Expert Habits vs. UI Improvements: Re-Design of a Room Booking System

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ABSTRACT
This paper presents the results of a case study examining prototyping as a method in re-designing a user interface (UI). In the case presented, a web-based room booking was re-designed. Running on a university web site, the existing system has caused much critique amongst its users. Their expectations for a new UI were increased ease of use, less effort required, and less time consumed. We prototyped a new UI using Visio and tested it with a small number of experienced and novice users. Our results partly favor the existing system and partly the new one. To our surprise, experienced users performed relatively poorer with the new UI considering their critique of the existing one. We found paper prototyping to be an efficient method to gain user feedback on usability issues and that a low-fidelity prototype does not automatically mean low-effort testing. We observed that visible-state UI elements can be demanding to test through paper prototyping.

Categories and Subject Descriptors
H.5.2 [**User Interfaces**]: Graphical user Interfaces (GUI), Prototyping, Evaluation/methodology, User-centered design

General Terms
Measurement, Design, Human Factors

Keywords
HCI, User interface design, low-fidelity prototyping, Visio, booking, booking systems, re-design.

1. INTRODUCTION
We present results of a case study examining prototyping as a method in re-designing a user interface (UI). In the case presented, we studied a web-based university room booking system [3]. Rooms offered by the system are generally small and intended for group work, seminars, and study sessions. The main reason for this choice of subject was frustration reported amongst users of the existing system. Re-design employing a low-fidelity approach combined with a user test of the re-designed system involving a small number of participants is often referred to as paper prototyping [8]. Due to the small amount of empirical data, user tests most often do not include statistical analysis. The case presented aims to develop an understanding of some of the factors involved in re-designing and evaluating a UI for web-based room booking.

Published by the British Computer Society
Volume 2 Proceedings of the 21st BCS HCI Group Conference
HCI 2007, 3-7 September 2007, Lancaster University, UK
Devina Ramduny-Ellis & Dorothy Rachovides (Editors)

2. RELATED WORK
Prototyping in order to guide the re-design process has been examined for various fields such as commercial UIs [1] and UIs for young users [9]. Practitioners' understanding of fidelity in prototyping methods was addressed by McCurdy et al. [6]. User-centered prototyping and design was examined by Kiris [5]. So-called HCI patterns have been applied to the re-designed online booking systems [10]. As part of an undergraduate HCI course given by one of the authors, students developed and tested paper prototypes to guide a re-design of their course booking system (Fig. 1). In short, while literature covers low-fidelity prototyping, re-design, fidelity in prototyping, user-centered prototyping, and patterns for the re-design of online booking systems, we are not aware of works aiming to guide the re-design of web-based room booking services. The results presented here may contribute towards establishing such knowledge.

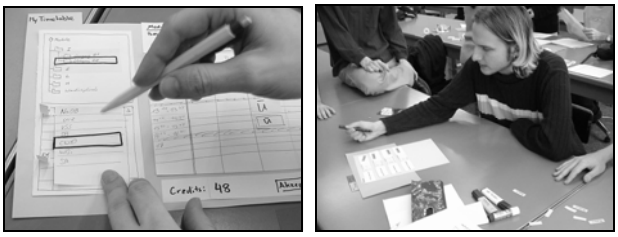

Figure 1. Developing (left) and testing (right) a paper prototype for re-design of a course booking system.

3. PROTOTYPING
In our work, prototyping was an iterative process with two cycles. First, we gathered requirements, re-designed the UI, designed a new GUI using Visio [7], and tested this using the three researchers involved in this project (see acknowledgements). Secondly, the outcome of the first cycle was used to refine the first-mentioned steps and then to carry out real user tests.

3.1 Requirements gathering

To gain knowledge about the constraints and requirements within the existing system as well as about typical users and their usage of the system, a few open interviews were conducted with students and staff of the Department of Computer Science, all experienced users of the system. This led to the following critique of the existing UI:

- Affordance: Lack of visibility of constraints in the system. Limitations are not visible until after an action has been taken and come in the form of error messages.
- Search: Difficult to book a room fitting a group's requirements because it is not possible to search for a room based on properties like time slot, size, and available equipment.
- Navigation: Difficult to find a room, as this requires browsing of a large schedule map and scrolling in both horizontal and vertical directions. This map is generally hard to navigate as identifiers for rooms and time slots can become hidden (see Fig. 2).
- Retrieval: Difficult to find a room booked by someone else, for instance, in the event of a group meeting.
- Cancellation: Difficult to cancel as users cannot easily access their own bookings. Instead, this is done by first accessing the room being reserved (provided the user remembers which room was reserved).

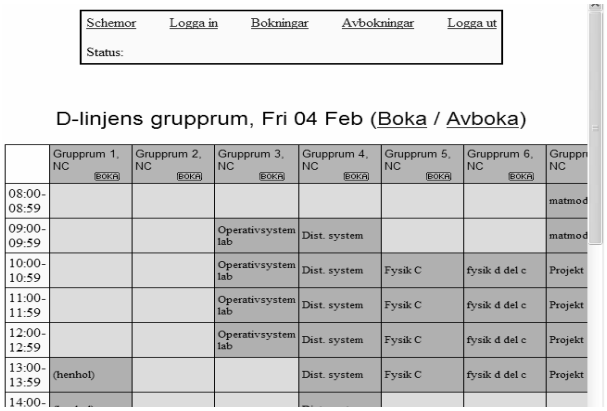

Figure 2. Existing UI: finding a free room.

To gain a greater understanding of general issues concerning booking systems, we reviewed a number of existing systems. These included travel booking systems, a generic commercial booking system, a library booking system, and several room booking systems related to universities. This review showed that most booking systems incorporate a notion of cost for the booking. These are either monetary and charged with each booking or related to access time. In both types of systems, it is important to make users aware of the cost issue. In a monetary system, a check-out cart usually presents costs and users approve the sum/fee to be charged. In an access time system, the cost usually consists of a limitation on the number of bookings that can be made at one time or over a period of time.

3.2 Re-design: developing the prototype

Based on input from the interviews as well as our own experience with the system, we performed a task analysis in the form of a use case model. The following attributes were identified as being central to the function of the system:

- Search: Finding a free room within the parameters of place, size, equipment, and free time. Finding existing bookings based on user or description.
- Booking management: Booking a room for a duration of time/time slot, finding own/others' bookings and canceling such bookings
- Easy access: Most lookup functions should be available without logging into the system, thereby speeding up access and not limiting the user base to only those with an account.

3.2.1 Constraints for the re-design

Working on an existing system we had to make a decision as to how far we were going to pursue the re-design task: either keep it at the very basic level, staying within the constraints of the existing system or suggest new types of functionality that would be beneficial to the users. We decided to stay close to the existing system's functionality (i.e. what is visible or imaginable through the existing UI), but with one exception: we added the element of room properties in order to make the task of searching for a free room more adaptable to users' real needs. This information could most likely be added to the room database with little effort.

Figure 3. Re-designed UI: example screen of one of the functionalities of the system: "finding a free room".

3.2.2 Prototyping

A low-fidelity prototype was deemed sufficient for the level of user evaluation required by the project (see Fig. 3). In order to be able to work iteratively and perform rapid changes a paper prototype was created using Visio. The rationale for this was twofold: Visio contains a simple drag-and-drop-interface with predefined (Microsoft Windows) widgets for all interaction elements we wanted to use, and it was easily available to us through university licenses. Any modern HTML-editor would likely have sufficed, but since the design presents the internal state of the application to the user, such an approach would have resulted in severe page duplication. With Visio we could handle the subsections of the screen independently and create the various combinations without worrying about the overall state of a page (this was, at least, our intention). It also works better in the production of printouts needed for the paper

prototype, including the frames for cutting, folding, and identifying the prototype pieces.

The screen images were configured in Visio for the different situations in the scenarios, assigned unique identifiers, printed, and then folded along the edges to have the widget identifier showing on the back. This should aid the human "computer" in choosing the correct prototype pieces to use for each scenario (see Fig. 4).

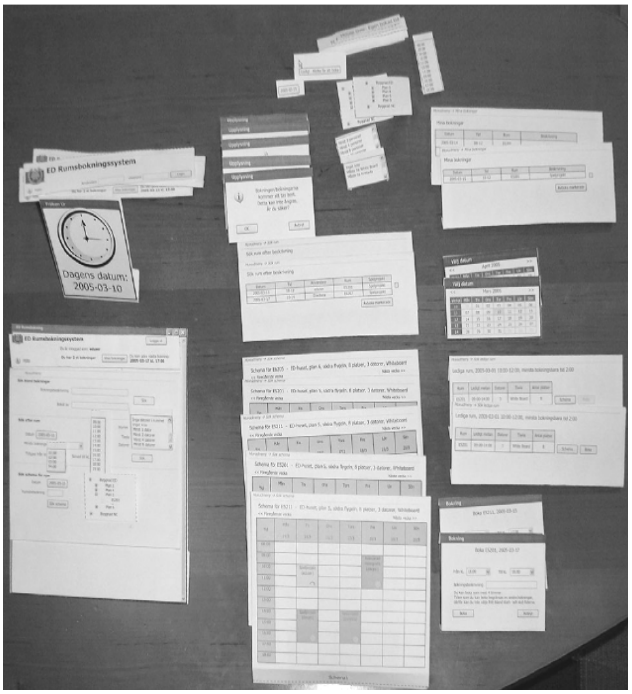

Figure 4. Paper prototype used in our study. More than 40 UI elements existed: windows, mouse-over texts, pop-ups, and dropdown menus.

3.2.3 Refinement of the prototype

As we tested the prototype with the three researchers involved in this project (see acknowledgements), a significant finding was the need for users to know their "current position" in the system ("click-hierarchy") in order to enable backward navigation. This resulted in the addition of so-called "breadcrumbs" [2]. Also, the selection method for room constraints (computer, white board etc.) was changed from Yes/No checkboxes to Drop-down choices, because the "Does not matter" alternative is important when expressing restrictions. We also identified the need to make certain texts in the prototype more understandable. With an accordingly refined prototype we then proceeded to the user test.

3.2.4 Experimental Setup

The experiment was carried out with an experimental leader, a human "computer", and five participants who were invited individually. Of the five participants there were three novice users and two experienced users of the existing room booking system. All subjects were highly computer literate. We prepared eight distinct tasks[1]. When creating and combining tasks, we tried to define a natural and effective way through the system. Tasks were formulated as clearly as possible without making them too easy to perform. Based on a fixed order of the eight tasks, we prepared a complete script describing exactly how the human "computer" should work. The script contained both what the "computer" was supposed to do and the expected user interaction. The script was inspired by an action list of a cognitive walk-through [4]. The script ensured that every test was carried out in exactly the same way, ensuring the attainment of valid, comparable data.

The test procedure consisted of a first interview regarding previous knowledge and actual task solving, and a second interview regarding subjective ranking of the prototype. Each task was followed by a few additional questions to ensure task completion such as: "Are you sure that you have logged out?". In the second interview, users were asked about the quality and functions of the system, usability, and possible changes or improvements.

3.2.5 Objective results

For the test scenario's eight tasks, total task solving time was between 8.0 and 17.8 minutes, with a mean of 13 minutes. We emphasize that two novice participants accomplished the tasks in a shorter amount of time than the experienced participants.

3.2.6 Subjective results

Information presented in the header (as the user's status bar) was considered confusing and indistinct. Such information was meant to show the user the number of bookings made and when the system allows new bookings. Some participants were uncertain whether this concerned the number of bookings remaining or the number made. The information regarding when the next booking could be made was also unclear. The subjects offered proposals for combining the information and reformulating them for better comprehension.

A search function for bookings was appreciated by the participants. A "my bookings" function in the header (where the status bar of the user is visible) was considered a convenient way to verify and cancel bookings. The ability to view a room's schedule and then make or cancel a booking was also highly valued. Pop-ups that appeared due to system restrictions were appreciated and not considered annoying.

Participants stated that the paper prototype gave them a very good insight into the system. However, the human "computer" response time caused by the shuffling of prototype pieces was a bit too high.

4. DISCUSSION

For re-design projects, i.e. projects where there is a user base with previous application experience, it is helpful to think *small* in terms of the size of advancements, the number of changes, and the magnitude of changes being incorporated. Our most interesting finding was the lack of enthusiasm that participants with previous experience expressed towards the new design *despite* their lack of enthusiasm towards the older design. The simple explanation to this is habitual work patterns: despite a lousy UI, people tend to adapt and become "power users" for simple systems in little time, finding their way around the quirks and problems. A re-designed UI may break this mode of operation. Still, the power of habit is truly a factor to be considered when re-designing a UI. Our experience is similar to that presented by Bryan-Kinns and Hamilton [1] where the need to adjust the experience along several dimensions (interaction, graphical, etc.) was noted. For re-design, an

[1] Eight tasks in the order presented (with operation(s)/state(s) required/encountered): i) book a room (search, login), ii) book a room (search, failure due to restriction), iii) find existing bookings, iv) book a room (from list), v) book a room (search), vi) unbook a room (using calendar), vii) find a room booked for a specific course, and viii) logout.

approach with small steps should be considered, which can teach existing users the benefits of the new design.

This problem also brings up the issue of learning: in order to test a UI there might be a need to instruct or teach the users the main principles behind it. However, this instruction can interfere with the testing as it may give away too much information about the issues for novice users. Since we thought that instructions could benefit expert and novice users differently, we decided to use a "no teaching" approach as much as possible, only informing the users of the existence of constraints and preconditions (e.g. that the scenarios would include a previous booking made by the same user). Interestingly, two out of three novice users performed *better* than the two experienced users, suggesting that the UI was generally usable (with some overall problems, see below), but that there was a discrepancy in usage mode from the existing system that could have hindered experienced users.

Although paper prototyping is a useful tool for testing ideas on a small set of users, there are issues of fidelity to be considered. We chose to use Visio because it would help us get started quickly and develop model content in greater depth. However, this was also a drawback because we added more details to the model than originally required. On the whole, a sketched prototype would likely have taken less time to complete despite the need to redraw duplicates. Walker [11] found that low- and high-fidelity prototypes are equally good at uncovering usability issues. This finding relates to the reported success of mixed-fidelity prototypes [6]. Our Visio model would probably have been more effective in a high-fidelity approach e.g. as the graphical basis for a simulation using PowerPoint or Flash.

Another problem we encountered with paper prototyping was making the status of UI elements clearly visible. Making this information visible required the human "computer" to shuffle pieces of the UI back and forth.

5. CONCLUSIONS AND FUTURE WORK

A main contribution to our understanding of re-design and paper prototyping of existing UIs was the finding that even a bad UI may have "committed" users. As such, a re-design may not be as simple or beneficial as initially hoped for. Furthermore, we conclude that it is important to consider habits of experienced users in the re-design of an existing system. Even if users do not like the existing system, they are still accustomed to it and designers have to take this into account. If a re-design diverges greatly from a current standard it must be well justified. The formulation of textual and graphical cues is important because any ambiguity can be misinterpreted by users. Some future work in order to help in understanding these issues may examine the learning process (i.e. the user workload) compared to the older system and considerations involving expert users and emotional attachment. Future studies using a larger number of participants may help in achieving more robust and relevant results.

Concerning paper prototyping as a method, we found that it is a convenient method for testing a new design. However, for the testing to run smoothly the system cannot be too complex. Our room booking system could be navigated in many different ways, producing an excessive amount of combinations to be taken into account. This resulted in our limiting the users, not allowing them to solve the problem their own way but only ours. Another problem with paper prototyping occurs when a visible system status must be updated frequently. Both of these problems resulted in a high workload for the person acting as the "computer", which was perceived by participants as increased response time.

6. ACKNOWLEDGEMENTS

Prototyping and re-design leading to this paper was done by Per A. Jonasson together with Linda Bööj and David Jonasson.

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