

AutoNUI: A Workshop on Automotive Natural User Interfaces

Bastian Pflöging,
Albrecht Schmidt

VIS, University of Stuttgart
Pfaffenwaldring 5a
70569 Stuttgart, Germany
+49-711-685-60069 / -60048

bastian.pflöging@vis.uni-stuttgart.de
albrecht.schmidt@vis.uni-stuttgart.de

Tanja Döring

Paluno, University of Duisburg-Essen
Schützenbahn 70
45127 Essen, Germany
+49-201-183-2955

tanja.doering@uni-due.de

Martin Knobel

University of Munich
Amalienstraße 17
80333 Munich, Germany
+49-89-382-30165

martin.knobel@ifi.lmu.de

ABSTRACT

Natural user interfaces by means of gesture and speech interaction have become an important topic in research as well as already for products. Most use cases currently center around consumer electronics like, e.g., smart phones, TV sets, or gaming consoles.

Motivated by the latest results in these areas, our vision is to apply natural user interfaces like gesture and speech interaction to the automotive domain. This integration has potential to reduce driver distraction in certain cases and to shape new experiences, e.g., for operating infotainment and entertainment systems.

The goal of this workshop is to explore the design space of natural multimodal automotive user interfaces in order to analyze where and how new interaction techniques can be integrated into the car. We would like to bring together practitioners and researchers to identify and discuss challenges and potentials of automotive natural user interface aspects, including concepts and guidelines, technologies and frameworks, prototypes and use cases as well as user experience design.

Categories and Subject Descriptors

H5.2. [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). H.1.2. [User/Machine Systems]: Human factors.

General Terms

Performance, Design, Experimentation, Human Factors.

Keywords

Workshop, automotive user interfaces, natural user interfaces, gesture interaction, speech interaction, multimodal interaction.

1. INTRODUCTION

In most application domains, human-computer interaction (HCI) strongly depends 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 requirements. Already the primary task of driving a car is challenging for the user – especially as the overall traffic is growing. Thus, an increased attention of the driver is needed. At the same time the automotive cockpit is getting more complex due to new feature-rich assistance, entertainment, and infotainment systems in the car. In

order to complete secondary and tertiary tasks [3] with these systems, most drivers are executing several tasks simultaneously besides the driving task. As buttons and similar controls are still predominant in the automotive design space [5], the increasing amount of available functions leads to a situation where there is no longer the option to access each function by just one key. In order to circumvent this problem, current systems tend to provide for example hierarchical menu structures to access a certain function. The drawback of these menus is that at least for some functions no immediate access is possible. This might lead to longer task completion times and – depending on the visualization – might increase the visual distraction. As one of the main goals of research in the automotive domain is to reduce driver distraction and to support driving safety, efficient and easy to use interfaces are of special interest. Natural user interfaces offer a number of potentials for in-vehicle user interaction that should be explored.

2. AUTOMOTIVE NATURAL USER INTERFACES

Within HCI research, interaction techniques such as touch and gestural interaction, voice commands, or full body movements have evolved to vivid research areas. As one umbrella term for these different and mainly novel ways to interact “natural user interfaces” (NUIs) has been coined (e.g., [11]). Wigdor and Wixon describe a NUI as an “interface that makes your user *act and feel like a natural*” [11, p. 14]. This does not mean that interface designers should mimic the “real world” but rather that they “create an experience that, for expert users, can feel like an extension of their body” [11, p. 13]¹. Furthermore, natural user interfaces should be “enjoyable, leading to skilled practice and be appropriate to context” [11, p. 29]. On the consumer market, already many devices exist, that involve forms of natural user interaction like multi-touch (e.g., iPhone) and gesture-based input (e.g., Kinect for Xbox 360). Hence, a lot of people today are used to some natural user interaction techniques and could easily transfer their experiences to novel in-car user interfaces.

If “two or more combined user input modes—such as speech, pen, touch, manual gestures, gaze, and head and body movements—[are processed] in a coordinated manner with multimedia system output” [9], the term “multimodal interfaces” is used within research and development. The body of research on multimodal interfaces overlaps with natural interaction, and as natural user interfaces likely will develop towards integrating more than one

¹ A discussion on the suitability of the term “natural” in “natural user interface” has begun in many places; see, e.g., “Natural user interfaces are not natural” by Don Norman [8].

input modality, much of the research on multimodal interfaces (see, e.g., “guidelines for multimodal user interface design” [10]) lays important foundations for natural user interfaces (and vice versa).

Although some early research has been done in the automotive context (e.g., on hand and head-gesture recognition [1], on speech input [12], on multi-touch interaction [2] and on multimodal interaction [6]), only some natural and multimodal user interfaces have found their way into the car. As these systems provide additional input modalities that have the potential to facilitate executing secondary or tertiary tasks and reduce driver distraction, the integration of these technologies is of particular interest (e.g., [7, p. 248]). Having in mind upcoming systems for (semi-) autonomous driving, new interaction techniques might be interesting as well as they enable for example the creation of new interactive systems for tertiary tasks while driving.

Additionally, natural user interfaces have the potential to increase the user experience. Applying experience design can result in positive, joyful experiences (e.g., [4]). Furthermore, this can lead to an increased acceptance of a system and avoid disuse. Drivers spend a notable amount of time in their cars per day while commuting, shopping, or traveling. Thus, a raised demand for entertainment and the establishment of a living room-like environment in the car can be noticed. This fact underlines, that it is important to enhance the emotional attachment between user and car.

Overall, broad aspects of natural user interfaces are in the focus of this workshop ranging from concepts, design guidelines, and (combinations of) interaction techniques to technologies, frameworks, concrete prototypes, use cases, experience design and user experience. The workshop will explore these aspects about integrating natural user interfaces into the car and invites researchers and practitioners to discuss challenges and potentials of new natural automotive UIs.

3. WORKSHOP TOPICS

Topics of interest of this workshop include but are not limited to:

- Usage of natural user interfaces in the car
- Visions of future natural user interfaces in the car
- Design tools and methods for natural and multimodal interaction in the car
- NUIs for the driver, the co-driver, and the backseat area
- Using NUIs for interconnections to the outside world
- Understanding how NUIs impact the driving experience
- Approaches for transitioning to NUIs in the car
- Experience and discussion of potential difficulties of integrating NUIs into the car
- Relevance of traditional user experience factors for gesture and speech in the automotive context.
- Researching how user experience factors might be the driver to integrate new user interfaces into the car
- Automotive user interface frameworks and toolkits that support multimodality and NUIs
- New concepts for in-car user interfaces to enhance user experience by experience design
- NUIs for Multimedia, in-car entertainment, in-car gaming

4. PARTICIPANTS

The workshop aims to bring together researchers, students, and practitioners, who are interested specifically in the automotive context. In particular, we hope for participants with different

backgrounds and perspectives, e.g., automotive user interface designers, experience designers, and engineers from a scientific as well as from an industrial perspective. The number of participants will be limited. Participants will be selected based on their submission through a review process conducted by the organizers as well as selected researchers working in this domain.

5. ACKNOWLEDGMENTS

The project is partly funded from the German Research Foundation within the Cluster of Excellence in Simulation Technology (EXC 310/1) at the University of Stuttgart

6. REFERENCES

- [1] Althoff, F., Lindl, R., Walchshäusl, L.: Robust Multimodal Hand- and Head Gesture Recognition for controlling Automotive Infotainment Systems. *VDI-Tagung - Der Fahrer im 21. Jahrhundert*, VDI (2006).
- [2] Döring, T., Kern, D., Marshall, P., Pfeiffer, M., Schöning, J., Gruhn, V., and Schmidt, A. 2011. Gestural interaction on the steering wheel: reducing the visual demand. In *Proceedings of the 2011 annual conference on Human factors in computing systems*. CHI '11. ACM, New York, NY, USA, 483-492.
- [3] Geiser, G. Man Machine Interaction in Vehicles. *ATZ* 87, 74 – 77, 1985.
- [4] Hassenzahl, M. *Experience Design: Technology for All the Right Reasons*. Synthesis Lectures on Human-Centered Informatics. Morgan and Claypool Publishers, 2010.
- [5] Kern, D., Schmidt, A. 2009. Design space for driver-based automotive user interfaces. In *Proceedings of the 1st International Conference on Automotive User Interfaces and Interactive Vehicular Applications*. *AutomotiveUI '09*. ACM, New York, NY, USA, 3-10.
- [6] Müller, C. and Weinberg, G. Multimodal Input in the Car, Today and Tomorrow. *IEEE Multimedia*, Vol. 18, 2011, 98-103.
- [7] Norman, D. A. *Emotional Design*. New York: Basic Books, 2004.
- [8] Norman, D. A. Natural user interfaces are not natural. *interactions* 17, 3, May 2010, 6-10.
- [9] Oviatt, S. Multimodal interfaces. In A. Sears and J. A. Jacko, editors, *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*, Second Edition, CRC Press, 2007. 413–432.
- [10] Reeves, L. M., Lai, J., Larson, J.A., Oviatt, S., Balaji, T. S., Buisine, S., Collings, P. Cohen, P., Kraal, B., Martin, J.-C., McTear, M., Raman, T. V., Stanney, K. M., Su, H., and Wang, Q. Y. Guidelines for multimodal user interface design. *Commun. ACM* 47, 1, 2004, 57-59.
- [11] Wigdor, D. and Wixon, D. *Brave NUI World. Designing Natural User Interfaces for Touch and Gesture*. Morgan Kaufmann, 2011.
- [12] Winter, U., Grost, T. J., and Tsimhoni, O. 2010. Language pattern analysis for automotive natural language speech applications. In *Proceedings of the 2nd International Conference on Automotive User Interfaces and Interactive Vehicular Applications*. *AutomotiveUI '10*. ACM, New York, NY, USA, 34-41.