Facilitating Playful Exploration: A Persuasive Mobile Guide
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Hypothesis
Our proposed system builds on past and ongoing efforts to provide useful mobile services to urban tourists; specifically, our service seeks to make its users more aware of the activities and places around them. It is not a complete mobile guide systems: when in use by tourists, it can complement e.g. Google Maps Mobile, Lancaster GUIDE, Trammate, which already provide many practical navigation and information services. Our interface is designed to persuade the user to engage her surroundings by pushing information about the surroundings to the user as she navigates the city, as well as providing a “game” structure which encourages users to explore their surroundings in depth. A collaborative messaging system similar to the “GeoNotes” system (described below) provides user-provided opinions of one’s surroundings, while an interactive map and the directedness of finding the next stop on a path facilitate comfortable exploration.

Evaluation Plan
We intend to evaluate our prototype system in two phases. The subject population will consist of CS 147 volunteers, and the prototype will be implemented on Series 60 phones. The first phase will be conducted in large laboratory setting, where the subjects will use our prototype to conduct specific tasks such as choosing paths to follow or registering arrival and actions with two-dimensional barcodes. They will walk about to perform the tasks. We will encourage the subject to talk aloud while performing their tasks, occasionally interrupting to ask them to elaborate on their thought processes. After the task we will solicit their opinions in an unstructured interview, combining natural inquiry with pre-formulated questions. This first phase is intended to refine the usability and the control flow of our application and verify that the users understand our application and can use it easily. Gathering users’ opinions about the overall usefulness and appeal of the technology will also be a priority. We hope to conduct interviews with about 5 users. This approach is supported by [1].

The second phase of the evaluation will be conducted in the field, in order to complement the in-vitro approach of the first phase—this method is suggested by [6]. The participants will keep the mobile devices for a week and use our application as they please on the Stanford campus. Although we see our application as being adapted for a more populous urban area, such as San Francisco, for testing purposes we will develop services tied to various locations around Stanford campus. As they go about their daily routines on campus, we expect our users to be prompted at various locations with information about their location and the opportunity to interact with the system. We will prompt them beforehand to keep track of when and where they interact with the application, as well as their attitudes at the time of interaction. At the end of the week, we will have the users fill out extensive surveys about when and to what extent the participants used the application, their divergence from their normal schedule, where they visited, and their reported subjective experience. This data will be augmented by application and server logs. For this phase, we hope to have 5 participants.

Current Prototype
Our current prototype is a Java Mobile Edition (J2ME) application for mobile phones. It is a mix of working and click-through interactions. We use an alpha version of the Semacode two-dimensional barcode reader SDK for J2ME. This provides our prototype with the ability to decode Semacodes—two-dimensional barcodes meeting particular specifications. So whenever the user would take a picture of a barcode, they can actually do this and the information is actually gathered from the barcode. This also allows barcodes with location information in the database to be mapped.

When the application is launched, the user is presented with a menu from which she can choose to take a picture of a Semacode, check for locations of interest (LOIs) nearby, and see
locations she has visited in the past. Upon checking for Semacoded LOIs, the user is presented with the resulting list of LOIs; these results are currently just fixed examples. The user can choose to start exploring the location, get more information about it, map the location, and see information about how other users have found that locations by seeing their comments and how long it took them to complete their exploration—including information about the time through multiple Semacodes for LOIs with a multi-barcode path. Though all of this has been created with an eye toward extensibility, the information is not live data. Below are screen shots from the application running in a Nokia Series 60 emulator.
Further Development

Our plan for future development has just changed, as we have recently discovered that the devices which we planned to use for our two staged evaluation—Nokia 7610s, though supported by the Semacode Reader Symbian C++ SDK, are not supported by the corresponding alpha J2ME SDK we had intended to use: they implement the Connected Limited Device Configuration (CLDC) 1.0, but not CLDC 1.1. There are several options for resolving this problem, including: we can use devices that implement CLDC 1.1 for evaluation; we can use a combination of a native Symbian camera/decoder/on-phone-server and a J2ME client; we can use a pre-built Semacode reader application for Symbian that could link to a remote Flash Lite application. This choice will constrain the interaction: our current design sandwiches the capturing and decoding of Semacodes between interfaces that we must ourselves create. Since we have made progress with the camera/decoder implementation for J2ME, we may continue to use this implementation for the first test phase—testing it on supported phones like the Nokia 6681—to provide more time to make these implementation changes.

No matter the particular choice we make, the major goals will remain intact. We divide these goals into three stages, based on the priority and relatedness of the goals and our evaluation schedule. The first stage involves completing the framework for adding LOIs and information about them, developing a format for providing non-map guidance, and creating an on-phone database to keep track of the users' history. The second stage includes creating the test content for the field study, preparing Semacodes for deployment, and developing a timed system for simulating alerts about nearby LOIs. The second stage must also include response to what we learn from the first evaluation. The third stage—if reached—would include further development based on the results of the first study and implementation of existing ideas, such as real user comments and ratings that would be shared among all users.

Summaries of Related Work

“Social and Technical Pitfalls Designing a Tourist Guide System”:

Borntrager and Cheverst's paper relates a number of issues concerning the design, testing, and implementation of mobile tourist systems similar to the one we are prototyping. The first major concern was the difficulty of acquiring users whose motivations and demographics resemble those of actual tourists; they resolved this by enlisting the help of the local Tourist Information Center to find people. The second issue was the difficulty of tracking users' behavior without affecting it; GPS tracking was often broken in certain environments (urban canyons, etc), and there was a concern that following the tourists at a distance would affect their behavior. The researchers also noted that users preferred speaker output instead of headphone output, probably because the users did not want to be identified visually as tourists. There was a noted preference for the simplified and symbolic map views, as opposed to the detailed map. Finally, it was discovered that in collecting user feedback about the system, the best approach seemed to be asking questions of the user in a non-fixed, dynamic, conversational manner, and in soliciting suggestions for improvement, it helped to provide small examples of features that might be added.

“Experiments With Multi-Modal Interfaces in a Context-Aware City Guide”

A second paper by Borntrager, Cheverst et al. goes into further detail about their experiments with location-based mobile tourist technology. In discussing their “Lancaster GUIDE” system, they identify various decisions about the interface, including the decision to “push” or “pull” information to or from the user, and the tradeoff between using a loudspeaker output as opposed to headphones. Using text to convey a moderate amount of information about tourist sites was deemed impractical, due to the small display. In contrast to the previous paper, the user interviews were described as “well-structured” and focused on user needs and preferences for “push” versus “pull”. The results of the study indicated that: users who traveled around more quickly preferred the map view to the detailed picture view; the presence of audio encouraged use of the picture view; detailed text was considered unimportant by users; the map was considered an indispensable feature of the tool, though opinions on how to implement it differed widely; the inclusion of the picture view was considered helpful; and users suggested the provision of a
“warning” when information was to be pushed. The evidence strongly supported the use of audio and the avoidance of headphones, and indicated nothing about the effect of group size on device usage.

“GeoNotes: Social and Navigational Aspects of Location-Based Information Systems”:

In this paper, Espinoza et al. examine social and navigational issues surrounding location-based information systems. They assert that user-created content is vital to providing a public information service as rich as the World Wide Web; they propose the “GeoNotes” system, in which a navigable database of user opinions and advice is available to users in public areas. The content of the database depends on the location from which it was accessed, so that users at a specific location can see only what other users at the same location posted. The challenge was to balance freedom of public access with an effective browsing utility and a feasible mobile interface to use it with. The format they settled on required users to provide a subject header, an “intended recipient” tag, a label describing the precise object or place to which the message is referring, a signature (which can consist of anything the user chooses), and the body of the message. The labels can be shared among anybody who can access it, for greater consistency and ease of input. Notes can be stored, and are filtered/ordered in order of popularity according to the algorithm “timesRead + (2*timesSaved) - (2*timesIgnored)”. The system utilizes a mixed push/pull system, in which users primarily search through notes for their location, but are alerted if a very high-ranking note appears in the vicinity. The stated goal for the project was to foster and encourage a system of democratic public discourse and involvement, as well as facilitate and influence public planning decisions.

“User needs for location-aware mobile services”

Kaasinen conducts a user-centered study around various usability, implementation, and functionality issues surrounding location-based mobile. The article identifies GPS, Bluetooth, and WLAN as the most feasible options for location sensing technology. They then describe a study involving a wide range of user groups (physically active hobbyists, motor-disabled users, the elderly, families, etc.) using a set of location-sensitive software (maps, tourism and information guides) in a variety of scenarios. The users generally responded positively to the software, but considered the design of the scenarios slightly narrow in focus and overly deterministic. It was suggested that the software refrain from enforcing an itinerary on users, and allow for exploration. Users thought that “push” approach would be acceptable as long as the information was reliably useful or pertinent, which lead Kaasinen to surmise that personalized filtering, in addition to location, should play a role in determining what gets pushed to the user. Users wanted detailed search options, and considered the interfaces most useful in unfamiliar situations or emergencies, when a lot of information needs to be accessed rapidly. Kaasinen holds an opinion of user-created content similar to those expressed in the GeoNotes article, in that it may ultimately be more useful to other users than externally provided content would be. Finally, the issues of consistency and privacy are mentioned, emphasizing the importance of seamless interaction and anonymity always available as an option.

“Evaluating the Usability of a Mobile Guide: The Influence of Location, Participants and Resources”

Kjeldskov expands upon Borntrager and Cheverst’s work, applying various usability evaluation techniques to many of the usage issues introduced in that work, such as designing an interface for ambulatory users, and designing information that is closely indexed to the location from which it is accessed. Evaluation techniques were weighed against one another, as Kjeldskov briefly defends laboratory studies of mobile device usage. He goes on to examine the “Trammate”, a mobile trip-scheduler that provides routes and tram itineraries. After describing each of the four evaluation approaches (field evaluation, laboratory evaluation, heuristic walkthrough, rapid reflection), he compares their results as applied to the Trammate study. Each technique was able to identify the majority (4 out of 5) of the total number of major flaws that were identified by all of the studies in conjunction, though no single study identified all of them. Field evaluation proved most effective at identifying minor issues, while rapid reflection did best at identifying cosmetic issues. Although heuristic evaluation was not necessarily the most effective, its data did have the least amount of noise. The study concludes by stating that for now, collecting data from the field is an integral part of any mobile evaluation study, and that discount evaluation
approaches are best suited to fast-cycle, discovery phase prototyping, while exhaustive evaluation is necessary later on in the product’s development stages.

Works Cited