AutoNUI: 2nd Workshop on Automotive Natural User Interfaces

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ABSTRACT
Natural user interfaces—generally based on gesture and speech interaction—are an increasingly hot topic in research and are already being applied in a multitude of commercial products. Most use cases currently involve consumer electronics devices like smart phones, tablets, TV sets, game consoles, or large-screen tabletop computers.

Motivated by the latest results in those areas, our vision is to apply natural user interfaces, for example gesture and conversational speech interaction, to the automotive domain as well. This integration might on one hand reduce driver distraction in certain cases and on the other hand might allow the design of new user experiences for infotainment and entertainment systems.

The goal of this workshop is to explore the design space of natural multi-modal automotive user interfaces and to continue the fruitful discussions held at the 1st Workshop on Automotive Natural User Interfaces from AutomotiveUI '11 in Salzburg, Austria. We would like to analyze where and how new interaction techniques can be integrated into the car.

Categories and Subject Descriptors
H.5.2 [**Information interfaces and presentation (e.g., HCI)**]: User Interfaces – Input devices and strategies (e.g. mouse, touchscreen), Interaction styles (e.g., commands, menus, forms, direct manipulation), Natural language, Voice I/O.

Keywords
Automotive User Interfaces; Natural User Interfaces, Gesture Interaction; Speech Interaction.

1. INTRODUCTION
Human-computer interaction (HCI) depends, in most use cases, on the context in which the interaction between user and computer takes place. This is especially true for the automotive domain with its multitude of environment-specific requirements. The primary task of driving a car can itself often be very challenging for the user— despite advances in assistive driving— especially as overall traffic density is growing. At the same time the car's cockpit is getting more complex due to new, feature-rich assistance and infotainment systems on both built-in and nomadic devices. In order to complete secondary and tertiary tasks [2] with these systems, many drivers execute several tasks simultaneously besides the driving task. Efficient and easy-to-use HCI is therefore of particular interest in the automotive domain, with the background goals of most research being the reduction of driver distraction and the support of safe driving.

According to the U.S. Department of Transportation, the average time drivers spend per day in their cars while commuting, shopping, or traveling is 43 minutes/day in Europe and 86 minutes/day in the United States. As most drivers spend this time alone, they demand ever-wider entertainment options and an almost living room-like environment for their vehicles. This underlines the need to enhance the emotional attachment between driver and car. Interaction design with an eye towards usability can help to foster this attachment. Furthermore, societal and IT trends are resulting in an always-connected environment in which drivers and passengers demand constant access to information and in which vehicles have to be aware of their surroundings. Adding to this challenge are upcoming systems for (semi-) autonomous driving as well as the increased prevalence of car-sharing. New interaction techniques are clearly needed to enable a new generation of interactive systems for information access and the accomplishment of tertiary tasks while driving.

Buttons and similar physical controls are still predominant in the automotive design space [4], however the increasing number of available functions has lead to a situation where dashboard space precludes a one-to-one mapping from physical key to function. In order to circumvent this problem, current systems tend to provide hierarchical menu structures to access certain functions. The drawback of this approach is that instant access to these

hierarchically nested functions is no longer possible. This might lead to longer task completion times and—depending on the visualization—might increase visual distraction.

The introduction of new electronic consumer devices like smart phones and game consoles has brought with it new ways of interacting with computers and embedded devices. Thus, a growing number of people today are used to interacting with touch-sensitive devices (touchscreens and touchpads) and many have some first-hand experience with speech technologies. Within HCI research, "natural user interfaces" (NUIs) 0 have become a fruitful research topic encompassing multi-touch and full body gestures, conversational dialogs and affective systems, among many others. The introduction of computer vision-based tracking technology like the Kinect for Xbox 360[1] and natural speech systems like Apple's Siri[2] has extended the interaction space for consumer devices. Inspired by these developments, the question arises whether these interaction techniques might also be suitable for automotive UIs. Although some early research has been carried out in the automotive context (e.g., [1], [5], [7], [9]), only some basic touch- and voice-activated interfaces have found their way into deployed in-vehicle systems so far. Gestural and multimodal interfaces are not yet broadly deployed. As they might facilitate the execution of secondary or tertiary tasks without increasing driver distraction, the integration of such interfaces is of particular interest (e.g., [6]).

Additionally, natural user interfaces have the potential to enhance the user experience. Designing experiences with these user interfaces can address and fulfill psychological needs of the user while interacting with the car (e.g., [3]). The resulting emotional attachment to the car can ease the acceptance of a system and avoid disuse. Considering the daily drive times mentioned above, the user experience offered by automotive computer systems is likely to gain prominence in the car-buying decision.

Besides integrating these technologies into the car in general, we must also be concerned with how potential new interaction techniques are designed and evaluated. How can individual NUI technologies be used, and how might they be combined in new and interesting ways to foster the overall user experience?

2. OBJECTIVES

This workshop addresses the following issues:

- Generating an overview of which (natural) user interfaces are already used in the car and how they might be used in the future.
- Concepts for future multimodal interactions in the car.
- Automotive user interface frameworks and toolkits
- Looking into special sub-domains: the driver, the co-driver, the backseat area, or connection to the outside..
- Understanding the definition of "natural" for different users. What are the differences across generations, cultures, and driving habits (occasional drivers vs. professional drivers)?
- Understanding how NUIs can be used in the automotive domain: do they replace or rather augment other interfaces?
- Discussion of potential issues of bringing NUIs into the car.
- Researching the relevance of traditional UX factors to the automotive NUI context
- Researching how UX factors might motivate the integration of new NUIs into the car.
- New concepts for in-car user interfaces enhancing UX and experience design in the car
- Multimedia interfaces, in-car entertainment, in-car gaming
- Future trends: the ubiquitous car in a mobile society

3. OUTCOMES

We have identified the potential for a fruitful continuation of our 1st workshop on Automotive Natural User Interfaces [8]. We want to give researchers and practitioners the possibility to discuss the ways of integrating NUIs into the car and measuring the "naturalness" of their designs. We think that it is furthermore necessary to identify challenges related to understanding and addressing users' psychological and affective needs with respect to automotive user experiences. We expect that the coverage of these topics will further participants' understanding of the role of NUIs in the car, and that workshop outcomes advancing automotive NUIs will more broadly advance the entire discipline of automotive user experience.

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