

Project Minesweeper

INF4060 - Interaction Design

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Autumn 2012

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1 Introduction

Our project group in INF4060 - *Interaction Design*, has developed an iOS-application for the science library in the Vilhelm Bjerknes' building. The application consists of two parts: One is a system for booking group rooms at the library, providing different types of information for the user. The other part is a social experiment for the possibilities of collaborative work at the library.

1.1 Project group

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Martin: Has a bachelor degree from IT and Information Systems and several courses in communication (UiA). In his bachelor project he started a pioneer technology and HR project focusing on increasing physical activity among employees with non-physical working environment. Martin has also been working as a graphic designer and photographer, and are very experienced with Adobe software.

Rebekka: Has a bachelor degree in information technology with specialization in web communication from the Norwegian School of Informatics (NITH). She is a competent user of Adobe InDesign and has experience as a test leader. Her bachelor project was about developing a customer portal for the IT company Syscom.

Siripong: Has a bachelor from Computer Engineering from Chulalongkorn University in Thailand, bachelor project was about 3D game programming development. He also had some work experiences in the fields of software development (Windows and iOS platforms).

1.2 Brief

The library staff gave all project participants free reins from the start and encouraged everyone to be creative. The topic was chosen after a brainstorm within the group. All members aimed to have at least five ideas for our first gathering, and most of our ideas were primarily meant to increase the library's appeal. The booking system, however, was the only idea that was mentioned twice. What separated this idea from the others was the practicality/necessity of the system, whereas the other ideas were more fun/pleasure-based. One of the project members had already confirmed with the library that there was no current booking system for the group rooms. Some of the group members also had experience with similar booking systems from previous schools, and found them to work very smoothly. After presenting the idea to the library staff they immediately gave us a positive response, and so the project began.

At first we wanted to implement several different features into the same application, and couldn't really free us from the gamification phenomenon. Initially we wanted to include a *fun feature* (the treasure room service) to increase the use of our tool, but this idea was rejected at a later stage due to the feedback from our users. The reason for this was that the users didn't see the benefit of increasing the activity around the group rooms, as they were already congested.

The additional idea we held on to, our most precious idea that we felt would make this application stand out, was the *social feature*. The group loved the challenge of maybe altering peoples behaviour, and changing the way group rooms could be utilized. This is like candy for any interaction designer. Unfortunately, there was not enough time in this project to harvest the fruits of our idea, but hopefully we have managed to plant a seed for further development.

1.3 Goal

A goal can, in our case, be defined in different stages. We want to create an application that will help the library manage its facilities by making them more accessible and offering them to the general student population in a way which promotes structure, predictability, democracy and order. This is the main use of the application, a use we can expect to see and one that we through research have found to be a typical and reliable product, that people will use if implemented. We wish to design this application, and conduct usability testing to promote a typical industrial process, gaining us experience and confidence in future work.

Having this foundation, we wished to try something new and innovative, and see how we could angle the new and emerging trend that is the digital social space. Seeing the great success

behind Facebook, Twitter and similar sites, we know that people like to be social and share their thoughts and ideas. What if we could use this desire to share thoughts and ideas? We want to take this digital space, and move it into the physical space. Why not use the library to discuss selected topics with other like minded individuals? We have a goal to promote this idea with our room booking application. We want to see people making new friends and promote collaborative group work in the university by offering them an easy tool that can do just this, wrapped in a reliable tool that the students would already be using.

1.4 Plan

Early in the semester we developed an initial progress plan with iteration cycles for the application development. In this early plan we also had focus on implementing necessary, physical gadgets, i.e. card readers mounted on the wall for check-in possibilities, but this had to be reorganized due to limited resources and time. In addition we got the impression that we had the entire semester for designing and developing the prototype, but realized later that the 4 first weeks were dedicated to the design and development process, and the last 6 weeks for evaluation, e.g. user testing and data analysis.

In subject to this, we created a new progress plan after the mid-term presentation (Appendix A) for the second half of the semester resulting in a more corresponding plan. However this plan also deviated from the actual progress. We originally planned for two usability tests, but since the first usability test was a lot more time consuming than expected, we were able to conduct only one.

2 Current technologies and applications

This section describes our choices with technology and platforms for our prototype and has a look at an existing relevant application.

2.1 Technology and platforms

At the beginning of our project, we had a discussion about the platform on which we planned to implement the prototype. We came up with three different platforms which are:

- Web application: We thought this would be the most appropriate platform as everyone can access this platform on different types of devices, e.g. smart phone, personal computer, laptop and tablet. It is also a standard that is applicable for different operating systems such as iOS, Android, Windows, OS X and Linux.
- Android: This is an operating system for smart phones and tablets which currently make up the highest percentage (58.8%) of market share of mobile OS [3].
- iOS: This is the platform for iPhone and iPad devices. This platform also make up the high percentage (32.2%) of the mobile OS market share compared to the rest of the platforms [3].

Considering these three choices, we believed that the first one is the best choice because it will be a product that is available for the majority of the population. However, since we had little experience with this, we decided to choose iOS as the platform for our prototype as it is the platform which our group have the most experience with in terms of application development. The tool we used in our development process is Xcode 4.5.

2.2 Similar applications

The Norwegian Business School (BI) has developed a mobile application. This application does not only cover library services, but also calendar schedule and an archive with access to all previous exams at BI. A information website clearly states that this app includes reservation of group rooms, but when downloading the app, we could not find any function that could remind of such a service. It should be noted that it has not been possible for us to fully explore and study the application due to log in requirements with a BI account. It could be possible that the group room reservation function is “hidden” underneath one of the other library functions, but most likely it is a lack of consistency between the website information and the actual app. We still examined how the website inform about the content of the reservation function: This app does not include a social feature for creating and joining discussions. This is a “traditional” group reservation function, but what strengthens it is that you can use the same software, the same app for all BI institutes in Norway. More information about the BI mobile app can be found at <http://www.bi.edu/students/IT-Services/BI-Mobile/>.

3 Theory

Research done in similar space as we wish to explore could be helpful for us. We have taken a look at some research we found relevant in this section, as well as the principles behind our design choices here.

3.1 Related research

Designing for situation awareness

The article [6] explains different challenge areas for system Awareness system, which are also applicable for our project. One of the challenge areas presented in the article is "*Data Overloading*". The challenge is about the limited bandwidth in the human mind that would become the bottleneck when exposed to an overwhelming amount of data. In regard to this challenge area, we have tried to design a system that provides the user with the appropriate amount of information according to the use situation. The "Book Now" functionality mentioned under section 6.1 is one of the examples of our endeavor to present only small amount of data. In addition, designing an application for smart phones, it is mandatory for us to think carefully about the appropriate amount of information that needs to be presented to the user in a small area.

We also tried to design an application that is easy to use and not to add unnecessary complexity into the product. The example can be found in our main menu page (Figure 6.1.1b) that contains only three major functionalities. Only when user selects from a specific menu there, the system will reveal the sub-features that are categorized under that specific menu. This could be seen as our effort of trying to avoid the "*Complexity Creep*" mentioned in the article [6].

Challenges of Participation in Large-Scale Public Projects:

This article is inspiring for our project, as it feels very closely related to our work. The article explains that; "*the new building that houses the library must necessarily reflect the ways in which the library as an institution is challenged and transformed by the emergence of new digital technologies*" [5]. We see a transformation described in this article, that the library is in the middle of. It is about an institution (re)defining itself in the modern society. For our project, the following statement felt very accurate; "*For many institutions, the case is that they play*

important roles in the public sphere not only due to the materials they house and curate, but because they have also become bearers of culture and places of public engagement and participation." [5]. Without going further into the cultural aspect, we argue that the library is a meeting place for students, and the meeting rooms as well as open areas are popular places of public engagement and participatory work. The article further speaks of the impact of this new technology and how it changes the definition of "participation". To us and our social project, this is a very important aspect to grasp. We believe that with the terms used in this paper, we are somewhere within the Arena A and B, where "*Arena A deals with the design of work forms and systems within an individual project arena*" [5] and B that includes "*technological developments concerning the content that a library hosts and provides access to (Arena B)*" [5].

The article also presents a triad of core values, that include Quality, Emancipation and Democracy [5]. While we cannot guarantee the quality in the group conversations that will emerge, we can work on the quality of the application that makes them possible. In regards to the Emancipation, we have tried to conceive this project from our viewpoint as designers, the students' viewpoint, and the library's viewpoint. The democratic view has been a sales pitch for us since the start.

In the Mediaspace project, we see a very large focus on participation with the means to create something new. This is not quite what we have in mind (public hearings and such) for our project, but we do find inspiration from the ideas like living blueprints [5].

Further we gain insight on issues getting people to participate in the projects. To us, we need to find a way to motivate and encourage users to find our social application and use this to change their understanding of what a library is for. The article states; "*Some potential users of the library may not at the present have any relation to the library, or may not think of the library as a place for them because it is disjoint from their current practices and the ways in which they access information and media.*" [5]. Solutions to this according to the article, is to make the participation a central value [5]. They need flexible learning environments, to feel the projects are relevant, get access to the information, and to be able to take an independent position on the problems. With our application, we believe we can offer the flexibility needed with the selection of topics and large base of participants. We can offer them course relevant discussions, and we can easily give them the information by the click of a button. The article does though bring to light the problem group, which is the people who do not currently use the library, and explains

that it is; “*very difficult when it comes to citizens who are infrequent library visitors, or who do not use the library at all.*” [5]. We can not come up with a solution like they did to promote the participation, but we can be aware that there will be issues promoting this application, and making sure the students knows about its existence.

3.2 Design principles

In recent years the appearance of products and how we interact with them, have changed dramatically. As a result of this, our relationship with products has become less engaging [4]. In our project we wanted to change this with our social feature. Instead of just inviting others to come join a discussion in a group room, which itself has a high threshold, we decided to use design and technology to lower the threshold and increase both the students’ and the library’s sociality. Hopefully the outcome of this would be a totally new experience of the library. Humans are emotional beings, why not make interaction a more fun and beautiful experience? [4] Furthermore it has been most important for us to apply well-known principles for good design in subject to create a user-friendly application. In the following subsections we examine Donald Norman’s (2002) principles of design and relate them to our application development and design process.

Visibility

“The more visible functions are, the more likely users will be able to know what to do next. In contrast, when functions are “out of sight,” it makes them more difficult to find and know how to use” [7].

Despite this, all the functions do not have to be displayed constantly, but only when the user needs those functions. Also, similar functions should be grouped in order to make it more intuitive to locate them.

In our design we have put a big effort into the main menu, which we think the user would expect to find. Only the most essential functions are located in this menu. The functions are displayed with both icons and text and the icons are big and clear – easy for the user to understand. Minor functions, i.e. the settings page is “hidden” in a secondary menu screen which can be revealed by tapping the *My page* icon (Figure 6.1.3c). In general for the application we have stressed simple, but still beautiful, design by not including a lot of small buttons and a lot of

text. When addressing the users' emotions we believe that there are other ways of doing such than to take the "*Walt Disney approach*" [4]. When users use the social feature we are addressing them in an adult way with a cognitive approach; clean and simple design. "*Design is not about the smile on the product, it is a smile in the user's heart*" [4].

Feedback

"Feedback is about sending back information about what action has been done and what has been accomplished, allowing the person to continue with the activity. Various kinds of feedback are available for interaction design-audio, tactile, verbal, and combinations of these" [7]. The principle of feedback has been applied carefully into our prototype. Every time the application need to load or process data, i.e. to or from the server, the user should be informed about what is happening, otherwise the user might think that something is wrong.

In respect of the feedback principle we have ensured that the user receives understandable feedback messages in a pop-up window every time the application needs to load or process data and thus needs some time to finish a task. We have also applied .gif animations like the turning wheel, which illustrates loading or data processing.

Affordance

"Affordance is a term used to refer to an attribute of an object that allows people to know how to use it. For example, a mouse button invites pushing (in so doing acting clicking) by the way it is physically constrained in its plastic shell" [7]. "*When the affordances of a physical object are perceptually obvious it is easy to know how to interact with it*" [7].

In brief, affordance means to give a clue/ hint of what action a function really perform. In our design we have been consistent with use of cognitive icons that through illustration reveals it's purpose and what services they lead to. For example, the calendar icon leads to the reservation function, the user icon leads to the profile page, and the speech bubbles leads to the discussion board. Of course, we cannot know for sure that every single user instantly understand what the discussion board function is, but the icon at least gives a clue.

For navigation, the iOS user interface is really great. In the top of the screen a navigation bar is always displayed to inform the user of its position in the application. In addition we have applied large and colored call-to-action buttons in locations where the user is urged or prompted

to process information, i.e. reserve a group room. In general for the application we have applied only necessary and important features into the different functions in order to guide the user in the right direction and to complete a task effectively.

Mapping

“This principle refers to the relationship between controls and their effects in the world. Nearly all artifacts need some kind of mapping between controls and effects, whether it is a flashlight, car, power plant, or cockpit. An example of a good mapping between control and effect is the up and down arrows used to represent the up and down movement of the cursor, respectively, on a computer keyboard” [7].

If the user taps an icon in order to perform a specific task it is vital that the application responds and performs the expected task. Otherwise this would confuse the user and contribute to bad usability. In our design we have diligently applied illustrations and icons to orient the user about what the he/she can expect before performing an action. We are not thinking labels, we are thinking expressiveness and identity. It is often hard to differ between controls and their actual purpose, and they are often quite similar to each other. With explanatory text and icons the user gets a better understanding of what the actions lead to or mean [4].

Constraints

“The design concept of constraining refers to determining ways of restricting the kind of user interaction that can take place at a given moment. There are various ways this can be achieved“ [7].

Eventually the user would want to perform a task that is not allowed, i.e. create a discussion topic before reserving a group room. In order to restrict the user from doing such, we have designed the structure in a way that “forces” the user to first reserve a group room before the option of creating discussions is revealed. The principle of constraints also relates to the principle of feedback: If a user repeatedly tries to perform a given task, which s/he is not “allowed” to, an error message displays to inform the user about why s/he cannot perform this way. The reservation function is also quite straightforward and let users reserve a group room only by a few steps without any significant interference. Even though we want to present a straightforward design, we would like to not think of the application as a product, but as

experiences. A design should offer the user freedom for building his or her own experiences [4], and not be constrained by a specific road with no other options.

Consistency

“This refers to designing interfaces to have similar operations and use similar elements for achieving similar tasks. In particular, a consistent interface is one that follows rules, such as using the same operation to select all objects. For example, a consistent operation is using the same input action to highlight any graphical object at the interface, such as always clicking the left mouse button. Inconsistent interfaces, on the other hand, allow exceptions to a rule” [7]

We consider our application to be perceived as really easy to use. The only thing you have to do is tapping icons and scrolling a time wheel to set you reservation. In order to keep the application as easy as possible we have not implemented any advanced finger gestures. We believe that finger gestures are unnecessary in our application and only would lead to more complexity in subject to the interaction design.

4 Methods

Most of our inspiration and theoretical understanding to this term, comes from the article by Chadia Abras, Diane Maloney-Krichmar and Jenny Preece, with the name “User-Centered Design”. The term UCD is described in the following way; *“‘User-centered design’ (UCD) is a broad term to describe design processes in which end-users influence how a design takes shape. It is both a broad philosophy and variety of methods.” [8]*. The choice for us was between Participatory Design or User Centered Design. However, with the time constraint and considering the risk of finding a group of participant who can take a role of co-designer with us for the whole design process, we decided to use the UCD as the approach for our project. In this chapter, we explain how we’ve followed the UCD guidelines, and how we have involved the users, to argument that our work falls under the UCD approach.

4.1 User-centered design

From the article [8], we learned that the needs and interests of the user must be in focus from the start of the project, as well as the usability. A golden rule for us during this semester has been to

follow this guideline; *“The role of the designer is to facilitate the task for the user and to make sure that the user is able to make use of the product as intended and with a minimum effort to learn how to use it.”* [8]. A first question to answer, might be; Who are the users? For us, these are mainly the people who use the library and its group rooms. These are the primary users for the room booking aspect of our application. From the social addition, we have wanted to broaden the target group, to all students at the university. This broader group, we will call the secondary users. The library has been a substantial stakeholder for our project as well, but from the feedback we had, and the time allocated for the project, we decided to focus on the students. For the sake of consistency, we will list the library as the tertiary users.

There are other stakeholders as well, but which have not directly been included in the development. We have had meetings with The Study Administration about their current complex infrastructure & system so we could find out to which degree we could be a part of this. The University of Oslo, as well as IFI are somewhat affected as stakeholders because of the territory of which we wish to deploy this technology, and the other libraries as well. We have though avoided these because our work is not directly related to any of their systems.

Involving the users: The techniques we have used are mostly based on the table presented on page 5 in “User-Centered Design” [8], with some smaller alterations. It started with observations and surveys to understand their needs, and what they used the group rooms for. From here on we moved to the focus group, to involve the stakeholders in discussion of use and functionality. The third step was a workshop that included the same groups (not the same individuals). The workshop was followed by some high fidelity mockups based on their design, and then tested with experts, to get more experienced feedback. The design was again changed, and we started Usability testing. We followed the five goals listed by Dumas & Redish [8] and focused on the usability, involving real users, giving real tasks as well as observe and record their actions. The session encouraged users to think aloud. We also conducted pilot studies beforehand, to ensure the quality, as is specifically mentioned in the article. The usability testing was followed up by some questionnaires, which directly related to their experience with the application.

We believe this approach to fall in line with the suggested usability engineering lifecycle presented in the article [8], and believe we have covered the three stages of iterative testing:

1. (Feedback before code with mockups and paper) Workshop
2. (Feedback on early-middle stage of prototype) Expert evaluation

3. (Feedback on ready interface and final product) Summative user testing (usability testing).

We would like to add that additional research on all of these iterative phases would have made our UCD approach stronger, but that because of our time limitations, we had to make sure we had time to cover all stages.

We believe we have understood and correctly used the UCD approach, and feel that our product has become a lot more viable because of this. We have learned a lot from exploring this approach, and feel all products should be constructed with the users in the centre of the design.

5 Design process

In this chapter, we will go through the ways we have acquired our research and the ways we have validated our project every step of the way. It starts with exploratory study done to acquire insight, and follows a user centered approach towards getting the user more and more into the project.

5.1 Exploratory study

Our group decided that, before rushing into the process of designing the application, it's better to take some time exploring the current "actual" situation in regards to the use of group room at the library and get the opinion from the "wider population" of potential user about our ideas. As a result, we employed the passive observation technique in the hope to discover the "actual" situation. Once we had some insight, we made a pilot survey, then two more (to insure quality) in order to gain opinion from the "wider population".

5.1.1. Observation

The primary information gathering were two observations performed on a Friday and the following Monday. The goal was to observe the activity around the group rooms, and see how the students organized themselves whilst working. There are 13 group rooms, and all group rooms were occupied during the first observation, with roughly 2 students in each room. Many had gathered around the open tables in the open areas and seemed to discuss loudly, perhaps cooperating about their homework. Also, NRK was doing a loud recording in the canteen that

could be heard all over the library. On the following Monday the same pattern was seen, but with less disturbance from the canteen. From these observations we could conclude that:

- the rooms were indeed popular
- that they provide one of few options to cooperate in peace without disturbance
- that many of the rooms were occupied by 1-2 people working alone, not utilizing the full potential of the room

5.1.2 Survey

We performed a survey (Appendix B) where we narrowed our scope for the actual people present at the Vilhelm Bjercknes' building. We handed out 20 questionnaires on a Friday and another 31 on the following Monday. The questionnaires were handed out to those present in all group rooms, and a handful of people in the canteen. This way we covered the whole building in two separate days (people are in a different mindset on Fridays and Mondays). We summarised exactly what we wanted to find out:

- Type of library user (frequent/ average/ never there)
- Who uses the group rooms/ how long/ for what purpose
- Would they use a booking system
- Does the idea of accessing someone else's room sound intimidating/ futuristic

We also added an open-ended question at the bottom with options for critique and ideas, but unfortunately we didn't get much feedback. This could be due to the survey being so short that they did not take enough time to reflect.

Key opinions from the survey:

- There were concerns as to how necessary the application would be for the students. Some were afraid that the booking system would result in confusion for those who were not aware of it, and causing busy students to be kicked out of their group rooms.
- Most people were positive to the social feature, but a good few thought they would feel intimidated using it.

There were a majority of responses in favor of the social aspect, and when asked if they would use the system, there were more "maybe" and "yes" than negative answers, so we decided to stick to the plan despite previous concerns.

5.2 Focus group

After conducting the observations and surveys we decided that we should conduct a focus group to “*easily gather a broad range of opinions*” [1] from the students. At this point we had some ideas about what features we wanted in the application, but we needed some feedback from the target group to make sure that we were on the right track. We therefore booked a meeting room at the science library and recruited five students to participate in an hour long discussion. Two of them were recruited in advance while the last three were recruited on location. The group consisted of two girls and three boys, of which two studied at master’s level and three on bachelor’s level. The library supplied gift cards from Akademika as compensation.

During the focus group we presented four scenarios/ storyboards (Appendix C) to the participants, two of the current situation and two of how the situation could be when the application was realized. After each scenario the facilitator encouraged the participants to share their opinions about it. Something that may have influenced the flow of the discussion, was that it was held in English. This may have inhibited some of the participants, especially early on in the discussion.

Outcomes

We got a lot of useful feedback from the participants. In the first scenario we discovered that we had misunderstood the main purpose of the group rooms. We thought that the students used them to work undisturbed, but they explained that they use them when they want to discuss things without disturbing the people sitting around them.

In general the students seemed displeased with the current situation because they spend a lot of time searching for vacant rooms. Another frustration was the fact that the rooms were occupied by one person at a time, and they suggested a system that would perhaps force two people to book a room, to avoid those situations.

They were positive to a group booking system where one could find out about the features of the room in advance, such as if the room had a screen and if it was working or not. A screen or monitor could display the status of all the rooms, so that students could easily tell if they are available or not. A “check-in” function could be applied, so that if people did not show up, the room status would change from “occupied” to “vacant”(which correlates with the issues presented in the meeting with the Study Administration). The participants also wanted a time

frame for the booking so that one could only book one day in advance and for a limited amount of hours. They also suggested a penalty for not showing up, for example being banned from the system for a week.

The social aspect was well received by the participants who expressed big interest in it when we brought it up. They thought the situation might be awkward if strangers came into the rooms and suggested that the topics may be displayed on Facebook so that friends can join in. They also wanted to sync the time and date of the discussion with their calendar and receive a reminder when the event was approaching. They were negative to the treasure room idea because they didn't want to attract more users to the rooms.

In general the students seemed positive to the group room booking system and suggested that it could be implemented over the entire campus so that it could lead people away from the Wilhelm Bjercknes' building. It seemed like the users supported the democratic ways of the room booking system and this gave us the confidence we needed to continue as planned. The only thing we changed as a result of the focus group was the treasure room function, which we removed.

5.3 Workshop

The main purpose of the workshop was to involve the users in the design process, and get feedback on how they wanted the main functionalities presented. We asked them to visualize their ideas through drawing. We recruited six students to participate and divided them into two groups. Together they discussed the possibilities for the booking function and the discussion feature.

Outcomes

The two groups ended up with quite different results. The first group divided room booking into two different functions where one was a real-time function that showed an overview of rooms that were booked at the moment and the second contained a calendar for booking ahead of time. They also wanted detailed information about each room to show who had made the booking, equipment available in the room and which topic being discussed.

The second group wanted a quick book function with few steps, so that it would be easy to book a room on the spot. They suggested marking the rooms with different colors to

distinguish which one is taken and which is available. They also wanted a map with the location of the rooms. After you have made the booking you could add a topic for discussion and invite people to join. They meant it would be more inviting to join a discussion if one could see the face of the person who initiated it, so people should have a personalized page called “My Page” with some information and a profile picture. To get a quick overview of booked rooms, they wanted a separate page called “My reservations”. The first prototype was largely based on these ideas.

5.4 Expert evaluations

Besides including the users in the decision making, we wanted the opinions of experts. We therefore had two sessions of expert evaluations.

5.4.1 Expert evaluation at Netlife Research

After our user workshop, we created a set of quick mockups using a combination of Mock and Photoshop as an idea for the prototype. (Figure 5.4.1 a-d).



Figure 5.4.1 a-d: The sample mockups presented at Netlife Research

Netlife Research is a company consisting of user experience specialists and we got the chance to present our project to them and gain feedback. After the presentation, we were suggested to simplify both features “Real Time”, the feature to see the current available rooms in the grid format with color codes (Figure 5.4.1 b), and “Make Reservation”, the feature to reserve a room

by specifying date and time in advance. In addition, we also got comments on that the wording “Real Time” could be perceived as a bit confusing.

Other phrasings such as “Instant booking” and “Book Now” were suggested by the expert group. As a result, these advices influenced the design changes in reservation feature in the final prototype. We decided to have date and time filters in the same page as the room grid status, which changes its colors code according to the availability of the date and time of each room (Figure 6.1.2a). At this stage, the “Real Time” was removed from the main menu as it was combined with the “Make reservation” feature.

5.4.2 Expert review from Alma Leora Culén

After finishing a high fidelity prototype, we demonstrated it to Alma Leora Culén, the teacher of the Interaction Design course INF4060. We were suggested to bring back the improved version of “Book Now” feature into our prototype. This time, the feature was enhanced for simpler use. (Figure 4.5.1c)

5.5 Analyzing the data

At the beginning of our design project, we collected the quantitative data from the survey. Data from the survey was made into pie charts and histograms. The purpose was to see the feedback from a wider public about our ideas before starting the real project. Apart from the quantitative data from the survey, we mainly dealt with qualitative data, such as observation notes, interview notes and audio recordings. We also used the sketched mockups produced from the workshop (Section 5.3).

The observation gave us descriptive understanding of the current situation of group rooms at the library. The data from the focus group, the audio recording and interview notes, were analyzed and categorized into two groups of functionality, room booking and open discussion creation (the treasure room was rejected from the scope at this phase). This resulted in the concrete functionality list for our prototype. The paper mockups produced by participants in the workshop gave us good inspiration regarding user interface design, which again created a starting point for the concrete mockups for our prototype. These were used as central point of discussion in the expert evaluation session at Netlife Research. The discussion in the session led us to combine the two overlapping features into one. At the end, the interactive version of our

prototype (high-fidelity prototype) was also improved after receiving advice from Alma about an additional feature, “Book Now”.

6 Evaluation

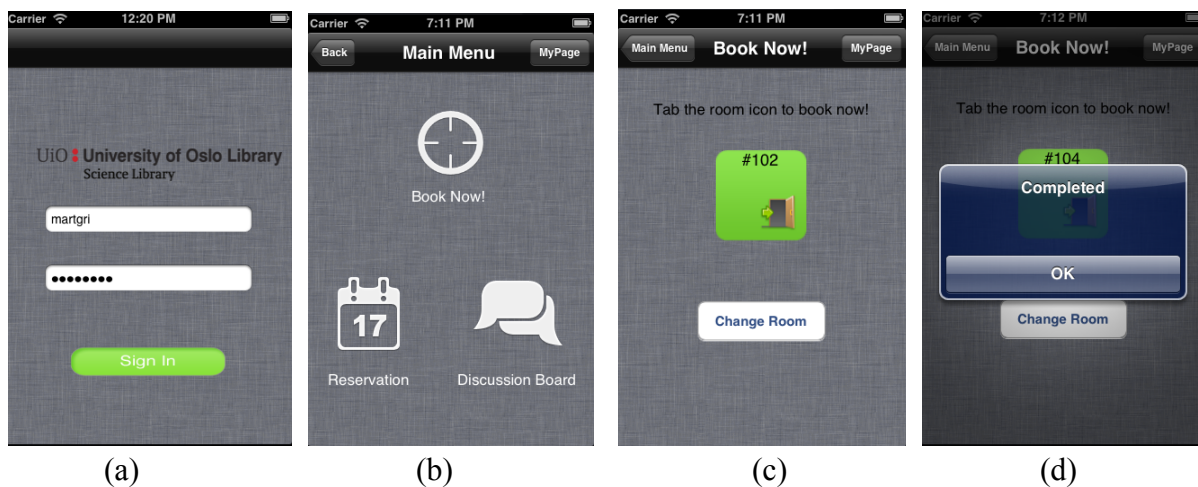
In this chapter we look at our efforts to test our application with representatives from the user group, and our real-use scenario.

6.1 Prototype for usability testing

This section explains the features and limitations of the prototype we used in our usability testings with participants.

6.1.1 Features

The first page of the prototype is the login page (Figure 6.1.1a) on which the user is supposed to provide their student ID and password, however, this is not the case right now. Please see more details from the limitation section below. After completing the login operation, the user will proceed to the main menu page (Figure 6.1.1b).



As you can see from Figure 6.1.1b, there are three main features of the application as follows:

“Book now” function: If the user taps “Book now!”, they will be provided with one room which is available *right now* (Figure 6.1.1c). This is considered as the fastest way to acquire a room at the current time because the user will get the room booked right away after tapping at the room icon (Figure 6.1.1d)

Reservation: After user taps “Reservation”, they will be presented with a simple grid view of all rooms with different color codes (Figure 6.1.2a). The filters to change date and time are available at the top of the page (Figure 6.1.2a). The red icons means that the room is occupied at the time specified in the top filter, while the green icons mean that the room is available for booking at the time.

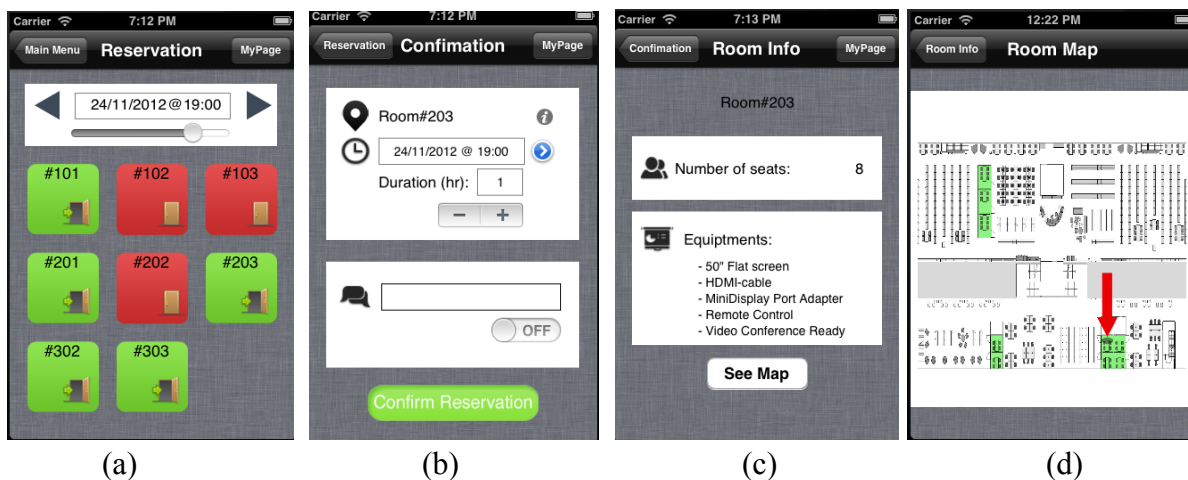


Figure 6.1.2a-d: The room grid view (a), Confirmation page (b), Room information (c) and Room map pages (d).

Tapping at one room icon, will send the user to a confirmation page (Figure 6.1.2b). On this page, the user can confirm the reservation by tapping at the green “Confirm Reservation” button. The user also have a choice to create an open discussion by entering a discussion name at the bottom area of the page (Figure 6.1.2b). The user can tap an information icon beside the room name of the page in figure 4.5.4a to see the information of the room (Figure 6.1.2c). In addition, from this room information page, if the user taps the “See Map” button, a map revealing the the rooms’ location will appear (Figure 6.1.2d).

Discussion board: After user taps the discussion board menu (Figure 6.1.1b), they will be navigated to a new page that contain a list of all available discussion (Figure 6.1.3b). If user tap any discussion topic, a page that displays the detail of that specific discussion will appear (Figure

6.1.3a). Then, user can tap “Join Now!” button to join that discussion and they will see the green check mark icon appearing in that discussion entry of the discussion list (Figure 6.1.3b)

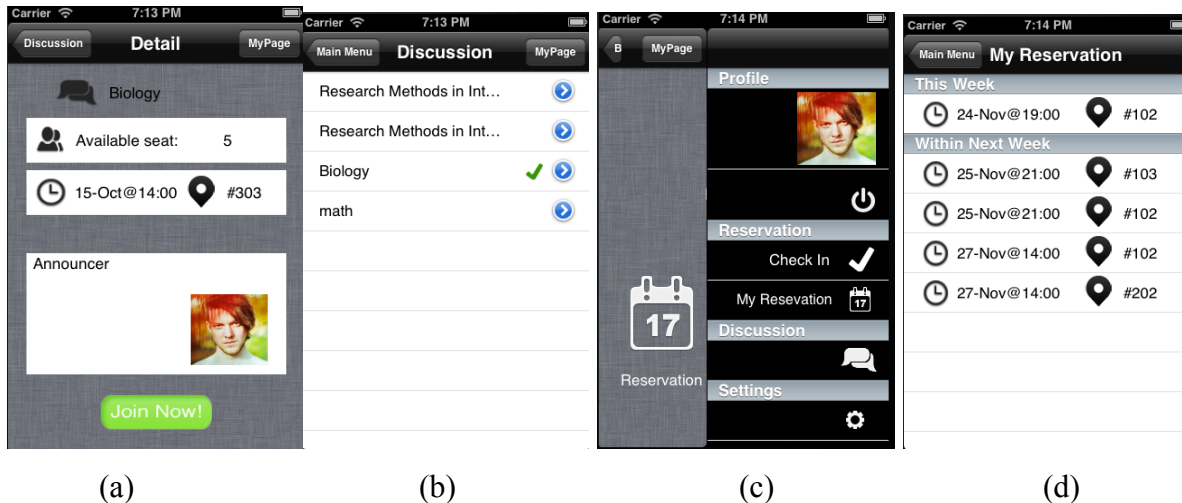


Figure 6.1.3a-d: Discussion Board features (a-b), my page sidebar menu (c) and my reservation function (d).

My page Sidebar menu: On any page, if user taps at the button on the top right of the page, the sidebar menu that shows different functions to manage user personal data will appear (Figure 6.1.3c). Because of the time constraints in this student project, we still haven’t implemented all functionalities listed in the sidebar. The only one currently working is “My Reservation” function (the calendar icon listed under the reservation group in Figure 6.1.3c). Tapping the calendar icon in the sidebar will show the list of all reservations made (Figure 6.1.3d). If the user taps any specific reservation in the list, they will be navigated to the reservation information and be able to cancel the reservation.

6.1.2 Limitation of the prototype

This section describes the current issues and some limitations of this final prototype. Firstly, we still don’t have access to the real student database in order to use the real student ID and password as a login for our system. Currently the prototype uses Google account to login and retrieve all booking information stored on the Google Calendar. Therefore, our second limitation is the connection to the real room booking database of the university (the database of “FinnRom”). The next limitation of this final prototype is that the application right now is available only for iPhone platform, as this is the platform our group has the most experiences

with in term of application development. Unfortunately, the time limitations of this project doesn't allow for learning new programming languages and development platforms.

Also, using a student card for the check-in by swiping the card at a card reader in front of your room is another area of improvement. We believe there will be a lot of security challenges which need to be taken into account here if the prototype is to interact with the real student's credentials (e.g. student card and student ID).

6.3 Usability testing

We wanted to get some feedback on the prototype we made from the target group. We decided to arrange a usability test as the best way to improve the quality of an interface is by finding flaws in it [1]. The goal of the testing session was to find out if the application was user friendly, if the users understood how to interact with the system and if they were satisfied with it.

6.3.1 Participants

We decided that it would be enough to recruit five participants because *“five users will find approximately 80 % of usability problems in an interface”* [9]. The book [2] suggested hanging up posters for recruiting participants. Our posters (Appendix H) around campus got so much response that we had to turn down a few people. Our final participants were science students between 20 and 30 years, three girls and two boys. They were both master and bachelor students and each of them received gift cards from Akademika on NOK 200.

6.3.2 Location, equipment and roles

We borrowed the User Experience lab on the 7th floor in the Ole Johan Dahl's building for the testing session, as this room doesn't feel crowded with six people in it. We set the limit to five people present in the room in order not to intimidate the participant.

In order to document the outcomes we recorded each session with a video camera and took notes of the participants' statements. The participants tested the application on an iPhone supplied by us. We recorded the screen during the test and were careful not to film any identify revealing details of the participants.

To keep track of the tasks that needed to be done on the day of the test we distributed roles to each group member: One test leader running the test and explaining the plan for the

participants, one observer writing down what the participants said and one for noting down non-verbal reactions, one technical person responsible for the recording, and another for picking up participants and making coffee.

6.3.3. Tasks

Each participant first signed our consent form (Appendix E). They then spent about half an hour on the test; 20 minutes doing tasks on the application and the rest filling out two satisfaction surveys. During the test we measured the time it took for each participant to finish four tasks and we also noted facial expressions, errors they made and suggestions they had for improvement. The tasks (Appendix D) evolved around the three main features of the application, namely “Book Now” (for instant booking), “Reservations” (for booking ahead of time) and “Discussion Board” (for creating discussions in group rooms).

6.3.4 Findings

The participants were for the most part able to complete the tasks without help. They also seemed satisfied with the application and asked us when it would be released. Here we mention some key findings that participants commented on and issues that their behavior revealed.

Book Now and Reservation: Three of the participants had trouble fine tuning the time of day when they booked a room on the “Reservation” page. Two participants showed frustration when they found out that the only way to change date was to press the arrow repeatedly. All five seemed confused about the difference between the “Book Now” and the “Reservation” function. Two participants had trouble finding the “Room info” page with the list of equipment, showing that the arrow that indicates info must be more visible. One participant had trouble finding “My Page” to get a view of previous reservations.

Discussion Board: Three of the participants spent some time finding out how they could start the discussion. They seemed puzzled by finding the discussion field on the “Confirmation” page as they expected to be able to create a discussion under the “Discussion Board”. They were also uncertain whether they joined the discussion or not, as the “Join now” button did not give any confirmation.

Overall satisfaction: A SUS-test (System Usability Scale) [2] was handed to each participant at the end of each session. This is a widely utilised satisfaction test, specially developed to give clear and precise results, where the scores of the questionnaire are calculated according to the SUS-procedure. A positive evaluation will give a score closer to 100 on the scale. The results for the five participants were: 60, 90, 55, 55, 87.5. The results were all on the right side of 50, (average 69.5) but cannot be said to be amazing. The test itself doesn't give a broad evaluation, but it's strength is that it is replicable and gives a good indicator of the system's appeal.

6.4 Improved prototype

After consolidating the feedback from the five participants during the usability test, we prioritized them according to the frequency and severity of the issues. The following were the five top areas of improvement:

- Notification: We removed some unnecessary actions required for a user in the message dialog, e.g. user have spent an extra tap on the “OK” button after the booking was completed. In addition, we added a confirmation dialog when the user wanted to withdraw from a discussion or cancel their reservation (Figure 5.4.1a).
- Discussion feature: We moved the function to create discussion feature to “Discussion Board” menu. Now, the user can see both the list of discussion topics (at the top of figure 5.4.1b) and select one of their existing reservation (at the bottom of Figure 5.4.1b) to turn it into a discussion topic.
- Book Now feature: As many users were confused with the “Book Now” feature and seemed to firstly go to the “Reservation” menu instead, we decided to reject this feature.
- My page sidebar UI: We also observed that many participants were confused about the sidebar navigation used for My Page feature. We decided to change it to be consistent with the navigation type of the other features. Therefore, we placed the menu of My Page into the main menu page and modified it to have it's own page (Figure 5.4.1c-d)
- Picture for button: There was also feedback that the information icon for navigating to the room information page was hard to recognize as a tappable object. We decided to change the image on the button to make it more obvious for the users that it's a tappable button (Figure 5.4.1a).

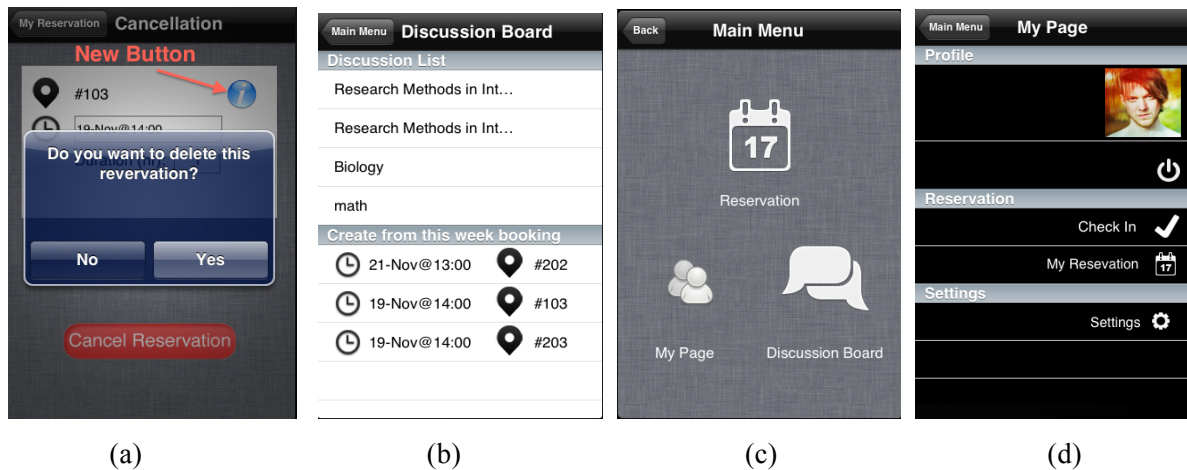


Figure 5.4.1 a-d: The screenshots of improved prototype after usability testings

6.5 Critique

In this section, we provide the critique on our own work after retrospectively looking at the whole project with a critical lens.

1) Findings Reliability: The University of Oslo consists of over 27.000 students. As mentioned earlier, we conducted a survey with about 50 participants. With a larger sample the survey's reliability could probably have been stronger. But, even though the university consists of that many students, perhaps just a fraction of these actually use the group rooms at the science library. Also, as we based a lot of our design on the end users input, it would be preferable to conduct several workshops and focus groups with even more participants.

2) Application Help: We have tried to make the system simple and self-explanatory, eliminating the need for help sections/user guides. However during the testing sessions, we discovered that help sections and explanations were still very much needed. This is something that will have to be implemented.

3) Platform Accessibility: The system has been developed for the iOS platform, which severely limits the possible user groups, and works against the open framework we have in mind. This will also have to be a topic for further work with our application.

4) Universal Design: Currently there is no support for any types of disability or impairments. There is no audio for those who have issues reading, nor any way to change font size/ zoom in. Nor has there been a solution worked out with the reception for those who cannot use our application. The color combination red - green - grey could be problematic for users with

color blindness, even if red/ green were handy metaphors for occupied/ vacant rooms. This will also have to be worked on at a later date.

7 Conclusion and way forward

At our final stage of this project, we are very happy to see that the social feature did not disappear from our initial specification. We have shown the ability to “kill our darlings” and listen to our users in regards to the treasure room feature we abandoned. This was never necessary with the social feature. Also, we have received very valuable feedback from both real users and professionals, guiding us to the final result.

Currently, only the administration and staff have the opportunity to book rooms through “FinnRom”, but not in the science library. We envisage the application as a tool that could cover all group rooms in the University of Oslo, as the science library only has 13 group-rooms. In addition, the rooms are too small (most of them have a maximum of 4 seats) to properly realise our social feature. An idea that came up during the focus group was that the application could divert students to other group rooms around campus that were not being used as much. We also touched upon limitations for how long in advance, and how many rooms per person, a user could book and how to validate that they actually show up. This is not included into the system, but we suggest another round of surveys to gather opinions about what these limitations could be.

Even though we cannot implement the system completely due to our time frame, we are still pleased with how far we have come with the application. We hope that the science library will want to continue our work so that we can see it finalized.

9 References

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Appendices

Appendix A Project plan

Iteration #	Description	Timeframe
1 - Survey	<ul style="list-style-type: none"> Decide which platform to develop for Make questions for survey 	Week 37
2	<ul style="list-style-type: none"> Distribute questionnaires Results in Google Docs form Conduct focus group 	Week 38
3 - Prototype	<ul style="list-style-type: none"> Complete schematics/mock-ups Integrate social functionalities Integrate reward system (treasure room) 	Week 39
4	<ul style="list-style-type: none"> Complete basic functionalities. Conduct workshop 	Week 40
5	<ul style="list-style-type: none"> Prepare prototype for evaluation phase 	Week 41
6 - Report and testing	<ul style="list-style-type: none"> Presentation Oct 15 (optional) Integrate sensors in each room and synchronize with application. 	Week 42
7	<ul style="list-style-type: none"> Pilot usability testing Usability testing 	Week 43
8	<ul style="list-style-type: none"> Analysing data from usability Prototype improvement 	Week 44
9	<ul style="list-style-type: none"> Pilot usability testing#2 Usability testing#2 Prototype improvement#2 	Week 45
10	<ul style="list-style-type: none"> Report writing 	Week 46
11	<ul style="list-style-type: none"> Report writing Report hand-in deadline 	Week 47
12	<ul style="list-style-type: none"> Final presentation Nov 16 	Week 48

Appendix B Questionnaire

Library survey (Vilhelm Bjercknes' hus)

Please circle around your answer

How often have you used the library this semester?

0-3 times 4-8 times More than 8 times

What do you use the library for? (multiple answers possible)

Individual study Project work Discussion

Other: _____

How often have you used a group room at Vilhelm Bjercknes hus this semester?

0-3 times 4-8 times More than 8 times

If you use group rooms at Vilhelm Bjercknes hus, what do you use them for? (multiple answers possible)

Individual study Project work Discussion

Other: _____

If you got the opportunity to reserve a group room digitally, would you?

Yes Maybe If no, why

not: _____

If yes, how would you prefer to access this service? (multiple answers possible)

Mobile application Web page At the VB reception

If a group room were discussing a topic that you were interested in, would you consider joining the discussion if there was an open invitation?

Positive Negative Other views:

In the same way, how would YOU feel about inviting OTHERS for your discussion?

Positive Negative Other views:

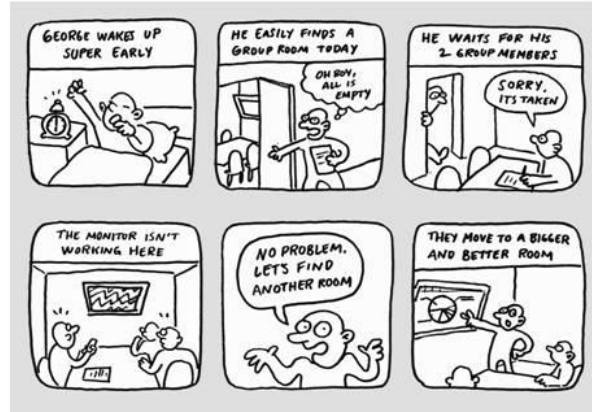
Other thoughts, suggestions, opinions, critique (positive and/or negative):

Appendix C Storyboards for the focus group

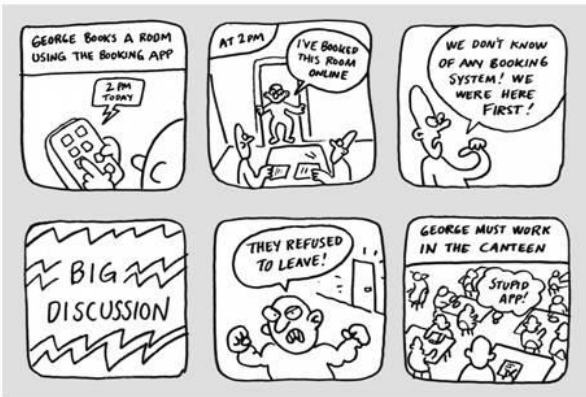
Scenario 1



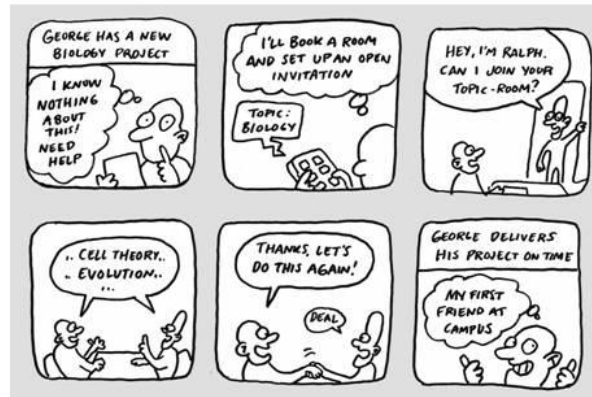
Scenario 2



Scenario 3



Scenario 4



Appendix D Task scenarios used for usability testing

Instant booking

Scenarios: You are at the library right now and need one room immediately for 1 hr. Please book a room.

Scenarios: You are at the library right now and need one room immediately for 1 hr. As a result you use the "Book now" functionality from our application.

However, the system provide you with a room you don't want so you decide to change it. How would you do this?

Future reservation

Scenarios: You want to schedule a group work tomorrow. You want to book the room at 12:00, and you want the room for 2,5 hours.

Scenarios: This time, you want to see which rooms are available and what equipment they have before you book a room for next month (november).

Personal reservation

Scenario: You want to check all detail of personal reservations you have made. Now you want to delete 2 reservations that you previously made.

Social feature: Set up a discussion

Scenarios: You desperately need help with your homework, so you want to set up a discussion room about **ecology**. You need the room for 16:00 o'clock, for the duration of one hour and obviously need to set the topic to: ecology.

Scenarios: You realise the room you booked for discussion doesn't have a TV-screen. You need to find a room that has a screen and book a new discussion room.

Scenarios: You want to see which discussions are going on today as you have some spare time. Perhaps there is a discussion about ecology? Find the discussion and join it.

Appendix E Example of our consent form

INFORMED CONSENT FORM

Usability testing session to investigate different aspects of (social) room booking system for science library at the University of Oslo.

PRINCIPLE INVESTIGATORS:

Siripong Jongsathitsathian, email: siriponj@ifi.uio.no

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Martin Braaten Grina, email: martgri@ifi.uio.no

Rebekka Castro, email: r.b.castro@mn.uio.no

Evy Litovchenco, email: evyl@ifi.uio.no

Purpose of the study: Our group is conducting a usability testing session for a project in cooperation with the library. This session is arranged in order to test different aspects of our application for a social room booking system for the library in the future. This project is a part of the INF4060 Master course (Department of Informatics). To improve the quality of the application, by finding flaws in it is the main goal

Procedures: This usability testing session focuses on our application for social room booking. Our aim is to sit down in a “usability lab” and see how a potential user interacts with our application. The participant will be presented with less than 10 tasks to perform, which will take around 20 minutes. These tasks will typically be to “book a room” and “create a discussion”. What we will measure is the time needed to perform the tasks, ease of use, error rate and satisfaction. After the testing, the participant will be interviewed for 10 minutes. The session will be audio / video recorded and we might take some pictures from the session, as we wish to have a look at the use pattern and satisfaction from using the application.

Discomfort: The whole procedure should take approximately 30 minutes. If the participant feels tired or for any other reason wishes to stop the session earlier, he or she may do so at any point.

Benefits: The results from this study will be a summative evaluation of the usability of our room booking system.

Compensation: Participant will be given gift cards from Akademika bookstore after participating in the usability testing.

Confidentiality: All information collected during the study period will be kept strictly confidential and anonymous. No publication or any report from this project will include identifying information on any participant. The audio records, video and pictures from the testing sessions will be erased after we finish our project (expected date for finishing our project is December 2012).

_____ I have read and understood the information on this form and I agree to participate in this Usability testing session.

_____ Participant's Signature Date

Appendix F SUS form

Participant ID: _____ Site: _____ Date: ___/___/___

System Usability Scale

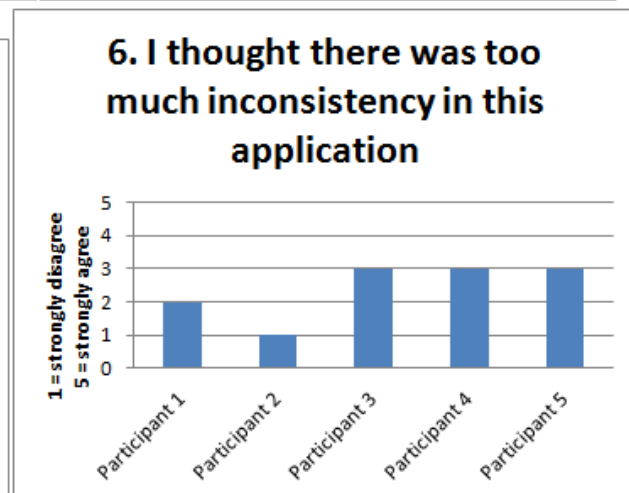
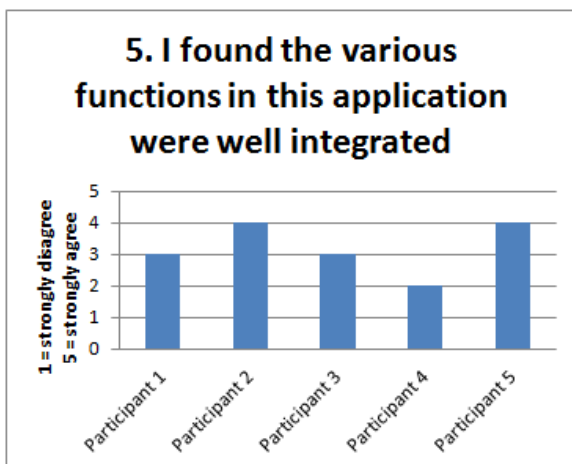
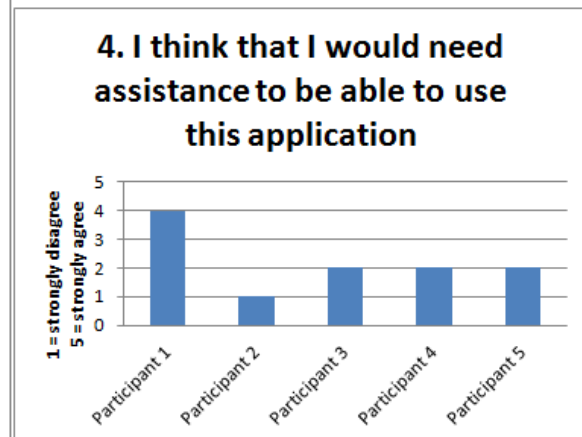
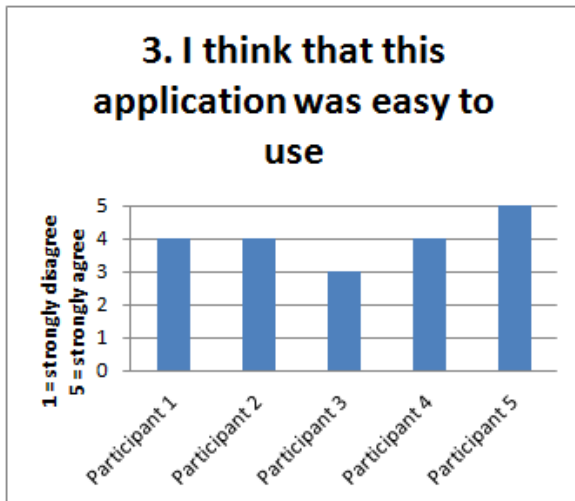
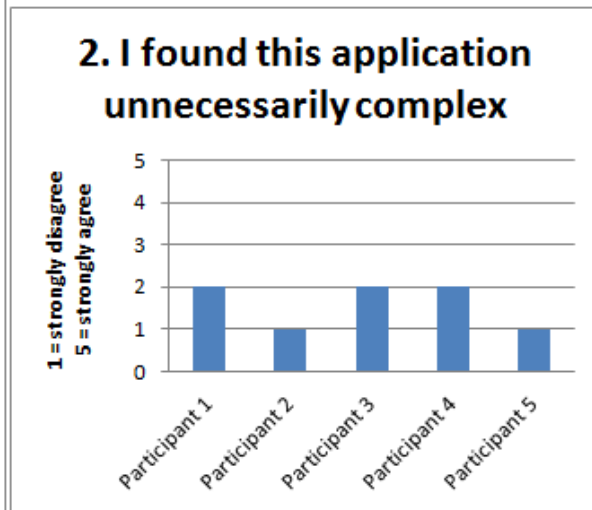
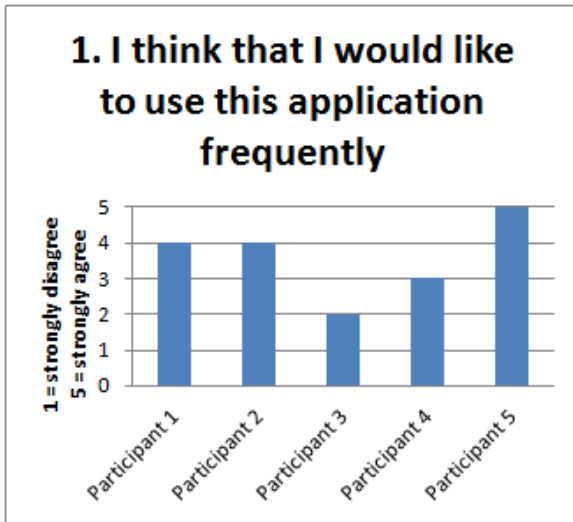
Instructions: For each of the following statements, mark one box that best describes your reactions to the website *today*.

		Strongly Disagree				Strongly Agree
1.	I think that I would like to use this website frequently.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	I found this website unnecessarily complex.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	I thought this website was easy to use.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	I think that I would need assistance to be able to use this website.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	I found the various functions in this website were well integrated.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	I thought there was too much inconsistency in this website.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	I would imagine that most people would learn to use this website very quickly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	I found this website very cumbersome/awkward to use.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	I felt very confident using this website.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	I needed to learn a lot of things before I could get going with this website.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

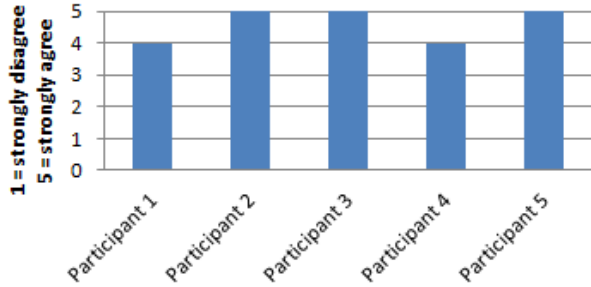
Please provide any comments about this website:

This questionnaire is based on the System Usability Scale (SUS), which was developed by John Brooke while working at Digital Equipment Corporation. © Digital Equipment Corporation, 1986.

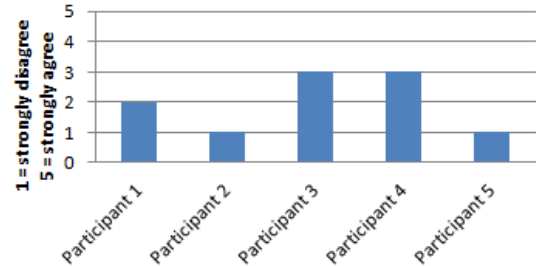
Appendix G Bar diagrams of the results of the SUS test



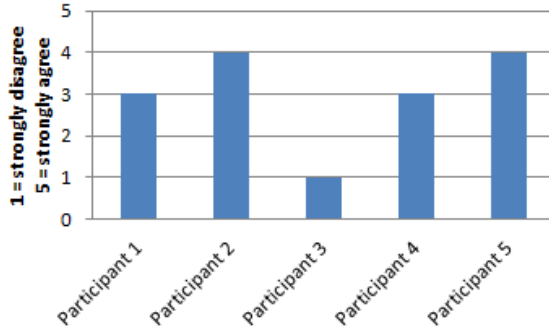
7. I would imagine that most people would learn to use this application very quickly



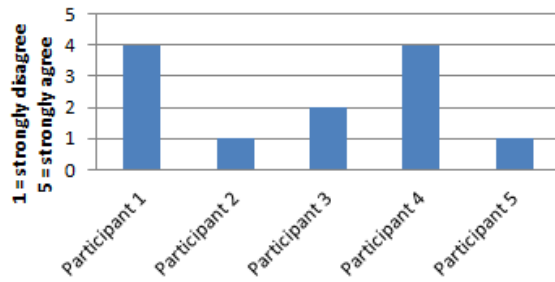
8. I found this application very cumbersome/awkward to use



9. I felt very confident using this application



10. I needed to learn a lot of things before I could get going with this application



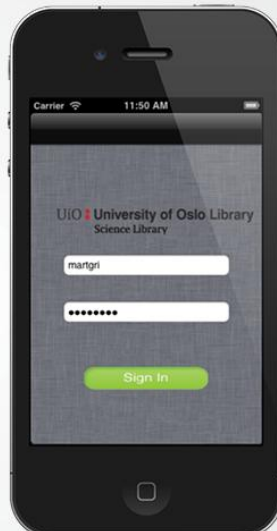
Appendix H Recruitment poster

Vil du være med å teste en ny **mobilapplikasjon?**

Dato:
Tirsdag 23. oktober

Tid:
10:00 - 14:00
Din deltakelse varer
kun i 30 minutter.
Kontakt oss for
nøyaktig tidspunkt

Sted:
Institutt for informatikk
(Ole Johan Dahls hus)



Som takk får du gavekort
på kr. 200,- fra

akademika

Interessert?

Ring eller send SMS:
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