilities, or having some doubts about the actual benefits or expertise that the facilities could add to his or hers development or organization/company. The demand of showing what the facilities have accomplished is a hard demand to meet. It is not simply a question of distributing reports from conducted usability evaluations -- the parties involved in these may not at all want CIT to disclose information, as several respondents wrote (see section 4.3). Moreover, what would good testing results mean? Is it how many usability problems that have been found in the facilities, or maybe how much the facilities have contributed regarding usability of the tested products? If through usability test few usability problems are found – are the tests really unproductive or is the product being tested so well developed that few problems are found? Or is the usability tests conducted in a poor way? By conducting a heuristic evaluation many usability problems can be found, but as the Chapter 2 showed, the heuristic evaluation may not identify the most severe usability problems from the intended end users’ point of view. Further the usability engineering lifecycle model by Nielsen (1993) shows that the iterative development cycle is an important part of the development process. If the usability problems found through usability studies are not dealt with – the usability of the product will not be improved. The results of the usability tests must be handled; the development process must
be iterative if the product’s usability is to be ensured. Problems found in usability studies are depending on in which iteration the product is in and how the studies are conducted (Nielsen 1993). Nielsen argues that it is hard to develop a perfect interface from the beginning, why many usability problems can be found during the first iteration. But if no usability studies are conducted at all – naturally no usability problems are found (by the development team). One possible solution to this issue is to provide an executive viewing room, though this would demand that the facilities are situated in a fairly large dedicated space, where a mirrored wall are installed. An executive viewing room would let the external parties watch the tests being conducted, letting them decide on the quality of the usability evaluations for them selves. Though this would demand that they do agree on getting their own products being tested at least once, since other parties may not want CIT to disclose information or results from tests. Recording the tests would provide another alternative for the external parties to decide on the quality of the tests being conducted, if watching the recordings. Though this would also demand that they agree on that at least one usability test is conducted, of the same reason as stated earlier.

“As soon as they are available and affordable – because there’s already a bunch of products that would benefit from such a facility.” (R3)

This respondent identified an issue that needs to be dealt with if Makerere University are going to establish the usability facilities, the cost issue. How much is reasonable to charge for the services and facilities; what are the external parties that use the usability facilities going to pay? How much are the stakeholders willing to pay for such services? If the facilities are adapted to the potential stakeholders needs researched in this study, the charge should be adapted to that the external parties derive from companies of different sizes, and to the fact that some of the stakeholders are stand-alone developers. Depending on what services the facility provides, the charge could be adapted thereafter. The charge could also vary depending on what services the client is using. One question is if all services should have the same charge of use. Portable facilities could be charged for by letting the clients pay a rent. Included in the rent “risks” of using devices elsewhere than a controlled laboratory could be incorporated. Risks with letting clients use facilities outside a laboratory could be that the facilities are forgot or stolen, or just that the facilities are worn out. One solution to the charge issue could be, as the question about the willingness of the respondents to pay for the services, that the charge would be subsidized.

5.3.2 Services the facilities should provide

Indeed, the potential stakeholders want to use the usability facilities if established at Makerere University. There are probably additional potential stakeholders with needs that could be contacted about the usability laboratory, who are not aware of the benefits of conducting usability studies and usability engineering. Therefore some needs might not been included in this study, since those needs were not collected. Though, all the respondents participating in this study have stated that they are interested in using the usability laboratory if one is to be established at Makerere University.
If the stakeholders had not used any usability facilities before, it might be hard for them to state what services they would like to see as part of the facility possibly being established at Makerere University. But this did not seem to be a problem since the respondents had many opinions of what services such facilities should contain, and what facilities they would use. Though, not many of the stakeholders provided answers that showed their interest in using services as stated in Chapter 2. Some of the respondents of the first survey stated that they wanted to perform tests such as “load testing”, “stress testing”, “integration testing” and “measurement of response time”, some the respondents was thinking that the usability facility would be used mainly for evaluating already developed products, and not so much for usability engineering activities in the early part of the development cycle. The respondents of the first survey might have been affected by the introduction given at the consultative meeting as well, making them think about usability assessment more than activities that take place during the whole development process, for ensuring usability. Though, the digital survey showed similar misconceptions or lack of knowledge about usability studies. One respondent stated for example: “1) Usability Reviews of Already Existing Systems” (R2).

The absence of usability engineering methods exposed in Chapter 2 does not mean that such usability engineering methods would not be beneficial for the stakeholders to conduct, nor does it mean that the facility should not provide such services. Rather it means that in order to make the most of the usability facilities, if established by Makerere University, some work with counteracting misconceptions about usability studies needs to be carried out. Educational activities and training could show and teach the companies and organizations in Uganda that usability studies and usability engineering can be performed during the whole development cycle, not just on finished products.

To make the most of the facilities, both angles should be provided, ensuring that the external parties can use the facilities both for testing finished products as well as engineering usability into developing products. Even though none of the respondents provided such answer (perhaps because of misconceptions), it is also thinkable that a client would like to compare two or more systems offered by a third party. Such comparisons could also be conducted as a way to map advantages as well as disadvantages of already existing products as the one being developed, as stated in Chapter 2. The facilities should provide for such comparison services as well.

Further, the laboratory should have “Access to international libraries for references” (R1) according to one of the stakeholders. This might be good also for the staff working in the laboratory, as well as for the students using the facilities as a part of their education. Though, it is not something that really has to do with usability (access to international libraries can provide much more than just usability references), why such service maybe should be provided by Makerere University instead of the usability facility it self. Though it would be good for the laboratory and the students using the facilities if some usability literature were made available, especially literature written by “big names” in the fields of HCI.

“- A service to explain to users what a new product does.

- Collection of comments and responses from users.

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- provide the actual product to users and measure easy of use, ease of learning and error rate.” (R7)

Adapting the facilities to this answer would mean that the usability laboratory should contain a set of staff, who can interact with users of products, teaching them how to use products, discussing with the users about products and conduct user tests. A usability team should consist of at least one person, preferably three according to Dumas and Redish (1999), as stated in Chapter 2. Though, I question if such staff is supposed to provide services such as the stakeholder’s first wish in the answer above. This is not something that has to do with usability studies, given that the explanation is not given as a part of a usability test. But then one could question the products’ degree of usability – if what the product does needs to be explained by a third party. Since one stakeholder said that he or she would use the facility to go to “lectures that aid me in including usability features in designs” (R6) the usability facility should provide lectures, if adjusting to the stakeholders’ wishes. Since Makerere University already give courses in the field of HCI – such courses could be adapted for other persons than just students taking programmes at Makerere University. Then the misconceptions about usability could be turned into accurate conceptions, as well as increasing the potential for facilities. The courses should contain more than just instruction on how to include usability features in design, preferably teaching the ones taking the course how to successfully engineer usability throughout the whole development cycle of a product.

One stakeholder wanted a “[…] Compilation of best practices for system design” (R2). Such standards are already available in some degree, developed by the International Organization for Standardization. Though, too much credence should not be put into such best practices and heuristics, since they cannot show all usability problems, and they should not be used as a substitute for user tests (Dumas & Redish 1999). Since Makerere University gives courses in the field of HCI it would be beneficial to let the students use and try usability engineering methods in the usability facilities, improving their skills of adapting methods and techniques to various products and making them less dependent on best practices and standards. It would also be beneficial to have educational activities, beyond those courses given to the students at CIT at Makerere University, for potential stakeholders and clients. Such educational activities could include showing and practicing the potential clients and stakeholders what kind of usability engineering methods that are available (in or through the premises of the usability facilities). This would increase the facilities in regard of use, further develop the stakeholders’ conceptions about usability studies and therefore hopefully increase to what degree usability is met in products developed and/or procured in Uganda.

According to one stakeholder the facilities should also include an “on-site statistician” (R3), who can add statistical data to the activities in the usability facilities. Though, this is only valuable in tests and activities where statistics are important. The results from usability studies can be interpreted, put together and presented in many ways but statistics do not always say much about usability problems. For example, if three of four test subjects could not complete a task in a usability test, does that really say anything about what in the products interface that needs to be changed? As stated in Chapter 2 the usability engineering is supposed to be an iterative process where studies always are conducted as a way of improving the products’ degree of usability. In order to increase the products’ degree
of usability; the results from the usability studies must be taken care of and carefully implemented into the product. Statistics and numbers about how many who could complete a task, for example, will not solve usability problems or the process by itself. If statistics are supposed to be useful the background and reason to the numbers must be there.

Two stakeholders wanted to use the facilities to ensure usability for disabled people. One of these stakeholders wished that the facilities would include “Bio-metric equipment” (R4). The same stakeholder wanted that the facilities could be used to “[…] enhancing voice recognitions” and that the laboratory should provide “touch recognition tools to enhance system designs”. This means that equipment such as eye-tracking devices needs to be included in the facilities. Though, since only two respondents said to have the need of biometric equipment, and such equipment is expensive, the needs of such equipment maybe should be further explored before implemented in the facilities.

One stakeholder answering the digital survey stated that he or she wanted a remote access to the facilities. This is a good idea, which could simplify the use of the facilities and make the use of the facilities more effective. The website could provide an online booking service and information about the facilities. If the external parties could obtain information about the facilities via a website misconceptions about the facilities could be counteracted. Providing results from the usability studies ordered by external parties would demand much time from the staff working in the facilities, but could compensate the time meetings with all external parties would take. If the results would be provided online, several people belonging to the organization that ordered the studies, could obtain the results without the need of an appointment that suits all affected people. Though, such service would demand that the website provides some kind of login in, since all products, information and results should be handled confidentially which the stakeholders demanded (see section “The stakeholders issues of concern”).

One of the most important things to implement in the facilities is the ability to test applications and services for mobile technology. One of the stakeholders stated that he or she wanted to test services for mobile money banking, another stated that he or she wanted to conduct studies on web applications. Since using mobile technologies such as m-banking and SMS-services is very common in Uganda this would be a big potential stakeholder to adapt the facilities for (Wireless Federation 2011b). Further, the market of web applications seems to be increasing, since the Internet connectivity is rapidly increasing in Uganda (BuddeComm 2012b). Further, as a majority of telephone users in Uganda use cell phones (Uganda Bureau of Statistics n.d.), testing such services and technology would also possibly have an impact on the degree to which usability is met in the Ugandan society as well. As stated in Chapter 2 many usability problems belonging to the use of mobile phones and services can be found by conducting usability tests in a controlled laboratory environment. Though as Rogers et al. (2007) argued, in-field studies will show how the product is actually being used, rather than how it is supposed to be used, why a combination of the two environments would be preferable. As many of the respondents of the first survey stated the usability facilities should be able to stage connectivity problems and power outages. Since the connectivity problems for cellular phones are widespread in Uganda, this would be an important service for the
facilities to provide. Such service would be able to stage the context of anticipated use. User interfaces in mobile phones and mobile services can be tested either on a computer screen, by using other prototyping techniques or of course directly in a mobile phone. Evaluations of the user interfaces for usability problems can be successfully conducted in a laboratory, but context specific usability problems may only be found in the anticipated field of use. Therefore if providing the option to test and evaluate mobile services, the usability facilities needs to be both portable as well as provide a laboratory environment, as earlier stated would be beneficial for CIT.

One respondent of the first survey brought up the involvement of users, such as letting users participate in the design process, by stating that he or she wanted to use the facilities as "A way to enable users express their version of the product". The use of prototyping would meet this demand, and would not demand that the facilities provide certain software or hardware, since such activities can be done with low fidelity prototypes, using for example paper. Though, of course such activities can also be conducted using more advanced techniques such as the Wizard of Oz-technique, which would require at least two computers and a space that allows the two computers to be separated, letting the user and the wizard interact with the prototypes by them selves. Involving the user can also be done by letting the user be a part of the development team (participatory design), gathering focus groups or using the card sorting-technique (see section 2.4). Involving the users in some of the expressed ways would demand that the facilities established at Makerere University provided a dedicated space, preferably separated from a busy environment which a university can be, so that the users can express their wishes and needs without hesitation or disturbances. If it is important to observe the users while they participate in the development process, then a mirrored-wall and/or cameras recording the user are a preferable solution. A mirrored wall would also simplify the use of the Wizard of Oz-technique, as well as performing user tests on designs, interfaces, mobile applications, which the respondents of the first survey stated that the facilities would be used for. Moreover, for successfully performing usability tests with users as test subjects the rooms separated by the mirrored wall preferably should be sound proof, so that the test team can talk with each other without disturbing the test subject. Since inexperienced test teams sometimes can use the laboratory, such as teams consisting of students taking courses in the field of HCI, the soundproof wall would be especially beneficial. My own experience is that inexperienced test teams consisting of for example students have a bigger need to discuss practicalities and such with each other during a usability test. Together with my experience, and the fact that either lecturers or usability experts may be in the laboratory instructing the inexperienced team, I am drawing the conclusion that a soundproof wall would be especially valuable for CIT to have.

When conducting user tests it is sometimes beneficial to give instructions to the test subject, especially if the test room is divided from the observation room. Therefore speakers and a microphone would be beneficial to have in the usability facility, enabling the test team to give either instruction to the test subject or audio output when performing Wizard of Oz-experiments. When using the talk aloud-technique it is beneficial to record the test subject during the test, especially if no one in the test team casts the data logger role (Dumas &
For this to be possible a microphone in the test room as well would be needed. Since some of the respondents wanted to be able to adapt the facilities to simulate where the anticipated end user will use the product, the setting in the room might change as much that the cameras would be needing several fixing points, or be completely movable throughout the usability laboratory. Otherwise it might be hard to record for example the test subject’s facial impressions successfully.

As stated earlier in this chapter, having an executive viewing room and recording equipment (cameras) would be a possible solution to the issue of ensuring quality of the tests being performed, as raised by some of the stakeholders. Having an executive viewing room would also let students using the facilities as a part of their education at CIT to watch other students perform user tests, as well letting lecturers review students conducting usability studies in the laboratory. Though such executive viewing room would together with the test room and the observation room allocate a lot of space in the premises of CIT. Preferably the university would allocate the space for the facilities since their students will use the facilities, but if such space is not possible to allocate for the usability facilities; the students could use the portable facilities as a part of their education. If CIT implement just portable facilities, to start with such portable facilities could be used at the university or just for in-field studies. If there would be a dedicated space at the university where the portable facilities would be used, the laboratory would be easy to change for new situations and tests since it is all portable, and equipment costs therefore could be held down (Nielsen 1993; Capra et al. 2009). If the facilities are being used a lot (by external, paying parties) new equipment can be bought and be permanently installed in the laboratory to extend the facilities further. Though, my conclusions is that a dedicated space for conducting usability tests would be the best solution both for the students as well as the potential stakeholders who answered that they would like to conduct usability studies in a controlled laboratory environment.

Indeed it is clear that the stakeholders want the facilities to provide with services as well as with equipment. Some of the stakeholders give examples of tools they would like to see in the facilities (“Information Architecture tools” “Usability testing tools” “Error detection and handling tools” (R5) or “[…] tools and lectures that aid me in including usability features in designs”(R6)), but these tools would rather be services than tools. Such service would be providing a usability testing team who can conduct usability tests for external parties. This team could test the Information Architecture, the usability and remark (usability) errors. The wishes for tools show the misconceptions about usability studies that some of the potential stakeholders have. It is important to point out that error testing and handling as wanted by one respondent should not be a part of the usability facility. To test and handle errors outside the field of usability should not be provided in the usability facilities, since such activities are not a part of usability engineering.

All the wishes expressed by the respondents show that the potential stakeholders have a wide range of conceptions of what they want to use the facilities for, from access to international libraries to enabling system designs for disabled people. Also, the stakeholders might be disappointed by the services provided by the Makerere University, when finding out that their needs cannot be catered for, since their conceptions about usability studies are
misconceptions. Adapting the facilities to misconceptions or even all accurate conceptions could be costly. This is an issue to deal with if the facilities are going to be established at Makerere University. Financing the facility could be done by letting its’ users pay for the services. The issue of how much to charge the external parties have already been discussed in section 5.3.2, and the charge could map against how much establishing the facilities cost.

5.3.3 How the stakeholders’ needs for services wanted are currently met

Some of the respondents stated that they ensure usability through standards, management reviews and demos, using UI experts, and by performing in house testing. All these methods are not enough for ensuring usability since the users are supposed to be a part of the usability engineering. Surely expert reviews, heuristic evaluation and standard inspection can be one way to measure and assuring usability, but should only be a supplement to the user testing (Dumas & Redish 1999).

One respondent of the first survey stated that the organization/company meets the needs by “external resources hired for the job”. Three of the respondents of the same survey stated that they perform tests in some form (“pilots” “pre-launch tests” and “we do in-house testing by one of the developers with one of the users”).

Two respondents of the digital survey (R3 and R5) stated that their development team members are the one who today are involved in usability engineering. All these methods stated by the respondents can, if these team members have enough knowledge of usability (such as heuristics), be one part of the usability engineering process. Though, as stated in section 2.6 “Who can ensure usability?”, the development team is so involved in how the product works, that logical gaps are filled in, gaps that users may not be able to fill out. These answers indicate that these respondents and their organisations could benefit from if the services they stated that they want to use in the facilities were present. Since some kind of testing is already a part of the organisations’ development processes, beginning to use the facilities if such were to be established at Makerere University, would also be easier than if no testing were a part of the development processes already (Nielsen 1993).

One respondent of the first survey answered that the services that the organization would use (in the facility at Makerere University) are not met at the moment. “Via feedback from the end users and continuous improvement.” (R2) This answer indicates that their users are involved first when the software is developed and ready to use, though that the feedback is used for improving the software further. Therefore, the conclusion that no usability engineering processes are performed during the early parts of the development cycle can be drawn.

R1 stated that the mother organisation is responsible for how the software development is conducted, and if the mother organisation would allow, enabling the rest of the organisation to further improve how development, testing and evaluation is conducted could be beneficial to their organisation as a whole.

Some of the respondents of the first survey use heuristic evaluation, standard inspections, expert reviews, but these methods should be complemented by user tests as stated in Chapter 2. Especially two of the respondent’s companies/organizations could be
potential stakeholders of the usability facilities at Makerere University, since they already pay for usability services or do not use such services at all at the moment.

Altogether, the respondents' answers to the two surveys show that the respondents do not seem to be able to meet the needs today, why I draw the conclusion that the respondents clearly benefit from if Makerere University would establish usability facilities. The respondents who already perform some kind of testing have already made the testing a part of their development process, why it would be easier to make the usability engineering a permanent part of the development process. It would be easier to convince the management of these companies or organizations to permanently use the facilities for ensuring usability of their products (Nielsen 1993).

5.3.4 The stakeholders’ willingness to pay for the services provided

Since 12 stakeholders responded to the first survey stated that they would be willing to pay for the usability services, this can be seen as a positive fact for the possibility to charge the external parties using the usability facilities. Though, as one of the respondents explained as a reason for answering no to this question, the charge mustn't be too high, because then some organizations won’t use the facilities. This question was not included in the digital survey. Though, since the issue of charge anyway were raised by the some of the respondents of the digital survey, the conclusion can be drawn that the stakeholders are willing to pay, but only if the pricing is right. As stated in section 5.3.1, some stakeholder cannot afford to pay a big charge since they’re stand-alone developers. The recommendation is that the charge should be adapted to what services the client is using in the facilities or that the charge is subsidized. As stated in the scope of this study (see section 1.2 Scope), the costs for adapting usability facilities will not be further researched in this study, why this issue still remains to be addressed.

5.3.5 The stakeholders’ issues of concern

10 respondents (six of the first survey and R1, R3, R5, R9 of the digital survey) answered that the facility must take care of legal agreements so that the confidentially of information and products being tested and developed in the facility is ensured, before the respondents would trust and use the facilities. This issue is therefore an important issue to address if establishing the facilities, and as so many of the respondents pointed out this issue of concern it should be addressed as soon as possible – so that it is already taken care of when the facilities are available for external parties to use. The conclusion drawn from the respondents answers is that the facilities must provide external parties using the facilities a non-disclosure agreement, ensuring that information, products and test results is handled with full confidentiality.

One respondent of the first survey and two respondents (R6, R3) of the digital survey stated that they would like to see some insurance of that the equipment as well as the usability methods holds high quality and contribute with quality results. This issue can, as stated under section 5.3, be hard to ensure, especially if the information about products and results of tests conducted in the facility needs to be handled with confidentiality (as just stated in the previous section).
To adapt the facilities to people with disabilities would demand that the dedicated space (if any) is accessible for people in wheelchairs and such. If such space were not thought of yet, this issue would be good to have in mind. Providing headphones and screens that is pleasant for the eyes, would be an asset for everybody using the facilities, not just people with hearing and visual impairment. Though, the usability tests should be conducted on such equipment that the end user is anticipated to use, otherwise the results of the tests are not as accurate.

“Usability testing goes inline with load and stress testing: The other tests before usability testing should be factored in because if the product is not efficient it will fail” (respondent of the first survey)

Since efficiency is a part of usability (see section 2.2 Definition of usability) such tests as the respondent describes should be available to perform in the usability facilities.

One potential stakeholder of the first survey argued that “Mobility” is an issue of concern needing to be addressed before trusting the facility. This statement can be interpreted as that the facilities needs to be mobile if the respondent would use the facilities.

The respondent of the first survey who stated that “Human resources” is an issue of concern that needs to be dealt with before the respondent can trust and use the facilities, might have meant that the usability facility must have personnel working there (providing expertise and assisting during usability tests). The respondent might have also meant something completely different, such as the issue of confidentiality discussed earlier in this section.

“Harmonize issues of standards with the National Standards Body (UNBS) for ease of enforcement” were stated by one respondent of the first survey, and is interpreted as that the usability standards (if developed and used in the facilities) should be harmonizing with standards developed by Uganda National Bureau of Standards (UNBS). This statement should not be met, since the UNBS standards do not handle usability (as ISO-9241-11:1998 developed by the International Organization for Standardization does). The standards established by UNBS are handling for example how food products are prepared and specified as well as engineering standards (UNBS 2010).

5.4 Answering the research questions
The main purpose of this study was to find out what kinds of usability facilities are beneficial for CIT at Makerere University to have. To meet this purpose, two research questions were formulated in section 1.2: a) What conceptions or misconceptions of usability studies do the potential stakeholders have? and b) What needs do the stakeholders have for usability facilities? The two surveys were used to map the potential stakeholders’ ideas about these issues, and the analysis above of their answers is here used to answer the research questions.

5.4.1 What conceptions or misconceptions of usability studies do the potential stakeholders have?
The respondents’ answers show that usability studies are conducted to measure if a product has a high degree of usability, which according to the respondents means that the product lets the expected user perform specified tasks with efficiency, effectiveness and satisfaction.
The respondents’ conceptions about why usability studies are conducted harmonize with what Chapter 2 showed that usability studies are about.

Further, the answers from the surveys show that some of the representatives of the potential stakeholders have misconceptions about when and how usability studies are conducted. These misconceptions show that some people see usability studies only as a way to evaluate already finished products. This is an ineffective way to conduct usability engineering since potential usability problems then are already implemented into the product, and therefore is costly (both in time measures as well as costs) to correct. This is a point where all the authors reviewed in Chapter 2 agreed on.

5.4.2 What needs do the stakeholders have for usability facilities?

All 26 respondents stated that they would be interested in using the usability facilities if they were to be established by Makerere University. The majority of the stakeholders would want to use the facilities in a foreseeable future, why the facilities could be founded by Makerere University soon.

The respondents’ answers show that they would like the facility to provide human resources, educational services and facilities for conducting usability studies. The human resources should provide both the external parties using the facilities as well as providing these parties’ clients with expertise as well as information about usability engineering techniques. The big interest for in-situ studies from the respondents mean that most of the facilities must be portable to use in field. However, since the facilities are supposed to be used by the students of Makerere University, the facilities need to be available at the university as well.

The facilities should contain IT products such as computers, computer screens (preferably LCD screens), headphones and bio-metric equipment. The facilities should be possible to adapt to resemble the anticipated context of use. To stage connectivity problems as well as power outages are important to the respondents. It should be possible to test and evaluate web applications and mobile services, such as m-banking services. Moreover, the facilities should according to some respondents provide services for load testing, stress testing, interface testing and back end testing.

Some respondents stated that they would like to access the anticipated end-user through the facilities, so that usability studies can be conducted on these users as well as design activities involving the users. Moreover, the facilities should be accessible for people with disabilities.

Interestingly, there were suggestions that the facilities should provide the external parties using the facilities with a template for non-disclosure agreements. Moreover, through the facilities access to usability literature and standards should be available. There was also a voice for a remote access to the facilities. The remote access should at least obtain information about the facilities and possibly provide a booking service.

Finally, the analysis for research question a) shows that there are more needs than voiced by the respondents. As already indicated, there is a need to come to terms with misconceptions about usability work. The Conclusion chapter will not only summarize and
categorize the findings for b) above but will start by a discussion on the problems highlighted concerning a).

5.5 Validity issues

Since surveys were used as a tool to gather data from primary sources in this study, as stated in section 3.3, some issues with validity have been exposed.

When conducting quantitative studies, getting different answers from one and the same respondent to a question is seen as a sign of low reliability. Though, in qualitative studies as this study, this is not the case. In qualitative studies it is more important to look at the whole context of where and when the respondent is interviewed, than the reliability between the respondents’ answers. In qualitative studies the intention is to map phenomena and to describe perceptions. (Patel & Davidson 2011) Though, since surveys were used in this study it has been clear, as discussed in this chapter, that some of the respondents did not answer the questions as intended. This is a sign of low validity, since the perceptions of the intended topic have not been collected in some cases (Silverman 2010). If conducting interviews with the respondents instead of collecting their answers through static surveys, the questions that were unclear could have been re-phrased and made clear until the respondent understood and answered the question as intended. This would have increased the degree of validity of this study. Though, the conclusion that the question is phrased in incorrectly cannot be drawn, since some of the respondents actually did answer the questions as wished-for. Further, I did not have the possibility to conduct interviews with the respondents because of time limitations and bureaucracy constraints, as stated in section 3. Even though the issues with validity have been identified, the data collected through this study is valid enough to use, since most of the respondents understood the questions correctly and conducted answers that were asked for.
6. Conclusions

The main purpose of this study was to find out what kinds of usability facilities that is beneficial for CIT at Makerere University to have. The result from the analysis will be presented in this chapter.

6.1 Services needed to be provided by the usability facilities

The misconceptions about usability studies among the potential stakeholders shows that teaching, educating and training activities in usability engineering methods in usability engineering methods would be beneficial for CIT to provide external potential stakeholders. Students taking courses in the field of HCI at CIT would also benefit from such activities, why courses given at CIT should be adapted for teaching usability engineering methods in addition to the range of courses that CIT provide today. As a part of the educational activities, access to literature about usability engineering should be available as well as usability standards. Usability engineering methods and techniques that would be valuable for all stakeholders (CIT, students and organizations in Uganda) to be taught are: prototyping, participatory design, thinking aloud, observation technique, focus groups, card sorting, eye-tracking and last but not least, user tests. The usability assessment techniques that would be valuable to be taught are: heuristic evaluation, guideline reviews as well as standards inspections.

In order to perform such studies as were found valuable for the potential stakeholders and therefore CIT, as well as valuable according to the authors reviewed in Chapter 2, the facilities should be able to provide testing for mobile services such as m-banking and SMS-services. Other products that the stakeholders would like to test are web applications. Further the facilities should cater for enhancing products for people with disabilities, hearing and visual impairments.

Since the Internet connectivity in Uganda still is low and power outages are common, connectivity problems and power cuts should be possible to simulate in the laboratory.

In order to provide all these services, the facilities need to be portable as well as available to use at the premises of Makerere University, enabling both in-field studies as well as studies conducted in a controlled laboratory environment. Through the facilities load testing, stress testing, back end testing and interface testing of products should be catered for. The facilities should also be able to test and evaluate developing products (using techniques as stated above), as well as finished products. For this to be possible a test team consisting of at least one person working as a test moderator should be available. Preferably the test team should consist of at least two more persons. These persons could help with logging data, handle equipment such as cameras recording the test and take care of the test participant before, during and after the test.

The results from the tests need to be put together and presented which would also be a task for the test team to manage.
6.2 The facilities at Makerere University

The analysis showed that both a portable as well as a permanent usability laboratory is needed. The permanent usability laboratory can be in a dedicated space at the premises of CIT at Makerere University, consisting of at least one soundproof test room, one observation room and possibly one executive observation room. A mirrored wall should separate the test room and the observation room.

The facility should be possible to adapt to resemble the anticipated context of use. The facilities should be accessible for people with disabilities.

6.2.1 Hardware

CIT would benefit from having the following IT-products in the permanent laboratory as well as the portable lab: computers, computer screens (preferably LCD screens), loud speakers, headphones, and biometric equipment such as an eye-tracking device. Further, the analysis showed that the facility should provide cameras for recording tests and activities in the usability laboratory. Such equipment would provide students as well as clients with valuable data and information to be reviewed and/or evaluated. Microphones in the test room as well as in the observation room would make interaction between the test team and the test subject possible, as well as the possibility to record the test subject during usability studies.

6.2.2 Software

CIT would benefit from having software for the eye-tracking device; used to record the screen the user is looking at during the test. Further, it would be valuable for CIT to have multimedia software used for creating prototypes.

6.2.3 Miscellaneous

In order to create mock-ups, papers and pencils should be available in the facilities. Further, in order to have external parties using the facilities, a template for non-disclosure agreements must be provided, ensuring the external parties that no information about products or test results are shared to other parties, if not wanted.

Moreover it would be beneficial for CIT to provide external parties remote access to the facilities, which at least obtains information about the facilities and possibly provides a booking service.

6.2.4 Next step to further develop the plans of the usability facilities

For CIT to successfully implement and provide usability facilities, three issues needs to be addressed:

- What the external parties are going to pay for their usage of the usability facilities.
- Templates for non-disclosure agreements need to be developed.
- Counteract misconceptions about the usability facilities by providing educational activities.
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Thank you.
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Appendices

Appendix 1: The first survey

CONSULTATIVE MEETING ON SETTING UP A USABILITY TESTING FACILITY AT MAKERERE UNIVERSITY, COLLEGE OF COMPUTING & INFORMATION SCIENCES

Preamble:
The College of Computing & Information Sciences at Makerere University is in the process of setting up a Usability Testing Facility dedicated for testing if web/ computer / mobile applications/systems meet their intended purpose. As one of the key stakeholders, please let us know your views by answering the questions below.

Feedback from Participants of a stakeholders’ consultative meeting held on February 22nd 2012

1. Organizations represented & positions of participants
   (Not included for anonymity reasons.)

2. If the Usability Testing Facility is established, would you be interested in using it?
   All the participants answered yes

3. If Yes to question 2, state:
   Services the Facility should have
   • Stress testing facilities
   • Ability to simulate connectivity challenges in the field
   • Relevant audiences for the systems
   • Testing for the design
   • Cross platform
   • Open source
   • Back end testing
   • Interface testing
   • Entire evaluation of the software product
   • 3G coverage
   • Wifi, computers, GSM coverage
   • Experts
   • Address grass root users
   • Policy on issue of licenses
   • Mobility to reach out to the user environment
   • Factors in the local challenges such as power cuts
   • A way to enable users express their version of the product
   • Some level of networking(both wired and wireless)
   • Mobile apps testing
   • Platform(os) independent
   • Mobile testing lab
   • Tests to be in a typical working environment
   • Training and evaluation reports and design testing
   • Load and Stress testing infrastructure
   • Virtual environment
• Consultation on user interface prototypes (e.g., discover ability, localization, back trackability), assessment of client’s ability to state their needs
• Web apps ease of use
• Mobile apps ease of use
• Simulation lab
• Training section
• Testing section

Services your Organization would use
• Testing designs
• Stress testing
• Load testing
• Interface testing
• GSM and Data
• SMS-web based platforms
• Synergy and networking
• User environment testing
• Client’s version of the product design
• All IT products
• Functional usability testing
• Integration testing
• Observation by experts of (naive) intended users
• Measurement of response time.

4. How are the services your organization would use currently met?
• Pre-Launch tests
• Pilots
• in house testing
• UI experts
• We do in-house testing by one of the developers with one of the users.
• They are not
• Fitness for purpose verification through Uganda National Bureau of Standards (UNBS)
• External resources hired for the job
• Management review, regular demos
• Interactive development involving client users

5. Would your organization be willing to pay (subsidized) for the services?
• 12 answered Yes
• 1 answered No
• 1 answered Yes and No

6. If No to question 5, explain why?
• Because the cost may be too high for our organization

7. What might be your issues of concern that you would want addressed before you can trust and use the facility?
• Intellectual property issues
• non disclosure agreement, a required time frame
• confidentiality, commitment and adherence to completion
• Usability testing goes inline with load and stress testing: The other tests before usability testing should be factored in because if the product is not efficient it will fail
• Mobility
• Human resources
• Harmonize issues of standards with the National Standards Body (UNBS) for ease of enforcement
• Confidentiality of software products provided
• Quality of testing
• Need for confidentiality
• Arrangements of Non Disclosure Agreement where info will not be passed on to competitors
• IP protection and standards

8. When would you want to use it (if there is any preference)?
• Soon
• Hopefully this year
• During product test launch
• When it has achieved a good percentage of good testing results
• As soon as possible
• March-2012
• now for Ministry of Health Reporting system (MOHR)- openx data based system for health center reporting
• when I have a new app that I want to launch

9. Where would you want to use it (if there is any preference)?
• Remote communities.
• Would be better if the lab exhibits mobility
• University
• Villages and schools
• Grass root communities
• In the field where the users are with the users in their environment
• Kampala
• With in the country
• At our office and on the web

10. Please provide any other comments
• Widen the scope to include all kinds of apps
• The issue of licenses, NDA needs to be well managed for us to have confidence in the facility
• It would be good to be able to simulate all available environments
• Get the facility accredited by NITA/UNBS
• Hope it will affordable for app developers

Questions Raised & feedback given/generated

a) Who will be the testers?

Answer:
• Experts assisted by Masters students & PhD students
• Partners who will help in setting up the facility

How?
• Use of standard usability testing methods like eye tracking, task analysis, etc.

b) Why the focus on usability testing when there are other tests like load, stress and functional which are more relevant and offer less stress?

• This is an important aspect ignored by most developers/development teams
• Research shows that many software products world wide and more so in developing countries fail due to little attention to user issues
• In most cases, developers get carried away in coding and forget focusing on the user but instead develop for themselves leading to massive software project failures
c) What’s the strategy for managing agile development since the product development time is being shortened to less than 4 weeks (i.e. 4-6 weeks)?

Usability testing is part of the entire software development cycle. So there are various tests for various stages of software development.

d) How is the aspect of mobility considered? Is there going to be a mobile lab, to carry out usability tests in villages?

Mobility will be catered for.

e) How much are you going to charge?

This will depend on a number of factors e.g. the rates of such services elsewhere, market forces, cost of investment, etc.

f) How will the culture of the people be simulated in the lab?

Usability testing during software development puts the user at the centre of the process so that all issues about the user are understood and catered for.

g) Is it that at this stage it is absolutely impossible to factor in other testing needs and we only have to focus on usability?

This project is focused on usability but consultations will be made on whether other software tests should be made part or left to be considered separately.

h) What are your plans for IP protection and confidential information including privacy?

The proposal is still in initial stages but this is one of the issues that has been earmarked for serious attention.

i) How is the idea of open source going to be dealt with?

The facility will not be limited to platforms.

j) What is the proposed equipment setup?

This will depend on the needs of stakeholders (partly being collected in this workshop) and availability of resources.

k) Is there any plan set up to bridge the gap between the different users with different qualifications?

Subjects will be guided by usability experts during testing so managing the different characteristics will be the responsibility of the experts.

Appendix 2: The digital survey

Feedback from the digital survey

1. Name

(Not included because of anonymity.)

2. Organisation

R1 belong to the economic sector.
R2 belong to IT-sector.
R3, R5, R6 belong to the software development business.
R4, R7, R8 belong to a university.
R9 belong to the telecommunication sector.

3. Position
The respondents had positions such as: head of fraud prevention, project manager, senior developer, two web administrators, technical manager, applications developer, and software developer.

4. What does usability studies mean to you? When, why and how are they conducted?
“Usability study is a system or process design stage at which the target market is involved in evaluation of the process or system to better understand the usefulness of the product. They are conducted during system simulation time by involving selected users to evaluate the product and comment on challenges because the product needs to go the market with acceptable risk.” (R1)

“Not studies in particular - but rather feedback from system users about how easy and intuitive they the system.” (R2)

“Well, to me Usability Studies are systematic practical methods by which one can assess the extent to which a product meets its intended use / purpose from the perspective of its intended users. They are means of measuring the success of interfaces and designs in products meant to be interacted with or interfaced with (for computer-consumable products).

That's the what and why, about the when; I believe they should be used alongside the development process / design process for high-risk products / critical products (e.g Flight Control software) or at milestone phases of normal development cycles (e.g at the end of each major cycle of a spiral SDLC).

In simple terms, usability studies should be employed during design and construction of a product, and before a product is rolled out to the public / final user domain.

About the how?

Am not a thesis / head-damaged expert on these matters, but based on my paradigm, I would say; conducting usability tests would vary from product to product, mostly depending on the kind of technology under test and the intended user / target domain. Here is this in cool talk:

Any product designed to be used (regardless of who the user is), can be tested for usability by employing users chosen using stochastic sampling from the possible user domain, to use / interface with the product (or its prototype) in free AND controlled sessions, and notes / scores taken of their satisfaction and efficiency while using it.

Personally, I don't believe in using usability experts to sit in front of a product to perform usability tests! That would ridiculous, a waste of resource, and statistically an investment in
biased investigations! All experts are ideal for, is designing the usability tests, assessing the results of such tests and overseeing the controlled experiments (oh, and sit in board meetings :-). That's all, the rest is for us -- the masses to decide.” (R3)

“user friendly, efficient, relevant to the community/indented users.” (R4)

“Usability studies refer to the fact finding techniques on how easy a user is able to use something. Which something may be a website, system, phone, car, computer etc.

When:
These should be conducted when the need for the ‘something’ arises.

Why:
They should be conducted to make sure that the end-user gets to appreciate the ‘something’ they plan on using and also make sure it fits with their needs and expectations.

How:
Through series of interactions with the intended end-user in meetings, discussion groups, opening and trying out already existent sites.” (R5)

“Usability is the science and art of ensuring that designs can easily be interpreted by first time users, learnt and providing the functionality intended to translate into satisfaction.” (R6)

“Usability studies are a process of subjecting a finished product to checks by people who represent possible end users to gauge how easy to learn, easy to use and how stable the product is.

They should be applied when the functionality of the product is quite finished or at least sub systems working well. They involve using both experienced computer users and people who are not so used to computers so as to gauge correctly.” (R7)

“Usability is the ease of use and learnability of a human-made object. The object of use can be a software application, website, book, tool, machine, process, or anything a human interacts with. A usability study may be conducted as a primary job function by a usability analyst or as a secondary job function by designers, technical writers, marketing personnel, and others”.

“Usability is how easy or difficult something is to use. Usability can be measured through a scientific process focused on evaluating user critical tasks and the ability, or lack thereof, of those tasks to be completed by users. Usability includes how efficient something is, how easy it is to learn, and the ability of the item to satisfy the user.” (http://www.usefulusability.com/)
When? Because these tests identify issues with web site design and performance, these tests can be run anytime in the website lifecycle. They are particularly useful early on in the design process for catching major flaws, or whenever changes are being made. (http://www.howto.gov/customer-service/collecting-feedback/usability-testing-factsheet#when)

Why?
On the Web, usability is a necessary condition for survival. If a website is difficult to use, people leave. If the homepage fails to clearly state what a company offers and what users can do on the site, people leave. If users get lost on a website, they leave. If a website's information is hard to read or doesn't answer users' key questions, they leave. Note a pattern here? There's no such thing as a user reading a website manual or otherwise spending much time trying to figure out an interface. There are plenty of other websites available; leaving is the first line of defense when users encounter a difficulty. (http://www.useit.com/alertbox/20030825.html)" (R8)

“Usability Studies deal with carrying out tests of a product/service to the targeted clientele in order to get the product error free. [sic]” (R9)

5. If a usability lab was established at Makerere University, would you be interested in using it?
All nine respondents (R1-R9) answered Yes.

6. If yes to question 5: State what services you would want such a facility to have
“a fully fledged networked computer laboratory with development applications. access to international libraries for references” (R1)

“1) Usability Reviews of Already Existing Systems
2) Compilation of best practices for system design
3) Research into new devices (tabs, smart phone) usability” (R2)

“1. Enough Computers and Peripherals please! (this ain't a joke)
2. An on-site statistician (for engaging in mathematically un-biased sampling of testers, design of experiments, assessing of results, overseeing of the numbers,.. you get what I mean?) Without one (or more), a usability testing lab would be a mere JOKE and trust me, no mind worth it's salt would call it one!
3. Enough (and dedicated) space to setup environments to emulate / approximate the actual environments in which products are meant to used (this is most important for the un-controlled experiments), as usability is not only affected by the product, but also the environment in which the product is used (this can greatly inform on psychological aspects of usability -- an important point to not be ignored especially for critical products).
4. In case you have plans of making this a very useful facility (in the perspective of external parties like me), then please prevent bureaucracy at such a facility by putting in place adequate services (preferably accessible remotely/online) by stakeholders/clients/etc to request, book, monitor and assess tests for their products.

5. The facility itself might benefit from the first series of usability testing :-) And I wouldn't mind participating...” (R3)

“Service to the blind, deaf and disabled.” (R4)

“Information Architecture tools
Usability testing tools
Design experience tools
Site Loading analyzers
Error detection and handling tools” (R5)

“In the usability lab, I would use, equipment, software tools and lectures that aid me in including usability features in designs. An example would be enhancing voice recognitions, touch recognition tools to enhance system designs” (R6)

“- A service to explain to users what a new product does.
- Collection of comments and responses from users.
- provide the actual product to users and measure easy of use, ease of learning and error rate.
- Conduct field studies on the new product. e.g a product meant for the common man in Uganda should be tested by common people out there in a chosen district, not urban dwellers who are so used to computers.” (R7)

“The Usability Lab is housed in two main rooms. The evaluation room is furnished with a desk and workstation for the usability participant. There is also a large observation room where design team members can watch the evaluation sessions on console monitors or on a large-screen plasma display.

Video Tour

See a virtual tour of our usability lab's conference space, observation area, and its recording equipment.

Observation Room

In the observation room, there is also a large wall-mounted plasma display where observers can watch the evaluation sessions. During a session, observers take notes on any usability issues that a participant encounters.

Observation Room Console
During a usability evaluation session, observers can see and hear the participant, as well as watching the participant's screen on the observation room display monitors.

Eye-Tracking Equipment

Eye-tracking equipment allows a design team to see immediately where a usability participant is looking on a Web page.

Recording Equipment(http://www.oit.umn.edu/usability/lab-facilities/index.htm)” (R8)

“Load testing of the product, system response time (how long it takes the system to give feedback to the user in realtime)” (R9)

7. If Yes to question 5: State what services in the facility that your organisation would use

“mobile money services testing
internet banking testing
online research” (R1)

“Data entry operational tools.” (R2)

“Free and Controlled Usability Testing” (R3)

“Bio-metric equipment” (R4)

“Information Architecture tools
Usability testing tools
Design experience tools
Site Loading analyzers
Error detection and handling tools” (R5)

“I would use a usability lab for learning and practicing the techniques for making system designs that are usable for all people. In a special way, the Persons with Disabilities.” (R6)

“All services i listed above” (R7)

“Eye-Tracking Equipment
Video Tour
Observation Room console
Recording Equipment” (R8)

“Testing for system response time.Ys” (R9)

8. If no to question 5: Please explain why!

No respondent answered no to question 5.
9. How are these services your organisation would use currently met?
2 respondents did not provide any answer for this question.

“(example) is relying heavily on the mother organisation for product development, testing and evaluation.” (R1)

“Via feedback from the end users and continuous improvement.” (R2)

“We are not a perfect team (no team is :-), but we try to have on board a wide range of skilled minds. Currently, when someone works on a product, you use principles to do the first set of usability tests, next someone else from the rest of staff can offer to emulate a client / user to further test, and eventually, we push the product out as a beta for the initial set of external users (who might not be the exact end / final users) to test and provide feedback.” (R3)

“Through a series of scrum discussions with fellow developers / analysts” (R5)

“We have standards we follow for all our designs, namely menu positions, font types and sizes, spacing but a lot still needs to be done” (R6)

“1. We deploy the software before it is widely tested by end users or possible end users and users learn as they use the software.
2. We keep close links with the users through the development process and they keep testing versions and new functionality as they are completed” (R7)

“I think, system response time” (R9)

10. Where would you want to use the facilities?
“at various national research centres [sic]” (R1)
“In evaluation of tools for clients” (R2)
“Preferably at the University premises (advantage of high concentration of highly skilled stakeholders and a good share of totally un-skilled / green users).

Also, a mobile usability lab might be a good idea (like if the facility could have a mobile unit equipped with means of performing tests "out in the wild", on the streets or right at the target-user's premises (e.g for products meant to be used in hospital, the army, factories, etc)” (R3)

“CoCIS Block B” (R4)

“Not sure i understand this question well, otherwise If possible at the office premises [sic]” (R5)
“(company)” (R6)

"Both at the school and in the field” (R7)

"In the useability lab [sic]” (R8)

"In an environment where customers are and other staff” (R9)

11. When would you want to use the facilities?
“any time” (R1)
“Per project basis” (R2)
“As soon as they are available and affordable -- because there's already a bunch of products that would benefit from such a facility.” (R3)
“before the end of the year 2012” (R4)
“As soon as its available” (R5)
“ASAP” (R6)
“By October 2012.” (R7)
“wherever a need arises” (R8)
“Hopefully late this year” (R9)

12. What might be your issues of concern that you would want addressed before you can trust and use the facility?
One respondent did not provide any answer for this question.

“confidentiality of information.” (R1)

“Nothing comes to mind immediately.” (R2)

“Prior to performing usability tests in the provided facility / premises, there should be clear and transparent legal steps taken to safeguard the product owner's interests from prying eyes and evil intentions / users!

Also, I would be happy if the facility would offer some sort of guarantee that they offer reliable services-- as in ability to allow clients to question the methods employed in assessing their products, but this might vary from client to client anyway...” (R3)

“Sensitization is thoroughly done, the users (us) and the innovation developers (you) might be thinking of something different and expecting something different too...” (R5)

“I would be skeptical on the quality of equipment procured” (R6)
“- The facility should be able to involve an equivalent of end users in the process. (example) is a software is meant for secondary school teachers, the facility should be able to involve a secondary school teacher from (examples)” (R7)

“Students with disability should be given priority especially those who can not go to high storage buildings. head sets should be available for those who may want to use the help functions which may have sound. LCDs may be used instead of CRTs to reduce on the effects to users with eye problems. The lab should be well ventilated (air conditioners)” (R8)

“When my work is disclosed to a competitor.” (R9)

13. Are the users of the software you develop involved in the collection and specification of requirements?
All nine respondents (R1-R9) answered Yes.

14. If Yes to question 13: How are the users involved?
“Providing process flow requirements evaluating system efficiency and security during test runs providing exceptions.” (R1)

“They provide usually 50 - 70% of the system functional requirements” (R2)

“Wow, I've already given too much input, forgive the next brief responses:

Our clients' participation in the SDLC varies from product to product, but we tend to follow an Agile approach many times.” (R3)

“questioner and interviews” (R4)

“Through a series of meetings and discussions.” (R5)

“Through initial interactions like sharing of necessary documentation, interviews and guided tours of client premises.” (R6)

“- we visit their premises
- we conduct interviews,
- we review organizational documents with the help of users
- we document the process, do visual representations and review the process with the users.
- we involve users thru the development process so as to keep on track. Users confirm that that is what they want or help us incorporate change before long.” (R7)
“The users are involved during requirement analysis to identify what exactly is needed of the new system and their expectations. Also users are involved at the testing phase to know whether the designed system meets their needs.” (R8)

“There is project manager who interacts with them to identify the needs.” (R9)

15. If No to question 13: Why are the users not involved?
No one of the respondents answered no to question 13.

16. Please provide any other comments
Two respondents did not provide any other comments.

“the usability lab would be a very good concept to advance IT research and can act as a software standards bureau for Uganda before any software is launched into the Ugandan waves” (R1)

“We wait to see the innovation and application” (R2)

“Is it possible to learn of the results of this survey? Am eager to learn from the results.” (R3)

“This will be a good initiative in endeavoring usable 'somethings' are developed.” (R5)

“A usability lab would be an enhancement to the system design process and is a good idea therefore.” (R6)

“This will be a great facility of successfully set up.
A lot of good software is developed but failure occurs at the stage of getting it to the users. This facility will close the gap between development and distribution. That gap is user acceptance and fine tuning of the product.” (R7)

“We appreciate the developments and pray its put in place because there has been a very big gap between the design and the user requirements phase, but with that lab in place am sure those problems will no more.” (R8)