

December 2003

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Recommended Citation

Henfridsson, Ola and Lindgren, Rikard, "Facilitating In-Car Use of Multi-Context Mobile Services: The Case of Mobile Telephone Conversations" (2003). *AMCIS 2003 Proceedings*. 253.
<http://aisel.aisnet.org/amcis2003/253>

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FACILITATING IN-CAR USE OF MULTI-CONTEXT MOBILE SERVICES: THE CASE OF MOBILE TELEPHONE CONVERSATIONS

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Abstract

This research-in-progress paper examines how to facilitate in-car use of multi-context mobile services such as mobile telephone calls, e-mail, news, and SMS. Because the car is a mobile context with specific convenience and safety problems, it is important to identify and explore seamless ways to use in-car resources such as dashboard control buttons, in-car audio systems, and in-car displays for enabling convenient and safe use of multi-context mobile services. The paper presents an interview study of mobile telephone use in cars. On the basis of this study, a prototype system, SeamlessTalk, has been developed for using in-car resources in making mobile telephone calls more convenient and traffic safe.

Keywords: Cars, in-car resources, mobile services, mobile telephone conversations, traffic safety, user convenience

Introduction: Research Objectives and Questions

Automotive telematics is portrayed by many analysts as one of the more promising application domains of new mobile communication technologies such as GPRS, 3G, and Bluetooth (Bisdikian *et al*, 2002). However, the recent crisis in the telecommunication industry has awakened an interest in user expectations and preferences. One of the user concerns is that in-car applications such as navigation and integrated mobile phone systems are designed as stand-alone services. Because the car is not isolated from other mobile contexts in which users find themselves (cf., May, 2001, pp. 189-191), a broader diffusion and adoption of car independent (or multi-context) mobile services such as mobile phone calls, SMS, MMS, e-mail and news require open in-car platforms that facilitate seamless in-car use of such services.

The car as a mobile context is characterized by some specific use problems. First, the safety hazards of mobile telephone use in cars are well-documented (e.g., Brookhuis *et al*, 1991; Redelmeier and Tishirani, 1997). It can therefore be considered important to design user interfaces of mobile services that do not reduce driving performance. Second, because the car is a perceptually demanding context (Salvucci, 2001), the overhead work of the user for using mobile services must be kept to on a minimum level. As part of an ongoing action research study (Baskerville and Wood-Harper, 1978; Susman and Evered, 1978), this paper examines the use of multi-context mobile services in car settings. The paper specifically explores mobile telephone calls as a type of multi-context mobile service that needs to be supported for handling the convenience and safety problems existing in the car as a mobile setting. Empirically, the paper draws on a qualitative interview study of 20 frequent mobile phone users. On the basis of the interview study, we have designed a prototype, SeamlessTalk, designed for supporting seamless car conversations in the new Saab 9-3 car. The prototype provides a platform consisting of in-car resources (such as dashboard control buttons, an in-car audio system, and an in-car display) for convenient and traffic safe use of mobile telephones in the car setting. The action research is conducted as a collaboration project involving academics at Viktoria Institute, Gothenburg, and practitioners at a car manufacturer (Saab Automobile), two mobile telecommunications network firms (TeliaSonera and Vodafone), and a systems integrator (Mecel).

Theoretical Background

Mobile Services in Context

As argued by Sørensen et al (2002), there exists little well-grounded discussion of the nature of mobile services. In going through the literature, there exist contributions on mobile work (Wiberg and Ljungberg, 2001), mobile collaboration (Luff and Heath, 1998), mobile meetings (Wiberg, 2001), mobile commerce (Anckar and D’Incau, 2002; Kalakota and Robinson, 2002; May 2001), and mobile knowledge (Fagrell, 2000) but there are few attempts to provide a comprehensive and systematic view of mobile services. In this paper, we adopt Sørensen’s et al (2002) conception of mobile services as interactive systems primarily supporting the productivity of mobile individuals.

Broadly speaking, it is possible to distinguish between context-dependent and multi-context mobile services. First, context-dependent services can be referred to as mobile services intended for and used in specific situations. Contextual elements such as location, situation, and mission (May, 2001) influence the usefulness of services like electronic payment in shops, navigation support, and traffic information. In this regard, it is the mobile medium in itself that enable the service delivered. Second, multi-context services can be referred to as mobile services that are less tied to the mobile setting itself. The value of mobile services such as telephone calls, e-mail, and news is much more related to time-critical, spontaneous, and efficiency needs (Anckar and D’Incau, 2002). The primary value of using the mobile phone for receiving and sending e-mails, for instance, is related to increased accessibility and urgency, rather than that the mobile medium would be superior to a PC.

The Car as a Mobile Context

Many of today’s top end cars can be described as sit-in mobile devices (May, 2001, pp. 189-191) equipped with communication technologies (e.g., integrated mobile phones, Bluetooth technology, and vehicle communication technologies such as CAN and MOST) and positioning technologies (e.g., GPS). The introduction of these technologies in cars has opened up possibilities for user applications such as dynamic traffic information, remote (car) diagnostics, theft-tracking, and so on.

It is just until recently that the automotive industry has started to view in-car mobile services as something related to other mobile contexts. In-car mobile phones and car navigation systems have traditionally been stand-alone systems that are used in the car context only. The widespread diffusion and adoption of mobile devices such as mobile telephones and PDAs, however, have triggered a re-thinking of this stand-alone paradigm. One important issue for most car manufacturers at the moment is to identify platform solutions for enabling a user context that supports the use of multi-context mobile services in the car setting.

A reasonably large portion of all mobile phone calls is made in car contexts (Koslowski, 2002). It is therefore not surprising that mobile telephone-enabled services are a top priority for car manufacturers in their efforts to enable the in-car use of multi-context services. As suggested in the introduction section, however, this is not just about enabling interconnectivity between the mobile telephone and the in-car audio system. The convenience and safety problems of in-car use of mobile services must be handled in order to make multi-context mobile services useful in cars.

The following sections of this paper outline the research strategy and methodology planned for this project. They also outline an interview study of mobile telephone users, a car conversation prototype, and the current status of the project.

Research Methodology

As part of an action research project (Avison et al, 1999; Baskerville and Wood-Harper, 1996; Susman and Evered, 1978) on in-car user-value, the research reported in this research-in-progress paper examines how to design mobile phone call support in car settings.

Empirically, the research reported in this paper consists of two interconnected studies. First, it consists of an interview study of 20 mobile phone users. The users were equipped with a 2-month subscription (October 2002-December 2002) to the WAP/GPRS-services offered by the Scandinavian teleoperator TeliaSonera for evaluating a total of sixteen different mobile services. The follow-up interviews covered topics such as mobile telephone use, hands-free usage, mobile telephone use in cars, and specific mobile services.

Second, on the basis of the literature review and interview study, a prototype, SeamlessTalk, has been designed to explore possibilities and problems associated with enabling the use of multi-context mobile services in car settings. An evaluation of the prototype is planned to early autumn 2003. The evaluation will be conducted in the context of car use. A number of Saab 9-3s equipped with the SeamlessTalk prototype will be used by a variety of user groups for assessing issues of convenience and safety in their day-to-day reality. Our current intention is that the evaluation period should be at least a month. This length is needed to get a reasonably relevant picture of how these kinds of services can be integrated in our ordinary life. The planned data sources include data sources such as focus group studies, participant observation of in-car mobile service use, and interviews.

A Qualitative Interview Study: Mobile Telephone Use in Cars

In going through the interview transcripts, there were five emerging themes related to the in-car use of mobile phones: *in-car time as an opportunity for talking*, *combining telephone conversation and driving*, *the inconvenience of in-car phone conversations*, *mobile phone conversations as a safety hazard*, and *hands-free problems*.

In-Car Time as an Opportunity for Talking

Many people spend lots of time in their cars. People commute, they travel between work sites, they go from work to sport facilities, they go on driving-holidays, and so on. It was clear from our interviews that many viewed the time spent in their cars as an opportunity to make phone calls of both professional and private character. Representative comments were:

“It is great [to use in-car time to communicate to other people]! Often you’re so stressed at work that you don’t have the time to make that phone call.... For example, when you sit in the car during the half-hour it takes from down town to the sports centre you’re not that productive. But this half-hour can be really productive by talking to someone over the phone.” (R. 1)

“The time spent in the car is often the opportunity to actually talk over the phone. You’re not busy with client meetings or planning. When being in the car, it is hard to do other things: you can’t use the computer or write any document. You’re busy driving, and talking on the phone is one of the few things you can do simultaneously. And I’ll try to do that. I update myself with what happens at the office, I keep up with things going on. And I also talk to clients as much as I can.” (R.18)

Mobile Phone Conversation as a Safety Hazard

While people seem to find in-car time as a good opportunity to talk on the phone, almost all experienced mobile phone usage as a safety hazard while driving. Some people recalled “close enough” incidents, while others echoed what they felt were the public opinion in regard to mobile phone usage in cars. Representative comments were:

“I have had one incident but I was lucky. It happened during rush hours, I was trying to answer the phone. The phone was in my bag lying in the passenger seat and I tried to answer the phone while while having my eyes on the road. As a result, I had to make a rapid course correction.” (R.1)

“You’re always told that it is dangerous to talk on the phone while driving. So, I usually think that I shouldn’t use it. The best thing is to stop.... I have not realized why really. But, of course, in city traffic, when you have to change lines and so... It’s messy. It’s hardly working and I often want to hang up. (R.9)

Combining Mobile Telephone Conversations and Driving

Even though many appreciated the fact that driving is a perceptually demanding context, however, most respondents thought that they were quite good at combining telephone conversations and driving. Almost all respondents said that they adapted their phone use to the traffic situation. Some of them had also developed different ways to tackle both tasks (driving and phone usage). Illustrative comments were:

“I hold the phone quite high so that I can keep my eyes on the phone and traffic simultaneously. In that way, I at least view a silhouette of what is in front of me. Then I switch my attention between the phone and the windscreen.” (R.6)

“Well, I guess that you have got used to steer with your knees and change gears with your elbow. Of course, in this situation you’re not that focused. But it hasn’t happened anything yet and you don’t think so much about it.” (R.8)

The Inconvenience of In-Car Phone Conversations

Besides the traffic safety aspects, a recurring theme in the interview transcripts were the experienced inconvenience of using mobile phones in the car setting. Consider the following observations:

“The recurring scenario is that the phone is in your bag when you get a call. You don’t know exactly where it is and put down your hand in trying to find it. And it keeps ringing. The caller usually hangs up before you find it.” (R.4)

“In many cases, the phone rings and you have it in your pocket. The seat belt is in the way, you don’t get to it, and it is just a mess. When I am alone in the car, I have started to put the phone on the passenger seat before I start driving.” (R.12)

Handsfree Problems

Despite the considerable mobile telephone experience of our respondents, it can be noted that the use of hands-free systems was relatively low and varying over time. Many of the comments concerned the obstacles of using handsfree systems of different kinds:

“It is really disadvantage that they [the wires of the handsfree set] tangle. So, if you haven’t talked for a while and the phone rings, you often drag it out [of your pocket] and dismantle the headset because you don’t want to sort out the mess.” (R.2)

“A better handsfree function would really improve the situation [mobile telephone use in cars]. The wire trouble and the difficulty to have one hand on the wheel and sort out the mess with the other one.” (R.12)

The SeamlessTalk Prototype

SeamlessTalk is an in-car mobile phone hands-free prototype intended to manage seamless car conversations for driving safety and convenience. The prototype is developed as a component of the infotainment system of the new Saab 9-3 car (see the dashboard in Figure 1). It provides functionality required to make use of a Bluetooth-equipped mobile phone in the car. The user can remotely control the phone by the using the in-car user interface, such as steering wheels controls or speech recognition. This prototype highlights seamlessness aspects particularly interesting in, for instance, transferring calls between the mobile device used and in-car phone resources.

SeamlessTalk consists of four main components (see Figure 2): A Bluetooth-enabled mobile phone (Sony Ericsson T68i), an in-car phone resource system, a service layer, and an infrastructure layer.



Figure 1. The Dashboard of a Saab 9-3 Equipped with the Infotainment System

First, the system includes a Bluetooth equipped mobile phone. In its current version, the system supports the Sony Ericsson T68i telephone.

Second, the system includes an in-car phone resource system intended to provide the resources needed for enhancing the convenience and safety of car conversations. This phone resource system consists of four components: dashboard control buttons, a 5.8 inches screen integrated in the dashboard, a microphone, and an in-car audio system.

Third, the system comprises a service layer that defines the session management considerations. This layer handles establishment of phone calls, maintenance of running sessions, hand over of calls between the phone and the in-car resources, and termination of sessions.

Four, the system comprises an infrastructure layer. This layer enables that the different components of SeamlessTalk can communicate and function together. One important component of this layer is the Bluetooth access point provided by the car's infotainment system. This access point is necessary to establish ad hoc connections to paired mobile phones.

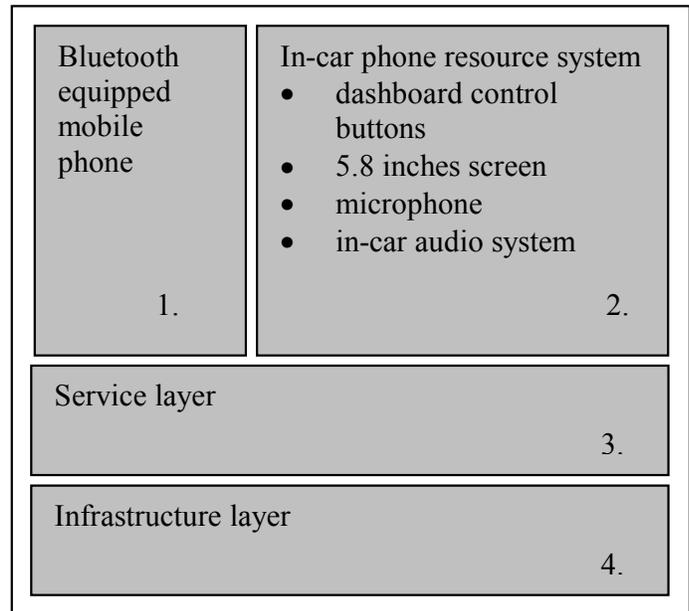


Figure 2. The Components of SeamlessTalk

Summary and Future Work

It can be noted from our qualitative interview study that people use mobile telephones frequently while driving. Even though that people are aware of the safety hazards, they tend to adapt their mobile phone usage to the current traffic situation. This observation corresponds to Esbjörnsson and Juhlin's (2003) finding (contrary to conventional wisdom) that drivers are good at combining driving and phone conversations. Many of our respondents found that they would like to see better hands-free systems, which can overcome both the safety and convenience problems experienced.

The SeamlessTalk prototype is an attempt to design a good platform for making in-car phone conversations more convenient and traffic safe. The prototype supports ordinary (Bluetooth equipped) mobile phone usage by providing the opportunity to use dashboard control buttons, the in-car audio system, and the in-car display for controlling in-car telephone conversations. The project is approaching the phase of evaluating the SeamlessTalk prototype in real use situations. The evaluation will be focused on assessing convenience and safety aspects in in-car mobile telephone usage. The research done will contribute with knowledge about how to adapt multi-context mobile services to specific mobile contexts such as the car.

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