The Mobile Oracle – an on Demand Wizard of Oz Tool

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ABSTRACT
This paper describes a novel tool for eliciting user requirements early in the design process of mobile applications. The "Mobile Oracle", as we have called it, is intended to help developers and designers obtain a better understanding of what the user wants at different points in space and time. It is an extension of a lo-fi version of the well-established Wizard of Oz technique, but it also adds an "on demand" component to force users to explicitly request the information they need. The technique has been tested in an investigation involving 15 users (sighted, visually impaired, and elderly). Results show it to generate valuable information concerning the ways people ask about directions and distances, as well as the services they would like to have in future mobile applications.

Categories and Subject Descriptors
D.2.1 [Requirements/Specifications]

General Terms
Design, Human Factors

Keywords
Design, on demand, wizard of oz, user requirements

1. INTRODUCTION
The study presented in this paper is performed within the framework of the HaptiMap project [17]. In this project, we target the design of systems making use of geospatial data for helping different future user groups in orientation and wayfinding. Thus, one of the questions we need to address is "what kind of information does the user need during the process of wayfinding and exploration, at different points in time and space". The project concentrates on a large number of future users (e.g. visually impaired, elderly and users without any particular sensory impairment) and also on multiple usage scenarios which include city navigation, cycling, hiking etc. Thus, we need methodologies for user requirements elicitation that are flexible enough to adapt to different user profiles and usage environments. Since we have a particular focus on the non-visual interaction design within HaptiMap, we need to be able to handle also these types of interaction. Furthermore we want to obtain a rich picture of the user's activities in order to derive a large number of implications for our future designs.

A literature review showed that previous research used mainly interviews, questionnaires, and experimental evaluations of cognitive wayfinding strategies or of prototypes of pedestrian navigation systems [e.g. 12, 18]. Though these methods provide valuable knowledge and input for design, they are often applied out of the user's context of daily activity. For this reason, relevant elements of this context may be overlooked. In order to get insight into these contextual elements, we decided to use ethnographically-informed observations of users' wayfinding strategies applied in naturalistic settings. In the literature, there are only few studies based on this methodology. Still, it could provide very rich, relatively objective and contextualized information, potentially useful for the design of navigational systems [e.g. 4, 5, 13]. The study presented in this paper adopts the approach of combining a lo-fi version of the Wizard-of-Oz (WOZ) methodology with an "information on demand" technique [20]. These two techniques and the resulting new tool are presented below. We also report an on-going user study within this framework and discuss its methodology and results.

2. RELATED WORK
The WOZ methodology was first introduced by Kelley [15] as a research technique for the design and creation of natural language interfaces. It is a well-established way of testing systems before the actual design is done. The basic idea of the technique is that a human called a *wizard* would act out the responses expected from the not yet existing system and would give feedback to the user whenever needed (just as was the case in the old movie "The Wizard of Oz"). This technique is well-suited to involve users in the early design stages of mobile applications, as the ones designed in the HaptiMap project, since a human can fairly easily impersonate functionality requiring features such as context

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sensitivity, knowledge of position and related geospatial information.

In the WOZ technique, the *wizard* can be designed with different levels of detail implying different roles for the human simulating the system to be designed [11]. A *wizard* acting as a "controller" fully simulates an unbuilt system function (e.g. system intelligence), whereas a "supervisor" simply oversees a working system and, if necessary, overrides decisions made by the user or the system [11]. An intermediate role is the one of the *wizard* "moderator" who supplements the functioning of an already working system, which cannot be fully trusted. The variety of *wizard's* roles allows the designer to obtain a similar kind of sketchiness or "fudgeability" [9] as the one that has been found to be useful in e.g. lo-fi prototyping [19]. Sketchy or "fudgeable" systems allow designers to explore a larger range of design issues than detailed but rigid systems. This feature is important since the level of detail will affect the way the user responds to the interaction: detailed designs tend to result in comments on usability issues and details, while more sketchy designs tend to provide comments on the concept and the overall design [21]. Specifically in early design stages feedback of the latter type is more important, and we decided to use a lo-fi WOZ design where the responses allowed to the *wizard* are not specified in detail, but rather given as information about areas of competence.

In order to add even more "fudegeability" (i.e. openness and flexibility) to the WOZ method, we decided to combine it with the technique of "information on demand" [20]. The idea of this technique is that, instead of looking for information himself, the user would ask questions to the experimenter (the *wizard*, in our case) when needed. The underlying assumption is that seeking advice is not only matter of question-answer dialogue, but also a matter of asking questions, as people frequently make specific claims about the answer in their own query [7]. Consequently, the "information on demand" technique allows investigating the pieces on information selected to solve a problem, the order in which they are used by the person, as well as the variety of individual problem solving strategies [11]. In addition, asking questions encourages people to make their information needs explicit. The resulting tool, called the "Mobile Oracle" which combines the advantages of a lo-fi version of the WOZ technique and the "on demand" technique, is introduced below.

3. THE MOBILE ORACLE IN THE FIELD

We employed the proposed "Mobile Oracle" tool in a test design where the user is instructed to request information from a mobile navigation service when he/she feels this is necessary. Our assumption was that such a combination could result in a potentially useful tool for providing additional insights into the kind of information users are interested in during navigation and exploration. To further strengthen the idea of the "on demand" part of the design we decided to call the individual impersonating the imagined device the "Oracle", since an oracle is held to respond wisely when consulted and asked questions.

The Mobile Oracle tool could be useful for design for three major reasons: 1) the richness and dynamics of dialogues as cooperative activities, in which protagonists' objectives are co-constructed, transformed and refined in order to gradually concord [14]; 2) the openness of a traditional WOZ task, in which there is no single correct answer to a question asked by the user; and 3) the additional freedom and initiative given to the user thanks to the "on-demand" part of the technique.

4. TEST CASE

To evaluate the "Mobile Oracle" we had to find an appropriate scenario. We wanted to have a relatively complex task, because, obviously, any simple task which only requires few interactions between the two protagonists will not give much data to analyze [10]. We also had a particular interest in more exploratory navigation. Thus we decided to make use of a shopping scenario where the user was asked to navigate in a shopping mall, to investigate three different types of items and select one of these. A shopping mall is an interesting place because shoppers often have problems in finding their way in a mall, while at the same time there are few studies on this topic [8, 25], especially as far as the needs of visually impaired people are concerned. At the same time we expected to obtain general information about wayfinding in urban environments, because a large part of the cognitive wayfinding strategies are similar in both settings. Since we target several user groups we included 3 sighted, 4 visually impaired and 8 elderly in the test. We conducted 2 pilot tests before the actual testing to make sure that the test design worked as intended.

Each test followed a fixed scenario:

> "You are to attend a birthday party. You have not yet bought the present and have a limited amount of money to spend. The person you are buying the present for is Oscar, 13 years old and a fantasy fan. He has a wish list that contains the following items:
>
> - A t-shirt/sweater with a fantasy motif (dragons/skulls or similar)
> - A necklace with a dragon/skull pendant ("cool" male type necklace)
> - A fantasy book with dragons in it
>
> You want to check all three types of things and buy the cheapest. But you can only spend 30 minutes on this task in order to make it for the party.
>
> An ORACLE - a person, who simulates a mobile navigational service, follows you. Please ask the ORACLE as soon as you feel you need some service or information. If possible we appreciate if you also try to "think aloud" about your navigational decisions/considerations."

We gathered test data by using a mobile phone to record audio and a small digital camera to take pictures (due to security regulations, video recording was not allowed, but we were granted permission to take pictures). During the pilot testing we had one observer that took notes – but this generated unwanted attention. Thus, during the actual test only a mobile phone (held by the test person) was used for the recording. By holding a mobile device we also wanted the test persons to be aware of the mobile technology.

One of the experimenters took the role of the "Mobile Oracle". It was designed so that it knew the layout of the mall and could say things about the general type of content in different shops. The oracle could also remember places or things for the user and can point out where things are in general (like different sections in a shop). Moreover, once at a particular stand the oracle could pretend to be a shop assistant/sales person (we did not want to

disturb the personnel in the shops since we did not intend to buy anything). To avoid influencing the user, we decided to leave much of the workings of the oracle open and only encouraged the user to ask as soon as some information was needed.

Figure 1. Pictures from the test environment

After the actual test we interviewed the participants about the navigational experience and their thoughts on potential navigational services. They also filled in a questionnaire containing questions about how familiar they were with the mall in question, their visual ability and their sense of direction.

5. EARLY RESULTS

The method used was seen to work well for all the users involved in the study. The resulting questions were recorded and could be grouped in the categories "Content overview", "Spatial layout", "Direction/route", "Distance", "Notification/prompts", "Confirmation", "Content", "Recommendation", "Memory", "Time" and "Capability of the device". Added to this grouping, the individual questions themselves were seen to provide rich and detailed input for the design process.

As one example, the preliminary analysis shows that all three user groups were interested in a service that prompts you as you pass by interesting things (although it has to be well-designed not to be annoying). Specific requirements for more severely visually impaired users were information about the precise location of the entrances and obstacles as well as the possibility of optimizing the way to a shop. Landmarks, distances, directions and orientations were other things of interest, as were the kind of shop indicating service that helps you noticing things as you move from A to B (eg. I'm going from here to the bookshop but I would like to add suitable shops for clothes on the way).

Overall the scenario caused exploratory behaviors and all three groups of users asked the Mobile Oracle relevant questions:

- The Mobile Oracle was able to engage the subjects in such as way that they could provide us with interesting and relevant information about "what kind of information does the user need during the process of wayfinding, at different points in time and space".
- The kind of questions asked (and the discussions generated) provided information both for the type of content that will be needed as well as for the type of services suitable.

Finally, the way the data was recorded did not disturb the environment. Two or three people walking around talking, where one of them is holding a mobile phone, fitted well into the environment and did not attract much attention.

6. DISCUSSION

On the general level, the results we obtained agree well with the available knowledge on which environmental features are important for wayfinding [1, 6, 18, 23, 24]. Added to this we get detailed, situated [16] comments and questions. We observed that the Mobile Oracle technique works well in studies involving non-visual interaction and a wide range of user groups (including visually impaired users). One of our initial concerns was that the sighted participants might neglect the Oracle and just solve the task on their own. This turned out not to be the case – even users stating that they did not like to ask for help and preferred to walk around on their own asked for help from the Oracle (in total 5 sighted persons did the test, since both participants of the pilot studies were sighted).

Although the main source of information is the user questions, interesting information can also be obtained from the interactions with the Mobile Oracle. It was interesting to see how the participants reacted to the directions given by the Mobile Oracle and how the Oracle (being human) adapted these descriptions to the user in question. In the presented study the Oracle was quite free to define and construct himself/herself through the interaction with the user using both verbal descriptions and physical pointing. Further work on this technique could examine in detail more specific guidelines for the way the Oracle responds.

In the presented field study one of the experimenters filled out the role of the oracle. This ensured that the Mobile Oracle had sufficient knowledge about the environment and the task. While the participant representing the user gives us insights into what information is needed, the insight we get about how to provide that information is limited since in every session the same set of persons (the experimenters) acts as the Oracle. Therefore another possible extension to the described tool could be to have participants also acting as the Oracle. This would allow investigation of how the needed information is conveyed by humans serving as a guideline for the information presentation design.

Nevertheless, in order to get valid findings, the participants acting as Mobile Oracle need to have deep enough knowledge about the environment to give helpful and timely suggestions. In the pilot tests performed before the actual study we tried having participants fulfilling both roles, and came to the conclusion that this did not work that well due to lack of knowledge of the environment, even though we provided the Mobile Oracle with an annotated map. One solution for this is to have a "Mobile Oracle training session" before the actual test, but this also puts higher demands on the amount of time the test participants have to spend. Another alternative is to find participants who are already very familiar with the environment in question.

7. CONCLUSION

Our results show the usefulness of a technique consisting of a combination of a "sketchy" or less detailed version of the well known Wizard of Oz technique with an "on demand" type of interaction design. The tool, which we call the "Mobile Oracle" has been tested in a recent user test in an explorative shopping scenario, and was seen to work well for sighted, visually impaired

and elderly users. The individual questions were seen to provide rich and detailed input for the design process while the overall categories resulting from a grouping of these questions agree well with what is found in earlier studies [1, 6, 18, 23, 24] confirming the validity of the "Mobile Oracle" approach. Thus this type of approach can indeed provide useful information in the early stages of a mobile application design process, by providing an open framework in which users can present, negotiate and construct their requirements for the future technology.

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