MIAA 2011: Multimodal Interaction for the Intelligent Environment Car

Christoph Endres
DFKI Automotive, IUI
Germany
christoph.endres@dfki.de

Gerrit Meixner
DFKI-IFS,
Germany
gerrit.meixner@dfki.de

Christian Müller
DFKI Automotive, IUI
Germany
christian.mueller@dfki.de

ABSTRACT

Automotive development has been dominated by the constraints of driving. However, natural relations to the more general area of Intelligent User Interfaces exist. Previous research in related fields therefore should be adopted and included. The aim of the 2011 MIAA workshop is to foster discussion between experts in otherwise unrelated fields of research. For example, public interfaces use crossmodal referencing in order to circumvent restrictions by the users current focus on a limited communication channel. Our aim is to raise awareness for this approach, concluding that crossmodal references in the car are helpful to bridge the gap between information inside the car and the environment. Another focus topic of the workshop is eco-friendly driving. Although universally regarded as a necessity, it remains an open question how to encourage drivers to drive ecologically. We discuss for example awards for eco-friendly driving by making it competitive and game-like.

ACM Classification Keywords

H.5.2 Information interfaces and presentation: User Interfaces, User-centered design

General Terms

Design,Human factors

INTRODUCTION

Developing Driver Assistance Systems is a very complex task which has to take a lot of specifics of the driving context into account and deal with a large number of constraints. *Automotive UI* systems differ from conventional user interface (UI) systems in a number of ways. Driving, the primary task, has a natural priority over interactions and presentations as secondary and tertiary tasks. Hence, a special focus of the application development is always on the distraction of the driver, attempting to keep it as minimal as possible, i.e. communicate non-intrusively with the driver. The dynamic of a changing spatial environment leads to constant replanning of tasks, and multiple presentation tasks are competing for limited output resources (e.g. displays). However, natural relations to the more general area of Intelligent User Interfaces (IUI) exist. Public user interfaces, for example, are often limited by spatial constraints. At the same time, information presented to the user needs to be as clear and unambiguous as possible in order to avoid confusion and to minimize the service personell required. A common multimodal fission [2] approach is to use a limited communication channel that is likely to be in the focus of the user to refer to a more suitable communication channel. Eco-friendly driving has become a major issue in the automotive field. But even with an enormous progress in eco-friendly technology, its effectiveness is still widely depending on the individual drivers behavior. Persuasion [5] and the impact of the human factor is the focus of discussion here.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.
IUI'11, February 13–16, 2011, Palo Alto, California, USA.
Copyright 2011 ACM 978-1-4503-0419-1/11/02...$10.00.

COMBINED RESEARCH APPROACH

Comparatively little research has been done on standardized, generic presentation languages for in-car presentations and on multimodal fission concepts for communicating a dialogue response or information to the driver. Most of these questions have been tackled in a similar form in the field of *multimodal interfaces*. We argue that multimodal presentation languages such as M3L [7] or MMIL [6] as well as user interface description languages like e.g. DISL, AbstractHMI, or VW-XML should be adopted and extended for the automotive domain. Combining these two approaches gives us powerful tools for presentations. Furthermore, we need a sophisticated device management [1], which is definitely needed for a complex environment such as a car. Research on *Intelligent Environments* [8] has done that for more than a decade now; we argue that results should be taken from there, and be adapted carefully. Thus, we now look at the car as a special form of Intelligent Environment with explicit multimodal fission. On the other hand, automotive research is not just including work from other research areas, but also contributes an exciting new point of view to an interdisciplinary effort trough the *Car2X concept*. Its core part consists of wireless communication between cars, motorcycles and infrastructure, which become highly mobile nodes in an ad hoc network. Applications for Car2X technology are mainly safety related.

Referencing across visual displays can be found at public stations for returning empties - both bottles as well as boxes of bottles. Once the user has finished returning the bottles, he can push a button and have a refund voucher printed for store credit. The main part of the user interface is located on the upper part of the machine and consists of a screen, a button and the voucher-printer. However, when inserting boxes in the hatch, the users focus is most likely at the bottom part of the device. If at that time a problem occurs, e.g. the tape being stuck or the storage space exhausted, a small one-line display right above the hatch lights up and informs the customer about a problem being explained in more detail on the screen. Another example of crossmodal referencing spanning differnet modalities (visual and auditory) can be found at train stations and airports. The display showing the departure times has only limited space for additional information, so if there is an important information to be added, the passenger sees a short note "please listen to announcement", which is sufficient to raise his awareness of the situation and if necessary he can turn off his mp3 player to hear the announcement. The previous examples illustrate two dimensions of crossmodal referencing. One being references between spatially distributed visual output devices of differnet capabilities. The other is the reference between two modalities, such as referring visually to an audio announcement or vice versa. Transferring this concept to the car will add another dimension: Referring from internal output channels to external channels or even the other way around. The other two dimensions can be applied as well, using several dimensions simultaneous is possible. We conclude that crossmodal references in the car are helpful to bridge the gap between information inside the car and the environment.

We discuss attempts to turn **eco-friendly driving** in a game-like competitive event and thus making it more desirable. [3] already investigated the acceptance of eco-persuasive interfaces. Social networks have become very popular over the past few years. Their original purpose was to connect to people and stay in touch with your social environments. Nowadays however, they serve additional functions, such as enhanced personal visibility and as a platform for earning digital status symbols like the number of your followers or the amount of positive feedback on your activities. We will use these effects by publishing above-average results in eco-friendly driving on a platform such as facebook, so that drivers can compete in earning points for their driving style. While connecting to a social platform is relatively straightforward, the question where to obtain suitable data of the cars gas consumption while not putting too much (expensive) additional equipment in the car is rather difficult. Furthermore there is the decision how and in what way the drivers eco-scores should be measured and published. We approach these problems as follows: In a first step, data from personal nomadic devices such as smartphones will be used for an estimate of the driver eco-score. Most modern smartphones have the ability to determine the current GPS position and we can use that in order to determine the driving speed. Although this is just a very rough estimate, we still can tell that driving at a constant speed of 100 mph is not very ecological. Self-reporting could be an alternative, but opens up some confidence issues. Some manufacturers furthermore already offer USB interfaces to download driving information. These data can be processed for a more detailed eco analysis. Based on the assumption that obtaining information from the car will become more and more easy and detailed, we plan on gradually improving the eco score measuring, and we would like to encourage the community to use our prototype and make a joint effort to improve it. Social networks are just one part of the youldeco concept. Other ideas such as an animated character commenting on the drivers eco score on safe presentation times can be combined with it and seemlessly integrated.

REFERENCES

1. C. Endres, A. Butz, and A. MacWilliams. A Survey of Software Infrastructures and Frameworks for Ubiquitous Computing. *Mobile Information Systems Journal*, 1(1):41–80, January–March 2005.
2. M. E. Foster. CoMiC Deliverable 6.1 State of the art review: Multimodal fission, 2002.
3. A. Meschtscherjakov, D. Wilfinger, T. Scherndl, and M. Tscheligi. Acceptance of future persuasive in-car interfaces towards a more economic driving behaviour. In *AutomotiveUI '09: Proceedings of the 1st International Conference on Automotive User Interfaces and Interactive Vehicular Applications*, pages 81–88, New York, NY, USA, 2009. ACM.
4. C. Müller and G. Weinberg. Multimodal input in the car, today and tomorrow. *IEEE Multimedia*, 18(1), 2011. to appear.
5. H. Oinas-Kukkonen and M. Harjumaa. A systematic framework for designing and evaluating persuasive systems. In H. Oinas-Kukkonen, P. F. V. Hasle, M. Harjumaa, K. Segerståhl, and P. Øhrstrøm, editors, *PERSUASIVE*, volume 5033 of *Lecture Notes in Computer Science*, pages 164–176. Springer, 2008.
6. N. Reithinger, C. Lauer, and L. Romary. MIAMM–multimodal information access using multiple modalities. In *International CLASS Workshop on Natural, Intelligent and Effective Interaction in Multimodal Dialogue Systems*, 2002.
7. W. Wahlster, N. Reithinger, and A. Blocher. Smartkom: Towards multimodal dialogues with anthropomorphic interface agents. In *In International Status Conference: Lead Projects HumanComputer -Interaction*, pages 22–34, 2001.
8. M. Weiser. The computer for the 21st century. *SIGMOBILE Mob. Comput. Commun. Rev.*, 3(3):3–11, 1999.