Designing TramMate

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Published in:
Proceedings of the 1st Conference on Designing User Experiences, DUX 2003 ACM

DOI (link to publication from Publisher):
10.1145/997078.997091

Publication date:
2003

Document Version
Early version, also known as pre-print

Designing TramMate: a Context-Aware Mobile System Supporting Use of Public Transportation

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Abstract
We describe the design of a mobile information service that provides users with a route-planning tool for the tram-based public transport system of Melbourne, Australia. The design sketches for TramMate represent early iterations of an ongoing design process based on data from field studies on the use of transportation by business employees who, during a typical workday, have to attend appointments at different physical locations. TramMate supports this activity by keeping track of contextual factors such as the userís physical location, upcoming appointments, and real-time travel information. The design is integrated with an electronic calendar and alerts the user when it is necessary to commence the journey.

Keywords
Field Studies, Acting-Out, Contextual Design, Mobile Devices, Route-Planning, Context Awareness.

Industry/category
Public transportation, mobile information services

Project statement
In the minds of many people, traveling by car supports great flexibility and freedom, whereas the use of public transport is complex and inflexible, imposing predefined routes and timetables; it is also subject to uncertainties

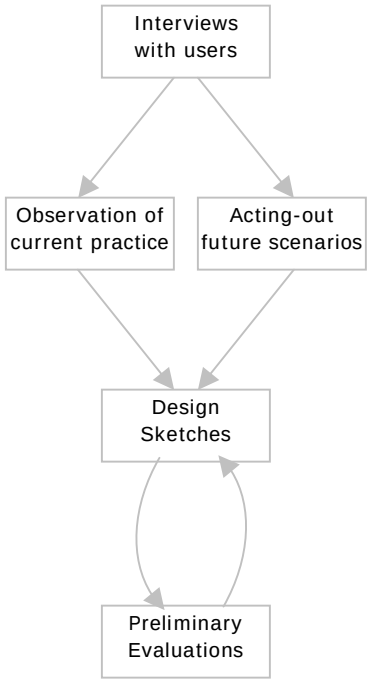


Figure 1: The Design Process

Use of the local tram system had a number of key limitations. Uncertainties related to route planning included: which routes to take, when to change trams, how many changes would be needed, would there be a wait at each change, how close was the tram stop to the desired destination, and so on. Often, users would tend to use their car or a taxi if tram changes were needed, or if the journey was to an unfamiliar destination.

about operation and possible delays. However, in large cities where traffic is often very dense, traveling by car can be highly time-consuming and unreliable, necessitating much planning. Valuable time is spent in traffic jams and in searching for parking spots. It is often difficult to predict the time of arrival, and travelers may arrive late for appointments. Planning for such uncertainties, however, may result in slack time at the destination. Furthermore, being a major contributor to increased air-pollution, the use of cars is not an environmentally friendly means of transportation.

TramMate supports the use of public transportation by means of a context-aware, mobile-information system. Using multiple techniques [Fig. 1], we explored (with interviews and observations) the current travel practice and possible future practice (by acting-out future scenarios) of business employees (referred to here as users), as they traveled to appointments in the inner city, by means of both cars and trams. For observations of current practice, users were engaged in real work tasks, requiring that they be at different physical locations at different times of the day.

Project participants

Two parties contributed to the TramMate project. The Novell office in Melbourne initiated the project and provided users for interviews, observations, acting-out, and evaluations. Researchers from the University of Melbourne conducted the field studies and produced the design sketches.

Project dates and duration

The project was initiated in Nov. 2002. Phase 1, which is described in this paper, lasted until Feb. 2003. Phase 2 involves the implementation and evaluation of our design sketches in an agent-based functional prototype. This phase will run until October 2003.

Process

The design of TramMate was motivated by a discussion among Novell employees about alternatives to the use of cars for traveling around Melbourne for sales or support-related meetings with clients. The use of cars was often highly time-consuming, due to traffic and parking conditions. Using Melbourne's tram-based public transport would not only be more environmentally friendly, but might also be more effective if uncertainty could be reduced by providing relevant information at the right time and place.

During the fieldwork, we investigated the existing Web and "info-stand" based information systems and the travel and work practices of our nomadic users. Our fieldwork consisted of three parts:

- Interviews with users
- Observation of current practice (driving cars in the city)
- Acting-out future practice (on-board trams in the city)

In order to establish the context, interviews with four users who frequently traveled for work-related activities in the city were conducted. The interviews focused on the users' perceptions of the pros and cons of travel by car and tram. Each interview was conducted by two researchers and lasted between 30 and 60 minutes.

It was clear from the interviews that the users were willing to use public transport when attending meetings in the city, but that being able to predict the precise time of arrival of the tram was seen as critical. The interviewees attempted to avoid being either late or too

Figure 2: Acting out a future scenario of catching a tram, assisted by a handheld computer (a piece of wood).

early (thus wasting time for their clients, or themselves, respectively). To assist in timely arrival at appointments, the interviewees wanted to know when to leave their office in order to arrive at their meeting just at the right time. When using the car, this estimation was reportedly done based on knowledge about normal traffic conditions in the city and was not very precise.

Uncertainty about combining routes, trams that may not run to schedule, finding the nearest stop and having to walk from it, all constituted hurdles to the use of public transport.

Following the interviews, the next phase of our fieldwork consisted of observing current practice. Here we were trying to understand both hurdles and enablers to car and tram travel. The observations were conducted by shadowing the users during travel from their offices to meetings in the city. One researcher asked questions about pros and cons of using this means of transportation while another recorded the session on video.

From the observations, we learned that, although driving to meetings in the city could be rather time-consuming, the car was seen as flexible and provided a useful “office on the move,” a semi-private space for limited work activities. Thus, time spent in the car was not necessarily”wasted” time.

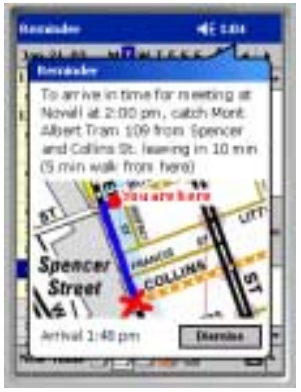
The final phase of our field study consisted of a number of sessions in which our nomadic users “acted-out” future scenarios of using mobile information technology to support travel by tram [Fig. 2]. The acting-out approach was adapted from previous research on envisioning future mobile devices [2]. When acting-out a future scenario, people were asked to envision and enact situations involving future use of technology, based on an overall frame of context and supported by simple props that could be attributed to desired functionality. For the TramMate project, the original approach was modified in a number of ways. First, real, prospective users instead of actors did the acting-out. Secondly, the acting-out was done in real context: using the trams for attending a real meeting in the city instead of performing an imaginary task in a studio. Two researchers facilitated the sessions and took notes. A third person recorded the sessions on a handheld video camera.

From the acting-out sessions we learned a lot about information needs and desires and how these varied across different situations and locations. Also, criteria for assessing the appropriateness of different form factors were revealed; for example, the need for privacy when conducting work in a public space. Specifically, the acting-out sessions revealed that before taking a tram into the city, estimation of travel time from one’s present location to the meeting destination was essential to determine when to go and what tram to catch. On the tram, the primary information needed was where and when to get off and what to do next.

Solution details

On the basis of the field studies, preliminary sketches for the design of TramMate were produced. The requirements for the first design were to:

- Relate traveling information directly to appointments
- Provide route planning based on current location



Figures: 3, 4, and 5

- Alert the user when it is time to depart
- Provide easy access to information about travel time, walking distance, and number of required route changes

Elaborating on ideas of context awareness [1] and indexicality in interface design [3], TramMate supports a user experience in which contextual factors such as time, location, and activity play a major role in the perception of information.

The idea behind the first version of TramMate was not to impose too much additional complexity on the user. Accomplishing this, we designed an extension to PDA-based calendars, providing dynamic route-planning information directly related to the user's schedule for the day. TramMate thus requires very little additional interaction. When a new appointment is made, the user is asked to specify the physical location of it, following which TramMate automatically schedules a special time-slot for getting there. When an appointment is coming up, this time-slot adjusts itself in accordance with the physical location of the user and the estimated time needed to get there, based on real-time information about the public transport system [Fig. 3]. Apart from specifying the first step of the route plan to an appointment, the calendar view also provides direct access to additional details on the suggested route: estimated travel time, required walking distance, and the number of times the user has to change routes. During travel to an appointment, the TramMate time-slot continuously updates itself with information about the next step of the route. Thus, normally, the user will not have to interact directly with TramMate; rather TramMate works through the user's electronic calendar. From the calendar view, the user also has access to a screen providing his current location on a map with directions toward the nearest tram stop. This screen also outlines the full route plan [Fig. 4].

Based on the time required to walk from the user's current location to the first tram stop on the route, TramMate notifies when it is time to leave in order to make the upcoming appointment. The reminder contains simple information on the related appointment, what tram to catch, how soon it leaves, where it leaves from, and how to get there [Fig. 5]. On the tram, TramMate notifies when to get off and what next step to take. Arriving at the destination, a map provides the location of the appointment as well as the user's current position.

Results

A prototype of the presented design is currently being implemented on GPS- and GPRS-enabled Compaq iPAQ handhelds for evaluations in real-world settings, which will subsequently inform additional design iterations.

Acknowledgements

The authors thank Novell employees who participated in the interviews, observations, and acting-out sessions.

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