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User Acceptance of a Decision-Theoretic Location-Aware Shopping Guide

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ABSTRACT

We are exploring a class of decision-theoretic handheld systems that give a user personalized advice about how to explore an indoor area in search of products or information. An initial user test in a simple mockup of a shopping mall showed that even novice PDA users accepted the system immediately and were able to achieve their shopping goals faster than when using a paper map of the mall. A key issue is the extent to which spontaneous user behavior can be accommodated within this framework.

Keywords

Mobile commerce, navigation support, decision-theoretic planning, user studies

ISSUES ADDRESSED

People often face the following situation: They want to walk around some limited geographical area (such as a museum or a shopping mall), making effective use of its resources within a limited period of time. Finding an optimal exploration policy is a complex problem, to which methods of decision-theoretic planning (see, e.g., [1]) offer a promising approach. Bohnenberger and Jameson ([2]) showed how appropriate policies can be computed and then presented on a handheld device in an airport shopping scenario. But will people actually find a system like this useful and usable? In a formative evaluation of an initial prototype, we aimed to identify the central issues concerning user acceptance.

THE SHOPPING GUIDE PROTOTYPE

Consider a user $\mathcal{U}$ who enters a shopping mall (cf. Figure 1) with the intention of buying 5 products of particular types, each of which which may be available in one or more stores. $\mathcal{U}$ needs to take into account the facts that (a) it is not certain that a truly suitable product will be found even in a potentially relevant store; and (b) stores differ in the time it takes to wait in line to pay for a product once one has been found.

Our prototype decision-theoretic shopping guide tells $\mathcal{U}$ at each point in time which store $\mathcal{U}$ should visit next; this advice depends in part on the products that $\mathcal{U}$ has found so far. The necessary decision-theoretic planning (described in [2]) is performed on a stationary computer, and the resulting *policy* is transferred to $\mathcal{U}$'s PDA. As Figure 2 illustrates, at various points the system $\mathcal{S}$ directs $\mathcal{U}$ toward the store to be visited next by displaying a navigation instruction on the PDA screen; $\mathcal{S}$ determines the current location by receiving an infrared signal from one of a number of beacons affixed to the walls. $\mathcal{S}$ knows which products $\mathcal{U}$ has already found, because $\mathcal{U}$ checks each one off after purchasing it.

USER STUDY: METHOD

A configuration of 30 beacons was installed on two floors of a university building. We defined two alternative shopping malls, each comprising 15 stores and using all 30 beacons, so that each subject would be able to perform a distinct shopping task with each of two types of guidance: a paper map (cf. Figure 1) and the PDA guide (Figure 2). The subject's task in each case was to buy as many articles as possible from a shopping list with 5 categories. The ordering of the tasks and of the guidance methods was balanced.

Of the 20 subjects (5 male, 15 female), only 2 had ever used a PDA before, neither of them for a navigation task. The subjects' monetary reward depended on the number of articles they found and "bought" and on the total time they required.

After an introductory period, in each of the two trials the subject began at the mall entrance and was followed around by the experimenter. When the subject reached a store, the experimenter took on the role of the sales clerk. Using a random number generator and a stopwatch, the experimenter determined which products were available and how long the subject would have to wait in line for them. The parameters used for these computations were consistent with the ones presupposed by the decision-theoretic planning model.

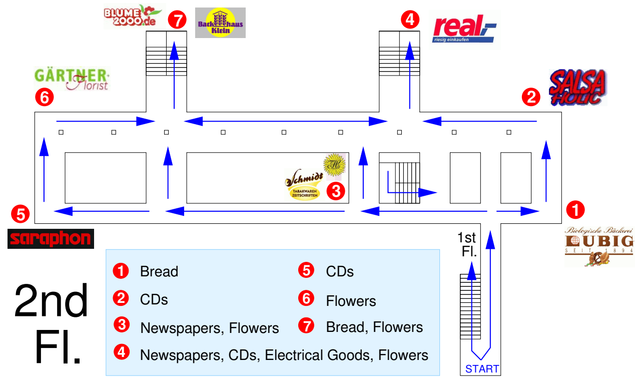

Figure 1. Part of one of the maps representing the mock-up shopping malls created for the user study.

Figure 2. The hardware of the PDA-based shopping guide. *(Left: Example display on the PDA, which receives location signals from a beacon (shown at the top). Right: Close-up of part of the display in the situation where the user has arrived at a relevant store.)*

USER STUDY: RESULTS

The key objective result concerns the amount of time subjects required to find their products. The time comparison was somewhat biased in favor of the paper map, in that it did not take into account the time that subjects spent studying the map before setting off on their shopping trip. Nonetheless, subjects using the PDA, who set off without any preparatory study, completed their shopping task 11% faster on the average than when they used the map ($t(19) = 2.65, p < .05$). Note that the time using the PDA included any time that these novice subjects required to become accustomed to PDA-based navigation and to the use of the beacons.

In a questionnaire-based assessment of subjective preferences, subjects were asked which method they would prefer to use if they had to perform further shopping tasks like the ones they had just completed. Of the 20 subjects, 18 wrote that they would "rather" or "much rather" use the PDA. Further questionnaire responses showed that this general preference was not due to defects of the particular maps employed but rather to several general advantages of the PDA guide:

1. Savings of time and effort in moving around the mall.
2. Elimination of the cognitive effort required to create a shopping plan.
3. Reduction in the frustration experienced when a plan has to be abandoned because of the unavailability of a product at a given store.
4. Elimination of the need to think about how to orient a paper map.

The most interesting drawback of the current PDA guide, mentioned by several subjects, is the feeling of being led around by the hand with little opportunity to second-guess the system or to act on spontaneous impulses. The addition of overview maps to the PDA guide may help; but a key question will be to what extent user control and spontaneity can be accommodated in the decision-theoretic planning of recommendations.

Most of the other comments made by subjects concerned ways of making it easier to follow the navigation instructions (e.g., the addition of auditory output or the presentation in some cases of more than one instruction at a time).

CONCLUSIONS AND CURRENT WORK

Even novice users can quickly succeed in using a simple, robust PDA guide like the one tested here. Users were generally enthusiastic about its suitability for goal-oriented, time-constrained searches within unfamiliar environments.

Supporting even this limited type of search within realistic settings will require some further enhancements and user testing. At the same time, we will try to determine how useful the decision-theoretic approach can be in situations where users desire considerable control and freedom of choice.

The small-scale demonstration of the prototype at IUI 2002 illustrates how the same methods can be used to provide guidance in a different domain: a conference poster session.

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