

Collectively Defining Context in a Mobile, Networked Computing Environment

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ABSTRACT

Mobile and wireless computers are rapidly becoming popular with the general public. In our research we design and evaluate new types of applications that take advantage of the unique characteristics of these devices in novel ways. One of these applications is Graffiti, a context-aware device designed using ideas from social navigation research. This system allows users to collectively define what's relevant and interesting about a location by posting electronic notes. Users encountered a variety of benefits and problems in using Graffiti primarily related to the reliance of the system on user contributions.

Keywords

context-aware computing, social navigation, mobile computing, wireless networking

DESCRIPTION OF PROJECT

The goal of our project was to combine two models of computer usage, context-aware computing and social navigation, into an application to be used on the Cornell University wireless network. Context-aware computing is the use of environmental characteristics such as the user's location, time, identity, and activity to inform the computing device so that it may provide information to the user that is relevant to the current context. Social navigation has been defined as, "the process of using cues from other people to help you find information and potentially to more fully understand what it is you have found," [2].

In the past, research in context-aware computing has dealt with expert-to-tourist or machine-to-user type information dissemination based on context. We believe that systems where the users determine what is relevant about the context might be more useful. For example, it could allow the users to contribute additional information about the context that the device is incapable of detecting or that an

expert may not know. Users could also contribute subjective information such as what's good to eat at a location, or what movies are interesting, something a computer could not do and ultimately might be more valuable coming from many users rather than just one individual.

To accomplish this goal of combining context-awareness and social navigation we designed an application that could detect two pieces of context information, location and identity, and would allow the user to receive information related to that context from other users. The resulting system, called Graffiti, associates electronic notes with specific locations on the Cornell campus. Users can read notes attached to their current location and can also create notes and attach those notes to specific locations.

RESULTS

About 50 Cornell students with wireless laptops installed and used Graffiti over the course of the Fall 2000 semester. Graffiti was designed to store all note creation and reading activity in a database, so this was a rich source of analysis for the experiment. By studying the notes users created along with surveys they filled out at the end of the semester, we got a good idea about the unique benefits and disadvantages of including ideas from social navigation in the design of the system.

System Defined and User Defined Context

Graffiti was designed with the ability to detect the user's location and their identity. However, this was all the context detection that was built into the system. In the actual creation of notes, users took into account context information beyond what the system was capable of detecting. For example, the system wasn't designed to know what people were doing at a location, but user's knew and the notes they posted reflected this additional contextual knowledge. For example, students knew that studying happens in Uris library, that eating happens in Trillium dining hall, that Computer Science students spend a lot of time programming in the computer lab in Upson hall, and their notes reflected this knowledge of activity. This was a distinct benefit that the social navigation features of Graffiti provided.

Social Navigation Facilitates Social Construction of Technology Use in Graffiti

Graffiti's social navigation capabilities allowed users to collectively drive the use of the system. This is one of the benefits of social navigation defined as social affordance, where the behavior of users suggests ways of using the system to other users [1]. From a research perspective, this provided some valuable insights into user's understanding of the system. It was clear from the notes users created and their interaction with each other via Graffiti that they saw the system as a form of computer-mediated communication very similar to e-mail or instant messenger. In survey responses many students commented that Graffiti had no advantage over e-mail or instant messaging. This was distinctly different from our concept of Graffiti as a tagging or annotation system. Had we designed Graffiti in such a way that content was not user-driven we would never have discovered this interesting user perception of the system.

Direct vs. Indirect, Aggregated Social Navigation Data

Graffiti was designed to support direct social navigation. This means that users had to make an effort to contribute content to the system. This proved to be one of the greatest barriers to the usefulness of the system. In survey responses many users commented that they had, "nothing useful to say," or had "no reason to [post a note]." Users also commented that they didn't check for notes on Graffiti because "others weren't using it," and because, "messages were of little value." So it became a vicious cycle where users did not contribute because they were not using Graffiti and they did not use Graffiti because few people were contributing. A possible solution is to use indirect, aggregated user behavior information for social navigation, rather than relying totally on user contributions. We plan to do this in the next version of Graffiti where the movement of users on the wireless network will be a form of information for social navigation. We envision a system that allows users to see where their friends or coworkers are and where they've been on campus to help with coordinating activities. The benefit of this is that users don't have to do anything to contribute to the system besides using their laptops on the wireless network.

Privacy and Social Navigation

Social navigation systems must strike a balance between protecting the privacy of users and tracking their behavior and identities. In designing Graffiti we did not provide the ability for users to post notes anonymously. We reasoned that users should be able to see who posted a note as a form of meta-data. For example if user A is a friend of user B, he will probably trust what user B says in a note more than if user B was an enemy. Similarly if a professor posts a note in her domain of expertise, other users will trust that note more than if an undergraduate posted the note. The

disadvantage of this strategy to Graffiti use was that it prevented some users from posting notes at all. One user commented that he didn't like to post notes because if he said something stupid it was associated with his name. The next version of Graffiti will allow for anonymous postings. We are interested in seeing if people use this feature and under what circumstances.

IMPLICATIONS TO THE FIELD OF HCI

The design and evaluation of Graffiti suggests new ideas for applications both in the realm of context-aware computing and social navigation. All context-aware systems face the problem of how to gather and interpret contextual information. How does the device know your activity or identity and what should it tell you or let you do once it knows? Graffiti is an example of how users can be partnered with the computing device to gather and interpret contextual information. This is a strategy we hope others will think about and employ in designing context-aware systems.

Research in social navigation often deals with real-world concepts of social navigation (such as getting directions or recommending books and music) and applying those concepts to online information spaces such as chat rooms, discussion boards, and web sites. However, we think a case can be made for improving social navigation in the real world by augmenting it with mobile computing devices. Graffiti demonstrates some of the advantages and disadvantages of this idea.

RECOMMENDATIONS FOR FUTURE INVESTIGATION

Testing of Graffiti-like systems in other environments and with other user groups would be valuable in discovering what issues are universal and what issues vary by environment or user group. For example are people more willing to share information with others in some environments? Are people more motivated to contribute in environments that are new to them or in environments they visit frequently and know a lot about? Is anonymity a bigger issue among some user groups? We hope to address some of these issues in future research.

REFERENCES

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