User Experience Design for a Decision-Theoretic Shopping Guide

Oliver Jacobs[1], Anthony Jameson[1], Thorsten Bohnenberger,[2] and Ilhan Aslan[2]2*

[1] DFKI, German Research Center for Artificial Intelligence, Saarbrücken, Germany
[2] Department of Computer Science, Saarland University, Saarbrücken, Germany

1 Introduction

Our main contribution as participants in this workshop consists in some lessons learned from the studies reported in the Pervasive 2005 full paper by Bohnenberger et al. [1]. That paper reports on extensions to a decision-theoretic location-aware shopping guide and on the results of user studies that accompanied its development. The version of the system that the full paper focuses on was based in part on the results of a study conducted in a mock-up of a shopping mall (Bohnenberger et al. [2]). A new user study with the improved system was conducted in a real shopping mall (cf. the screen shots in Figure 1). The generally positive user attitudes found in the earlier study were confirmed in the much more realistic setting. The new study also sheds further light on the usability issues raised by the system, some of which can also arise with other mobile guides and recommenders. One such issue concerns the desire of some users to be able to understand the system's recommendations. This requirement led to the development of an explanation component for the decision-theoretic guide, which was evaluated in a smaller follow-up study in the shopping mall.

2 Methodological Issues

This study raised some methodological challenges that seem likely to appear in other studies of user experience in pervasive computing:

1. How can we investigate a system that requires specialized infrastructure in the environment when it is not possible to implement that infrastructure for the purpose of the study?
   Our shopping guide presupposes a special infrastructure for localization. As it would have been too expensive and time-consuming to install this infrastructure only for the purpose of the study, we decided to simulate the infrastructure with a second hand-held system: The experimenter sent signals to the users system at particular places where the infrastructure would normally have been installed. On the whole, this simulation seemed to create largely the same user experience as the real infrastructure would have created.

* The research of the authors has been supported by the German Science Foundation (DFG) in its Collaborative Research Center on Resource-Adaptive Cognitive Processes, SFB 378, and by the German Ministry of Education and Research (BMBF).

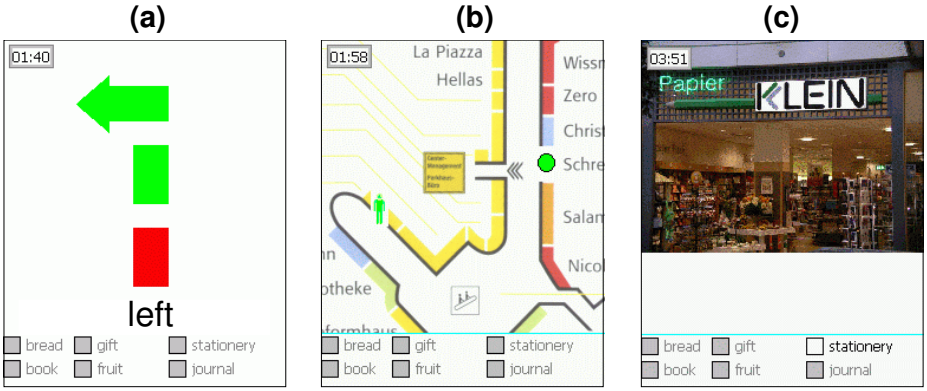

Fig. 1. *Three screen shots of the improved shopping guide for the user study in the shopping mall. (a: Animated arrows are used for user-centered navigation recommendations. b: Overview maps show the user's location, the expected next store, and further information about the environment. c: Shortly before the user reaches the expected next store, a picture of the store is shown on the display of the PDA to help the user recognize the destination.)*

2. How is it possible to recreate in a user study the essential aspects of a shopping trip conducted under time pressure?
   One feature of our shopping guide is its ability to help the user to complete a task within a fixed, limited period of time, despite the uncertainty involved in predicting how long parts of the task will take. It would not have been feasible to conduct the study with shoppers who naturally appeared at a shopping center needing to buy certain items within a limited period of time: Such shoppers would not have had time to be initiated into the system or to answer questions about their experience afterward. Therefore, we created a related situation artificially:
   - Each subject was allowed to buy for 25 Euros ($30) 1 item from each of 6 categories (some fruit, a book, some stationary, a magazine, some bread, and a gift). To personalize the shopping, each subject had to specify the item she wanted to buy from each category. Therefore, the subjects bought items that they really wanted to have.
   - We imposed a time limit of 20 minutes to create some time pressure—which might normally be created, for example, by the need to leave the mall for an appointment by a certain time. Any products that the subjects were not able to find and buy during that period represented a material loss for the subjects.

3 User Experience Issues

This scenario of this system raises several relatively novel user experience issues:

1. How do people respond to a system that attempts to help them deal with time pressure in performing a task?

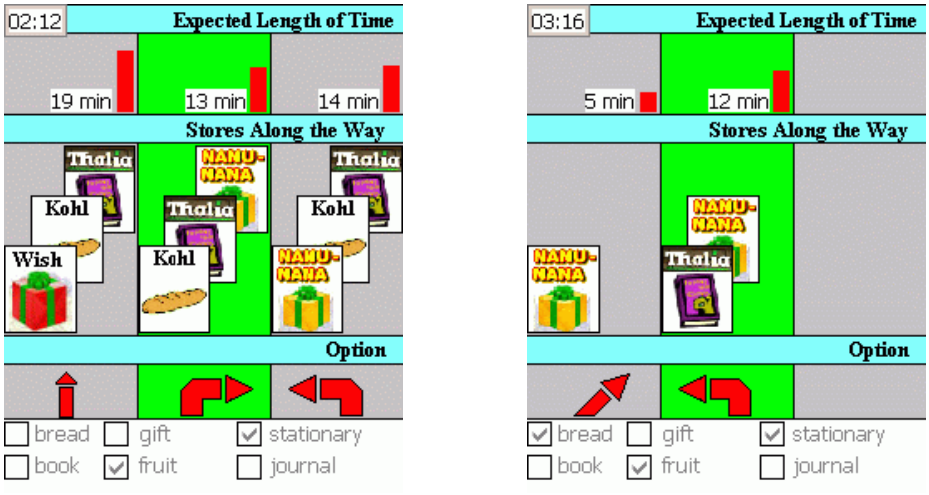

Fig. 2. *Screen shots from the initial implementation of the explanation mechanism. (Each store is represented by a rectangle that shows the name of the store and the type of product that it sells. For example, Wish and Nanu-Nana are two alternative gift stores.)*

The shopping guide's functionality that helps the user to deal with time pressure is unusual. It was therefore interesting to see how people responded to it. All subjects expressed a favorable attitude toward the system, and most of them said that they would use be interested in using such a system in real-life shopping if they were under time pressure. During the study, the subjects relied on the system without hesitation. But after finishing their shopping, some subjects asked why the system had acted the way it had at a given point. This result suggests that under time pressure many people appreciate a system that they can rely on without thinking about decisions.

2. How do people respond to explanations of the system's reasoning and behavior in a mobile context involving time pressure?
   In order to make it easier for users to understand the system's recommendations—and to second-guess these decisions where appropriate—we implemented and tested a simple explanation component (see Figure 2).
   Subjects' responses to explanations differed. There were subjects who appreciated the explanations that the system offered, partly because they increased the subjects' confidence in the system's recommendations. But the predominant tendency was for subjects not to care about understanding the system's decisions because of the limited time available. It appears that time pressure does not simply encourage people to do everything faster; it can radically change their attitude toward a system (e.g., with regard to their desire to understand how the system works).
3. To what extent is utilitarian shopping compatible with the frequent goal of recreational shopping?
   Often, a distinction is made between *utilitarian* and *recreational* shopping. Because our system primarily supports utilitarian shopping, it is important to understand the

relationship between the two types of shopping experience, which is not as simple as it may appear at first glance. For example, these two approaches can be pursued by the same person, who wants to finish the necessary shopping as soon as possible to have more time for recreational shopping afterward. Further research will be required to determine the extent to which utilitarian and recreational shopping experiences can be supported by the same system.

References

1. Bohnenberger, T., Jacobs, O., Jameson, A., Aslan, I.: Decision-theoretic planning meets user requirements: Enhancements and studies of an intelligent shopping guide. In Gellersen, H., Want, R., Schmidt, A., eds.: Pervasive Computing: Third International Conference. Springer, Berlin (2005) 279–296
2. Bohnenberger, T., Jameson, A., Krüger, A., Butz, A.: Location-aware shopping assistance: Evaluation of a decision-theoretic approach. In: Proceedings of the Fourth International Symposium on Human-Computer Interaction with Mobile Devices, Pisa (2002) 155–169