Social, Natural, and Peripheral Interactions: Together and Separate

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Abstract
A major challenge in the future of traffic is to understand
how "socially-aware vehicles" could be making use of their
social habitus, formed by any information that can be
inferred from past and present social relations, social
interactions, and a driver's social state when exposed to
other participants in real, live traffic. The aim of this
workshop in recognition of this challenge is to advance
on a common understanding of the symbiosis between
drivers, cars, and the infrastructure. The central objective
of the workshop is to provoke an active debate on the
adequacy of the concept of social, natural, and peripheral
interaction, addressing questions such as "who can
communicate what", "when", "how", and "why"? To
tackle these questions, we would like to collect different,
radical, innovative, versatile, and engaging works that
challenge or re-imagine human interactions in the near
future automobile space.

Author Keywords
Automotive user interfaces; social driving; natural user
interfaces (NUI); multimodal interaction; peripheral
interaction (PI); human-centered design; human factors;
cognitive limits; individuality and personality.

ACM Classification Keywords
Human-centered computing: [Interaction design]:
Interaction design theory, concepts and paradigms

Human Interaction in the Future Car

This workshop will explore the emerging themes of autonomous driving, social driving, and novel user interaction approaches: natural user interfaces and peripheral interaction. Our aim is to define the future landscape for research within and across each of these areas.
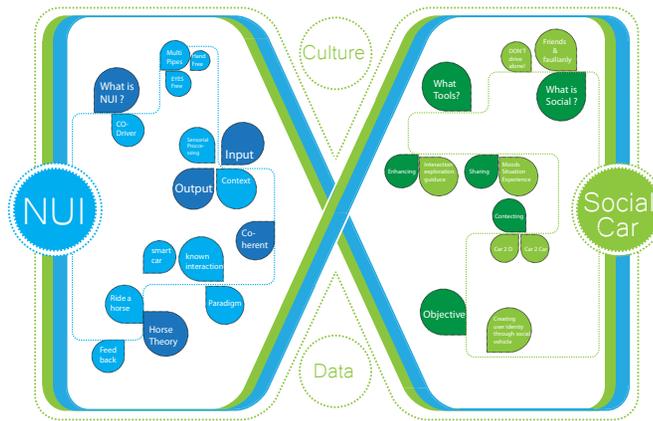
Figure 1: The result chart of our AutoUI 2013 workshop [9] shows the coexistence and interdependence of social cars and NUI's.

We would like to collect different, radical, innovative, versatile and engaging works that challenge or re-imagine human interactions in the near future automobile space. We seek to challenge existing thinking by exploring what is possible both now and by the time the autonomous vehicle is a standard feature of our roads. Participants will be encouraged to suggest alternative concepts with either low fidelity or high fidelity or both. Especially encouraged will be works that are experimental and can provide hands-on demonstration. The workshop will be an opportunity to re-shape the conversation of automobile

technology by introducing the community to a new way of thinking. A further goal of this workshop is to continue the discussion and exploration of the design space of natural multi-modal automotive user interfaces and to continue the fruitful discussions of our previous workshops at AutomotiveUI 2011-2013. We would like to analyze where and how new interaction techniques can be integrated into the car for manual and (semi-) automated driving situations. Complementing topics of our previous workshops, we decided to pay particular attention to peripheral interaction and find similarities and differences to NUIs in the context of the "social car". As a convenient side effect of this combination of different, but closely related topics, this workshop will bring together researchers from different research areas and will help to identify possible synergy effects.

Discussion: Background & Similar Approaches

Many drivers spend a reasonable time each day in their car – for commuting, shopping, and traveling. 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 communication and in which vehicles have to be aware of their surroundings. Adding to this challenge are upcoming systems for (semi-) automated driving as well as the increased prevalence of car-sharing and a higher need for information when using electric cars. The traditional automotive research has mainly focused on a primary task (i.e., driving) and directly related constructs, such as performance and

workload. The secondary tasks have been treated as a concept of distraction. Given the rapidly increasing interests in "pleasant experiences in vehicle" (e.g., [1]) and "autonomous vehicles" nowadays, researchers need to enlarge the scope of automotive research with alternative interaction concepts and interactive systems to enable accomplishing secondary tasks and even tertiary tasks at reduced levels of workload.

Social cars
Vehicles are being connected to and communicating with each other [2] and a driving concept has evolved from an individual task into a collaborative task with an in-vehicle agent [5] or passengers [3]. In this social car context, a large portion of the primary task is being transferred to the in-vehicle system, which allows a driver to have more resources to be allocated to non-driving tasks. Consequently, a way of communication between a driver and a car or a driver/car and other drivers/cars has radically changed. This has brought about a new conceptualization about an ecosystem of the vehicle journey with expanding attention not only to a driver, but also to passengers in a passenger seat and back seat, which yields a number of novel research domains, such as natural user interface, peripheral interaction, and even gamification in the vehicle context.

Natural user interfaces
The introduction of new consumer devices like smart phones, tablets, and game consoles has brought with it new ways of interacting with computers and embedded devices. Within HCI research, "natural user interfaces" (NUIs) [10] have become a fruitful research topic encompassing multi-touch and full body gestures, conversational dialogs and affective systems, among many others. Inspired by the success of technologies like 'Kinect', 'Leap Motion', and 'Siri', the question arises whether such techniques might also be suitable for automotive user interfaces. Gestural and multimodal interfaces are not yet broadly deployed. As they might have the potential to enhance the user experience. and facilitate the execution of secondary or tertiary tasks without increasing driver distraction, the integration of such interfaces is of particular interest (e.g., [7]). Designing experiences with these user interfaces can address and fulfill psychological needs of the user while interacting with the car (e.g., [4]). Moreover, further development of display technologies like glasses-free 3D, high resolution, shaped, or transparent displays offer new ways for visualizing interactive as well as informative content. So far, output technologies are less investigated in terms of natural user interfaces and especially inside the car.

Besides supporting interaction for the driver, suitable infotainment and entertainment functionalities are also of special interest for co-drivers and passengers on the backseat. Also, we must 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?

Peripheral interaction
While the field of NUI searches for interfaces that are more natural and, thus, more easy to use, the upcoming field of peripheral interaction tries to enable users to use technologies in the periphery of their attention. Since peripheral interaction can be designed to get the user's attention on different levels (e.g., by using the toolkit described in [6]), drivers can solve secondary or tertiary tasks without getting distracted from a primary task (in

this case: driving). In a future, where a driver just has to monitor the autonomous vehicle, we may keep a driver informed on the car's status in his/her periphery, while he/she is doing something else.

Workshop Objectives

Beyond the scope of "pure" social interaction, we also want to identify how new interaction techniques can be designed, implemented, and evaluated in the vehicle. Therefore, we want to further continue the fruitful discussions of our previous workshops on "social-inspired mobility services" and "natural user interfaces" and include the closely-related upcoming field of "peripheral interaction" to allow broader discussions on what these fields can learn from each other.

Topics of interest
Potential topics to be discussed at the workshop include, but are not limited to

- What represents a "social car"?
- Social norm in the automotive domain
- Plausible types of information in in-car social services
- Benefit assessment: why should driver-car units disclose their "social status" or "social relationships"?
- Parameters to describing social status of a driver or behavior of a vehicle
- Modeling techniques for handling social interaction behavior, e.g., traffic superorganism, pheromones, stigmergic behavior [8]
- Co-existence of autonomous and manual-driven cars
- Symbiotic systems and bio-inspired technology
- Incentives to support behavior change
- Gamification of automotive user interfaces

- Driving as a "collaboration" with either passengers or an agent [3]
- Privacy, safety, or security issues related to in-vehicle social services (concepts for authentication)
- Cultural differences in in-vehicle social services [5]
- Future of natural user interfaces (NUI) and peripheral interaction (PI) in the car
- Concepts for future multimodal interaction in the car, considering driver, co-driver, backseat area, and the outside
- Discussion of new input and output modalities for the car
- Frameworks and toolkits for designing NUI's and/or PI
- Models, guidelines, and rules: What are physical, legal, etc. restrictions and challenges for NUI's/PI in the car?
- New concepts for in-vehicle user interfaces enhancing UX and experience design in the car
- "Flexible" automotive user interfaces that support the needs for (semi-) automated driving situations

Preservation of workshop results
This workshop should be an opportunity to re-shape the conversation of automobile technology by introducing the community to a new way of thinking: We would like to analyze where and how new interaction techniques can be integrated into the car for both manual and (semi-) automated driving situations. All accepted contributions will be published electronically at the workshop website (e.g., position papers, Powerpoint PDF slides, and additional material). After the workshop, a summary of discussions and workshop results will be posted in a suitable format on the workshop website and/or will be hosted at a dedicated site, (e.g.,

). Depending on the number of submissions and the success of the workshop, it is planned to compile a survey paper about the "Grand Challenges", issues, approaches, etc. discussed at the workshop to communicate the state-of-the-art in social and natural inspired driving to the community (ACM Computing Surveys). As the topics of the workshop have already advanced over the last workshops, a second idea is to also discuss the creation of a book on social, natural, and peripheral interaction for the car. In this case, a call for participation could be set up after the workshop to write and submit chapters for this book. Workshop participants would be encouraged to extend their workshop contribution into separate book chapters. In order to ensure a certain scientific contribution of this book, a suitable review process would be set up.

Organizers Short Bios

Andreas Riener
is an associate professor at the University of Linz's Institute of Pervasive Computing. His research has yielded more than 80 publications across various journals and conference proceedings. His research interests are the recognition of vital bodily functions using embedded sensors, multimodal sensor-actuator systems, embedded intelligence, context-sensitive data processing, and human factors in driver-vehicle interfaces. Riener received a PhD in CS from the Johannes Kepler University Linz. In 2012, Riener coined the term "Social Car" and was founder of the "social-inspired mobility services" workshop series.

Bastian Pfleging
is a researcher at the Institute for Visualization and Interactive Systems at the University of Stuttgart, Germany. His general research interests are multi-modal and natural user interfaces, especially in the automotive

context. He received his Diploma in Computer Science from TU Dortmund, Germany, and was a founder and organizer of the AutoNUI workshop series since it beginning in 2011.

Myounghoon "Philart" Jeon
is an assistant professor in the Departments of Cognitive and Learning Sciences and Computer Science at Michigan Tech. His research areas encompass auditory display, affective computing, assistive technology, aesthetic computing, and automotive interface design. His research has yielded more than 100 publications across various journals and conference proceedings. He received his PhD in Engineering Psychology and Human-Computer Interaction from Georgia Tech. Previously, he worked at LG Electronics as an automotive UI and sound designer.

Ignacio Alvarez
is currently research assistant at the Human-Centered Computing Lab in Clemson University focusing on Automotive User Interaction design and its relation to driver distraction. Furthermore he is project manager in BMW for Connected Drive and Innovations for the Asia Pacific Area, where he directs the development of vehicle telematic functions for driver assistance, security, infotainment and location based services. He obtained his PhD in Computer Science and Artificial Intelligence at University of the Basque Country in Spain in 2012. His dissertation focused on the development of natural vehicle voice interfaces adaptive to the driver distraction level.

Mario Chiesa
is head of the Creativity and Design Innovation Research Unit at Istituto Superiore Mario Boella in Turin, Italy. He holds a Master's degree in Interaction design from Interaction Design Institute Ivrea and a M.Sc. in Electronic Engineering from Politecnico di Torino. His

research interests include NUI's, data visualization and social innovation in several domains, like automotive, cultural heritage, and energy.

Andreas Löcken
is a researcher in the Human Machine Interaction competence center at OFFIS – Institute for information technology in Oldenburg, Germany. He holds a Master's degree in Computer Science from University of Oldenburg, Germany. His research interests include new display modalities and peripheral interaction in the car. In particular, he aims at unobtrusively displaying information to drivers using a light display.

Heiko Müller
is a researcher in the Interactive Systems group at OFFIS – Institute for Information Technology. He has a background in computer science. His research interest lies in conveying information to users with unobtrusive ambient light displays.

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