HCI and Autonomous Vehicles: Contextual Experience Informs Design

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Abstract

The interaction between drivers and their cars will change significantly with the introduction of autonomous vehicles. The driver's role will shift towards a supervisory control of their autonomous vehicle. The eventual relief from the driving task enables a complete new area of research and practice in human-computer interaction and interaction design. In this one-day workshop, participants will explore the opportunities the design space of autonomous driving will bring to HCI researchers and designers. On the day before workshop participants are invited to visit (together with workshop organizers) Google Partnerplex and Stanford University. At Google participants will have the opportunity to explore Google's autonomous car simulator and might have the chance to experience one of the Google Cars (if available). At Stanford participants are invited to ride in a Wizard-of-Oz autonomous vehicle. Based on this first-hand experience we will discuss design approaches and prototype interaction systems during the next day's workshop. The outcome of this workshop will be a set of concepts, interaction sketches, and low-fidelity paper prototypes that address constraints and potentials of driving in an autonomous car.

Author Keywords

Autonomous vehicles; automated driving; user experience; human-machine interaction.

ACM Classification Keywords

H.5.2. Information interfaces and presentation (e.g., HCI): User Interfaces

Background

Autonomous vehicles have shaped public debates over the last years and it seems that it is only a matter of time until fully autonomous vehicles appear on our roads[1]. Google's driverless car is one of the best-known examples of autonomous vehicles at the moment [14]. Such fully autonomous vehicles are expected to change human mobility behavior tremendously with significant consequences regarding the interactions between drivers, their cars, and other road users.

Automated driving technology promises not only an increase in road safety but also a relief from driving stress that will fundamentally change the transportation experience in many ways. So far, the majority of HCI research has been focused on the transition to autonomous driving, looking at safety, trust, and handover situations [e.g., 11]. However, there is very little research on the everyday experience of autonomous driving, resulting from the lack of availability of autonomous cars. Despite the fact that many new autonomous vehicles, both concepts and prototypes, have been presented over the last years, a remarkable little number of people (including HCI researchers) have had the chance of actually ride in an autonomous vehicle. To compensate for the lack of vehicles for experience related studies, researchers

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[1] See for instance http://www.continental-corporation.com/www/pressportal_com_en/general/ov_automated_driving_en/automated-driving-intro-en.html, last access 2015-10-09

have to draw on Wizard-of-Oz approaches or lab-based driving simulators [1].

Studies on advanced driver assistance systems show that the transfer of the driving task can be experienced as a loss of control and competency as well as a feeling of being at the mercy of technology [2]. On the other hand, the relief from the driving task provides a unique opportunity for new types of non-driving-related activities [10] during the piloted journey, amongst them new forms of in-situ entertainment, productivity, and games grounded in the contextual specificity of the automotive, mobile situation [3, 13].

With this workshop we will give participants the opportunity to investigate autonomous driving from an experienced-focused perspective. We encourage participants to attend our excursion to Google's autonomous car research facility and Stanford University one day before the workshop. This excursion will be voluntary for participants but is highly encouraged. Participants will have the opportunity to visit together with the workshop organizers Google Partnerplex to experience Google's autonomous car simulator and might have the chance to experience one of Google's autonomous cars. At Stanford University we plan to let participants ride in their Wizard-of-Oz autonomous vehicle.

The actual workshop on the next day will focus on an exploration of the design space of autonomous vehicles from a experience-based perspective. The outcome of this workshop will be a set of concepts, interaction sketches, and low-fidelity paper prototypes that address constraints and potentials of driving in an autonomous car.

Motivation

This workshop is based on the success of last years CHI workshop with the title "Experiencing Autonomous Vehicles: Crossing the Boundaries between a Drive and a Ride" [6]. At this workshop we have discussed how user experience is affected by driving in automated vehicles. We also have learned that many HCI researchers and practitioners in this area are still missing the experience of autonomous driving. This workshop tackles this issue by allowing workshop participants to explore Google's research facility first-hand and to ride in Stanford's Wizard-of-Oz autonomous vehicle and then share their experience with researchers and designers during a dedicated prototyping session on the following day.

Informed by this experience workshop participants are encouraged to explore the design space of an autonomous vehicle from an HCI research or interaction design perspective and translate their findings into a creative practice. For instance, relieving the driver from the main driving task can provide the possibility to imagine new interaction approaches in this context beyond the current paradigm of driver-car interaction. This design and prototyping session will be facilitated by a variety of ideation technics such as 6-3-5 Brainwriting, PLEX and/or V-N-A cards [4] that will be provided and moderated by the workshop organizers.

Workshop goals
- Understanding what it actually means to drive in an autonomous vehicle
- Discussing potentials of a shift from a 'joy of driving' to a 'joy of being driven'

- Exploration of new forms of connectivity, entertainment, productivity, gaming as well as transportation-related services
- Envisioning novel driver and passenger interaction potentials with autonomous vehicles including handover situations between drivers and automated cars
- Discuss the design space that autonomous vehicles provide for HCI research and practice
- Exploration of user experience factors relevant for autonomous driving such as acceptance, trust and driving fun
- Sketching and building (paper) prototypes of novel user interaction approaches including natural and gaze interaction, subliminal information, and brain computer interfaces
- Exploring application potentials (e.g., entertainment systems and games) for drivers and passengers in autonomous cars, as well as gameful and playful design approaches

Participation
The workshop is intended for HCI researchers and practitioners (e.g., designers and developers), who have developed and/or applied approaches and tools for (semi-) autonomous vehicles or a background in (public) transportation, to bring their experiences in the workshop.

Workshop candidates are invited to submit an application (2 pages in the CHI extended abstract format submitted via email to alexander.meschtscherjakov@sbg.ac.at) in which they provide personal information, their experience with autonomous vehicle research, their abilities in experience and/or interaction design, as well as, a

motivation statement why they want to participate in the workshop.

Organizers

The workshop will be organized by a group of researchers and practitioners who have been involved in the field of HCI, User Experience (UX), Autonomous Driving, and Human-Robot-Interaction over the last years. Starting in 2013 many of the organizers have been involved in the organization of a series of workshops on user experience in autonomous driving at the International Conference on Automotive User Interfaces and Interactive Vehicular Applications [7, 8, 16]. In 2015 they organized a one-day CHI workshop on "Experiencing Autonomous Vehicles: Crossing the Boundaries between a Drive and a Ride" [6].

Alexander Meschtscherjakov
Alexander will be the main contact person for the workshop. He is an Assistant Professor at the Center for HCI at the Computer Sciences Department of the University of Salzburg. In his research he deals with automotive user interface design as well as user experience with autonomous vehicles ([12] and "deskilling" issues [5]. He was co-chair of various conferences (e.g., AUI2011) and organizer of different workshops (AUI'13-15, MobileHCI'13, ACE'13, CHI'15).

Manfred Tscheligi
Manfred is professor for HCI & Usability at the University of Salzburg and is heading the Business Unit Technology Experience at AIT. He brings in expertise for experience innovation projects and in particular interface creativity activities within these projects ("Experience Innovation Lab") for a variety of application domains. He is very much involved in

driving experience activities (e.g. als an national initiative on Car Interaction Safety)and has been shaping the discussion on autonomous driving and human robot-interaction [15]. He has been involved in several conferences (e.g., co-chairing CHI'04, ACE'07 and AUI'11) and co-organizing workshops and SIGs (e.g., CHI'15, AUI'14, AUI'15, and Interact'15). He will be also Conference Co-Chair for HRI 2017.

Dalila Szostak
Dali designs future experiences in transportation, services and platforms. Her work involves uncovering that which we need, want and love and incorporating those findings as requirements She specializes in international research and has conducted workshops and published her work in a wide range of academic and industrial gatherings globally. To uncover the user experience of airplanes, cars and traveling, she has collaborated and partnered with companies such as TomTom, Boeing, Intel, Toyota and Ford. She holds a doctorate degree in User System Interaction from the Technical University of Eindhoven.

Sven Krome
Sven is researcher at Royal Melbourne Institute of Technology. In collaboration with Audi Electronic Ventures and the Games and Experimental Entertainment Laboratory (GEElab) he is re-thinking autonomous driving from an experience designer's perspective.

Rabindra (Robby) Ratan
Robby is an Assistant Professor and AT&T Scholar at Michigan State University's Department of Media and Information. He studies the psychological experience and effects of media use, with an emphasis on

Time	Schedule
	Individual arrival at Google Partnerplex
09:00 – 12:00	Visit Google's autonomous driving simulator at Google Partnerplex
12:00 – 13:00	Lunch at Google
13:00 – 14:00	Individual / joint transfer to Stanford University
14:00 – 17:00	Riding Sessions with Stanford's Wizard-of-Oz autonomous vehicle
17:00	Joint dinner near Stanford University
	Individual departure

Table 1. Tentative pre-workshop program

interactive mediated environments (e.g., the road, video games, virtual worlds) that include mediated self-representations (e.g., automobiles, avatars, agents).

Bastian Pfleging
Bastian is researcher at the University of Munich (LMU), Germany. Previously, he was researcher at the University of Stuttgart and the BMW Technology Office in California. His special research interests are automotive user interfaces, now with a focus on non-driving-related activities and the transition towards automated driving. He was involved in co-organizing various workshops (e.g., AutoNUI, [9]) and conferences in this domain (e.g., Work-in-Progress co-chair at AutomotiveUI '15, PC member of AutomotiveUI since 2012). He has a Master's degree (Diplom) from TU Dortmund, Germany.

Ioannis Politis
Ioannis completed his Professional Doctorate in Engineering (P.D.Eng.) on HCI in Eindhoven. He continued as a Usability Engineer for Philips Healthcare, performing interaction design and conducting usability tests for one of the company's latest medical platforms. Since October 2012 he is a PhD student at Glasgow Multimodal Interaction Group, co-funded by Freescale Semiconductor, investigating the utility of multimodal displays to alert drivers.

Sonia Baltodano
Sonia is a PhD student at Stanford University's Center for Design Research. Her research focuses on the role of emotions in cars. She has a MS in Mechanical Engineering from Stanford and a BA from RISD.

David Miller
Dave is a doctoral candidate in the Department of Communication, and the 2015 Coleman F. Fung Interdisciplinary Graduate Scholar. He works jointly with the Center for Design Research, investigatiing the design of agentic systems. His research has included work on mental mode switching, technological persuasion, mental models of automated systems, and trust in automation.

Wendy Ju
Wendy is the Executive Director of Interaction Design Research at the Center for Design Research at Stanford University, and Associate Professor at California College of the Arts in San Francisco. Her research focuses on the design of interactive devices, particularly human-robot interactions and autonomous vehicle interfaces (e.g., [15]).

Website

The workshop website is available at https://hci.sbg.ac.at/chi2016_autonomous_vehicles. It contains the call for participation including dates and author instructions. We will provide background information on the topic, actual links to interesting news on HCI and autonomous vehicles, as well as, the background of each organizer. Furthermore, a detailed schedule of the workshop and requirements for participants will be provided. Additionally, accepted position papers will be available for download on the dedicated website.

Pre-Workshop Plans

The call for participation will be distributed via HCI-, UX- and AutomotiveUI-related mailing lists (e.g., chi-announcements). We will further use our own

Time	Day 2
09:00 – 09:15	Welcome and introduction to workshop goals
09:15-10:00	Pecha-Kucha like 2 minutes presentations
10:00-10:15	Group building (5 groups with 4 participants + 1 to 2 organizers per group)
10:15 – 11:00	Ideation phase
11:00 – 11:15	Coffee break
11:15 – 12:30	Sketching/prototyping phase I
12:30 – 13:30	Lunch
13:30 – 15:00	Sketching/prototyping phase II
15:00 – 15:30	Coffee break
15:30 – 16:45	Presentations of the concepts/prototypes created: 15 min. for each group
16:45 – 17:00	Wrap-up

Table 2. Proposed schedule day 2

distribution lists (based on a variety of workshops and conferences we have held over the last decade). A website will be created in order to provide information about the workshop, the submission modality, and links to related material, so candidates can get familiar with the scope of the subject and the goals of the workshop. Accepted applications and other pre-workshop materials will be made available to all participants.

In a voluntary pre-workshop program (see Table 1) participants will have the opportunity to gain insight into Google's autonomous car research facility. Participants and organizer will have the possibility to explore Google's autonomous driving lab and maybe ride in the Google Car (if available). After a joint lunch we will move on to Stanford University, where we will have the possibility to ride in Stanford's Wizard-of-Oz autonomous car. Thereafter we will have a joint dinner.

Workshop Structure
This will be a one-day workshop consisting of approx. 20 participants and the organizers. There will be no traditional paper presentations; instead we will focus on ideation and prototyping activities.

On the optional day prior to the workshop, we will provide immersive and inspirational opportunities for the participants. This will be an "optional" day, but highly encouraged. The activities will include visiting the Google Autonomous Vehicle research facility and a ride in Stanford's Wizard-of-Oz autonomous car. Participants will have the opportunity to interact with experts in the fields, and the workshop organizers will provide input into different areas that will be discussed during the official workshop day.

Participants will be welcomed at the conference venue and introduced into workshop goals. Each participant will be asked for a short introduction on his/her background and experience in autonomous driving research in form of a Pecha-Kucha style two minutes presentation (www.pechakucha.org).

The workshop (see Table 2) will be devoted to group sessions in which the participants are invited to explore and sketch novel and unique interaction and design concepts inspired by the contextual experience from the pre-workshop program. Participants will explore the design space in team-work sessions by envisioning and creating interface concepts, interaction designs, and low-fidelity paper prototypes, which leverage the design specificities of autonomous driving.

The organizers will provide prototyping material. In the afternoon each group will present their sketches and low-fidelity paper prototypes.

Post-Workshop Plans
The workshop results will be communicated to a larger audience. We plan to produce a report for publication in ACM Interactions and prepare a special issue in a selected journal (e.g., Interactions) following the conference. Workshop results will be made available through the workshop website, which will be kept up-to-date also after the workshop in order to provide an interactive platform for research on user experience and autonomous vehicles in HCI.

Call for Participation
"HCI and Autonomous Vehicles: Contextual Experience Informs Design" is a one-day workshop at CHI 2016 in San Jose. In a pre-workshop program participants will

have the possibility to experience Google's autonomous car lab at Google Partnerplex and ride with Stanford's Wizard-of-Oz autonomous vehicle. This contextual experience should inform participants how it feels to drive an autonomous vehicle and inspire the design of novel interaction at the workshop. Participants will explore the design space in team-work sessions by envisioning and creating interface concepts, interaction designs, and low-fidelity paper prototypes, which exploit the potentials of riding in an autonomous vehicle.

Workshop candidates are invited to submit an application (2 pages in the CHI extended abstract format submitted via email to alexander.meschtscherjakov@sbg.ac.at) in which they provide personal information, their experience with autonomous vehicle research, their abilities in experience and/or interaction design, as well as, a motivation statement why they want to participate in the workshop.

The workshop is restricted to approx. 20 participants. Applications will be selected by workshop chairs, who will evaluate submissions based on the applicants diversity and design/prototyping capabilities. We aspire to compose a diverse group of different backgrounds and complementary skills.

The author of an accepted application must attend the workshop and register for both the workshop and for at least one day of the conference.

Deadlines
- Workshop participation application deadline: January 13, 2016
- Feedback to applicants: February 12, 2016
- Workshop at CHI2016: May 7-8, 2016

More Information:
https://hci.sbg.ac.at/chi2016_autonomous_vehicles

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