Make a Trip an Experience: Sharing In-Car Information with Passengers

Abstract
Current in-vehicle information systems (IVIS) are designed for use by a single entity – the driver. In this paper we propose that the benefits of IVIS can increase if we also consider the needs of passengers and their potential contribution as additional information handlers who buffer the driver from information overload. The benefits these “incidental users” of IVIS can reap from having trip-related information shared with them include reduced boredom, increased trust and a sense of inclusion. Drivers’ benefits include less distraction caused by questions previously aimed at them as the exclusive owners of the trip-related information, and reduced information load by allowing passengers to actively control selected in-car systems.

Keywords
Driving, passengers, information systems, car travel, service, user experience, IVIS, incidental user.

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous; H.5.2 User Interfaces: User-centered design

General Terms
Design, Human Factors, Theory
Introduction

Dashboards and in-car systems are designed with the driver in mind – because some information is necessary and directly impacts driving decisions and because in every trip there is a driver but not necessarily passengers. However, information provided in today’s in-car systems extends far beyond drivers’ actual needs and may even distract them from their primary task (driving). Sharing this information with passengers could benefit them, but the traditional, driver-focused design of car dashboards, entirely overlooks this possibility.

We argue that the experience of passengers in a car could be significantly improved by sharing car- and road-related information with them. Children sitting in the backseat, for example, could be shown information (possibly in the form of a game) about the time and distance to the final destination or the next stop. Passengers might appreciate having access to driving-related information or the ability to control the car’s entertainment system - and drivers may be happy to shed some of the load of operating multiple IVIS.

Passengers as incidental users

Traditionally, the field of human-computer interaction (HCI) has focused on designing for people who actively use interactive products. This viewpoint neglects a vast number of people who are not considered “users” in the traditional sense. The term “incidental users” was used to describe those people who are affected to various degrees by systems and by those who directly interact with them, but who are often neglected by system designers and service providers [6]. They are often presented with only little (or no) feedback or information regarding their situation or the process (e.g., riding a car) in which they are involved.

The incidental user phenomenon was described as related mainly to the context of people receiving services. However, its basic attributes also characterize the context of passengers riding in a car -- a system (the vehicle), a person who actively interacts with the vehicle (the driver) and persons who are affected by the system and the driver (the passengers). Most of us have had the experience of being an incidental user of a car information systems – peering to the side to peek at the speedometer, noticing a red light in the dashboard, or hearing a sound - with the associated indicator being too small or at the wrong angle to be seen. Following [6], we propose a framework (Figure 1) that depicts the key players in the trip context: the system (the car and its information systems), the active user (the driver), the incidental user (the passenger), and the setting in which the service is provided (a car ride).

In this paper we want to draw attention to the phenomenon of passengers as incidental users and to the responsibility of the HCI community and the automotive industry to address it.

Drivers and passengers

The driver is indeed in charge, pressing the gas pedal and brakes; steering the car; and deciding if and when to turn on the windshield wipers. Driving a car can be divided into three groups of tasks [3, 7]: Primary, maneuvering-related, tasks, such as steering the car and observing the environment; secondary, safety-related tasks, such as activating the wipers; and tertiary tasks, which are the operating of infotainment
systems. In general, the information provided by the dashboard is necessary for the secondary tasks of driving and therefore must be visible to the driver.

Passengers, although generally in the car in order to get to a specific destination, may just be tagging along or keeping the driver company. They rely on the driver not only to drive safely, but also to answer questions they may have about the journey – where they are right now, how long until they arrive or when the next pit stop is. One issue associated with being a passenger, particularly for a long period of time and especially for children, is boredom [8]. Sitting in the same position, with a limited amount of space, and with no control over the situation can prompt a person to look for something to draw his interest. Looking out the window, playing games, singing and watching DVDs are some ways in which this is done – but how about sharing some of the information that’s already there with the passengers? Might this make them feel more involved in the trip and less bored? Might knowing that nothing is being hidden from them inspire trust? Information helps us understand the environment in which we operate and to feel that we are in control, making us feel better in our environment [10]. As a result, sharing of information can have a twofold benefit: it can reduce uncertainty [2] a goal that humans constantly seek to achieve. It can also increase transparency – the ability to ‘see through’ something and to share information that is not usually shared [5]. It is surprising that even seemingly visionary concept cars, often exclude passengers in their design. The Chrysler 200c concept car (see Figure 2) is an example of an interface that is clearly directed toward the driver, both in terms of visibility and in terms of control. The Mini’s dashboard central display (Figure 3) is a definitive contrast to the driver-oriented dashboard of the Chrysler. With its exceptionally large central speedometer visible to all, it both makes the information transparent and sends a clear “I have nothing to hide” message.

Reducing the information load
Driving the car is just part of the driver’s information processing activity [14]. Various distractions are caused by directing attention to information sources inside or outside the car. Research of crash causes [12] indicates two main sources of inattention that contribute to the highest incidence of events: wireless device use (mainly cell phones) and passenger-related tasks (mainly conversations).

Today’s IVIS include not only cell phones, but also navigation systems, entertainment and internet-based services. These systems provide drivers with increasingly accessible information, but at the same time place an even greater burden on their cognitive resources, hence increasing the likelihood of inattentive driving and involvement in accidents. Navigation systems, which combine cognitive demands with lengthy visual distraction, are particularly disruptive.

One possible approach to dealing with these distractions is to reduce information load. This can be achieved by delegating some of the tertiary tasks -- currently in the sole responsibility of the driver [7], such as navigation, music, and cell phone -- to the passenger. Two potential benefits of this approach are: allowing the driver to focus on driving the car and reducing passengers’ needs to communicate with the driver, thus being less likely to cause a distraction.
Clearly not all interaction with the driver is negative. Research shows that in many cases passengers become involved in certain aspects of driving the vehicle - “the front-seat passenger and driver were conjoined in their engagement with the road ahead” [8] - with this often leading to a safer experience, in which the passenger is able to point out hazards the driver may not have been aware of.

A support for our view is presented in a study that examined the use of navigation systems [9]. According to this study, a passenger riding beside the driver is sometimes assigned the role of interacting with the system. The researchers also discuss passengers’ reactions to the fact that some in-car systems allow only minimal interaction while driving, for safety reasons. Some informants expressed a desire that interactive properties be preserved for the passenger.

**Creating an experience**

Letting passengers view and control in-car systems is important from the traditional safety-related perspective. In addition, it can affect the overall travel experience for the passenger. Experiences engage individuals and create memorable events by using services as a stage on which the experience is delivered [13]. It is the combination of all cues, whether present or absent, that form a total experience [4]. The trip itself, in our case, is the service and the information provided to passengers serves as the cues [1]. Providing passengers with information that is of interest to them has the ability to create an experience beyond that of the trip itself.

Towards further study of designing passenger-inclusive IVIS we discuss below several aspects that influence the incidental use scenario in the car environment. For the passenger, interest is a key factor. Additional factors are the in-car setting, trip related factors, the relationship between the passenger and the driver, and the level of control a passenger is afforded.

**Interest**

Passengers’ interest in in-car information depends on numerous factors, including curiosity, perceived importance of the information, allocation of attention, and boredom. Interest may depend on characteristics such as age: children and adults may be interested in different information. The reason for the trip is also a factor - passengers who are anxious to reach their destination are likely to be more interested in the amount of time left than a friend who has just come along for the ride. A passenger who is in the car as part of a service (e.g., during a taxi ride) may be most interested in the fee she’ll be asked to pay at the end of the trip or in a description of the major points of interest along the ride.

**The physical setting**

The location of the passenger is a key factor in determining the travel experience: front seat passengers can generally view and control a number of systems, such as a navigation system, speedometer, or sound system. Back seat passengers, on the other hand (or those in the “way back” third row), suffer from obstructed views and little or no control over the IVIS.

**Trip related factors**

The duration of the trip and its level of complication are significant: information is likely to be more relevant in longer trips, particularly those requiring complicated navigation. Also, long trips may provide more...
opportunities and reasons for the passengers to want to interact with in-vehicle systems.

**Driver-passenger relationship**

Relationships between the driver and the passenger can take on many forms. One salient dimension of those relationships relates to whether the passenger pays for the ride or not. In-between situations may include, for example, carpools or car-sharing. Non-paying passengers (e.g., family members or friends), who have a personal relationship with the driver, are far more likely to take on the role of a co-driver - answering a phone call or setting a destination on the navigation system. Passengers receiving a service, on the other hand, are unlikely to actively operate in-car systems and may even hesitate to ask the driver for information. Passengers in a carpool or car-sharing situation may fall into either category.

The situation of a passenger in a taxi resembles that of an airline passenger. In the past, passengers depended on occasional messages from the crew regarding the advance of the flight, its location, and projected arrival time. Today, in-flight systems allow passengers to monitor the progress of the flight and to watch the outside view via external cameras. This demonstrates design solutions that increase the range of information accessible to the passenger.

Passenger-oriented IVIS can benefit passengers receiving a service in various ways. Such systems could reduce their need to directly interact with the driver by providing them with the information that interests them. They can also improve the passenger’s access to information, (e.g., reducing language barriers when riding in a taxi in a foreign country), and improve their experience. Boston Cab Dispatch has installed “Passenger Information Monitors” that enable passengers to view details of the current trip [15]: “The Passenger Information Monitor (PIM) provides the passenger with real-time mapping to track their journey. Passengers can choose to view maps at scales ranging from street level to regional, allowing passenger to view either their surrounding streets or a complete track of their journey.”

Another variation of a situation where a person is being chauffeured is limousine passengers. They are receiving a service but often have a higher degree of control over the situation. The passengers of the Maybach luxury car, for example, have an extra speedometer in the passenger compartment, in addition to dials for time of day and outside temperature (Figure 4). Clearly, current technologies allow the expansion of the range of information provided to the back seats.

**Level of control**

The degree of control a passenger may have over in-car systems depends on the level of trust between the driver and passenger, the criticality of the information for the driver (e.g., setting a destination on the navigation system vs. browsing radio channels) and the passenger’s place in the car (a front-seat passenger is better able to take control). A range of other considerations may also play a role in sharing activities between drivers and passengers (e.g., passengers’ age, their skill in operating various IVIS functions).

**Conclusions and future work**

Incidental users in the context of the automotive environment are passengers who could (1) benefit from available information that current IVIS are not designed to provide them with, and (2) help drivers concentrate
on their primary task by sharing the load of information and reducing distractions. We believe that sharing information and increasing passenger involvement can potentially improve travel safety and experience.

This paper presented a preliminary theoretical foundation to the issue of sharing information with passengers in the context of car travel. In order to further explore the degree and the means for sharing information, we plan to use a variety of research methods to study several related issues. For example, what types of information actually interest passengers? Do front and back-seat passengers have different information needs? How can drivers transfer some of their tasks to passengers, while remaining in control? To what degree and under what circumstances are drivers willing to share control over information or to share sensitive information with passengers (e.g., speed, while speeding)? Our research plan includes: 1. Employing ethnographic tools to study the needs of both passengers and drivers. 2. Studying a variety of scenarios, differing in context and social interaction (e.g., friends and family vs. taxi ride). 3. Extending the model by introducing new variables or contingencies. 4. Exploring the potential of new interactive technologies (e.g., mobile devices, location-based information and services) between the passengers in the same car, and between them and road environment (e.g., [11]).

References