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# Experiencing Autonomous Vehicles: Crossing the Boundaries between a Drive and a Ride

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**Abstract**

Autonomous vehicles have gained attention recently since research organizations and companies have presented (semi-) autonomous vehicles driving in public traffic. This workshop covers the crossover between driving/riding in (semi-) autonomous vehicles and user experience (UX) research. The focus lies in an in-depth discussion on challenges and potentials for UX in autonomous vehicles. We will explore various areas such as, user experience factors, interaction design issues, entertainment potentials, social driving, and methodological issues. Additionally, we envision building a bridge between the automotive community and the human-robot-interaction community, since we believe autonomous vehicles can be regarded as a very specific kind of a robot. The overall aim of the workshop is to discuss the future landscape for research within and across each of these areas.

**Author Keywords**

Autonomous Vehicles; Human-Autonomy-Interaction; User Experience Design and Research.

**ACM Classification Keywords**

H.1.2 [User/Machine Systems]: Human Factors, Human Information Processing.

### Motivation

It is widely predicted that automated driving will become more widespread in the near future [1]; with numerous research organizations and major companies developing prototypes [7]. Perhaps the most famous is Google's driverless car [8], which has gained public attention recently. Also the human-robots-interaction community has investigated autonomous cars as autonomous robots<sup>1</sup>.

This workshop draws on the success of two prior workshops hosted at the domain specific Automotive UI conference [9][4]. Based on the results of previous workshops we are motivated to discuss the issues raised and the recent developments with the broader and more diverse audience of CHI community. In order to gain expertise beyond the automotive domain we like to address issues such as level of automation [5], visualization of uncertainty in autonomous cars [2], automated vehicles in the wild, the transition phase from manually driven cars to autonomous vehicles [3], and driving fun and entertainment in future cars.

### Introduction

For many people Advance Driver Assistance Systems (ADAS) are the first encounter of autonomous technology in the car. ADAS enable a delegation of an elementary driving task to the car such as Adaptive Cruise Control (ACC) an adaptive speed control technology. Although there is rigorous research investigating safety and behavioral effects of ADAS [11], there are only a few studies that explicitly investigated the effects of ADAS on the driving experience [6][10].

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<sup>1</sup><http://humanrobotinteraction.org/2014/program/panel-session/>

Experience related research on ADAS discovered severe issues regarding the personal feel and the expectation of these new technologies. For instance, in an experience-based investigation of ACC, the drivers reported a feeling of losing control as well as reduced autonomy and competence [10]. Another recent study identified a continuous decrease of perceived control and fun, the higher the autonomy level of the technology [6]. In other words autonomous technology is not always perceived as a major benefit in a car as it can be viewed by drivers as being related to a reduction in their driving competency. In turn this can negatively change their perception and experience of a trip.

For good reasons automotive interaction and interface design has been focusing primarily on improving the driving task performance and reducing safety concerns. However, this driver-centric and technology-driven approach has left lots of potential areas unexplored. For example, relieving the driver from the driving task can open up in-car experiences to move beyond the current paradigm of driver-car interaction. This shift from a 'joy of driving' to a 'joy while driving' may be facilitated by an exploration of new forms of connectivity, entertainment, gaming as well as transportation related services.

Beyond research a plethora of new services and devices tailored for the driver or the passenger have become available such as *VW SmartDrive* or traffic related applications such as *Waze* or projects such as *I-GEAR* [12]. The integration of these services in the context of the driver's increased interactivity require to radically re-think the way we conceive the in-car experience.

The aforementioned transformation process, from driving a car to the passive role of supervising a car, provides the central angle of the workshop's discussion. In the following section we outline corresponding design challenges and relate them to levels of automation.

### **Design Challenge**

Researchers and car manufacturers predict the introduction of autonomous cars as a progressive process. In an effort to clarify automotive automation technology the National Highway Traffic Safety Administration (NHTSA) defines the following levels: (0) No automation, (1) Function Specific Automation (2) Combined Function Automation (3) Limited Self-Driving Automation and (4) Full Self-Driving Automation. Each level refers to an increasing degree of automation and corresponds to a distinct driving experience, varied degrees of interactive freedom and with it a set of new challenges in terms of supporting automated driving. Whereas lower levels (1-2) require strict supervisory control by the driver; higher levels provide the potential for new immersive interactions and advanced services.

It is important to note that design challenges for each level of automation are not limited by the technical and safety constraints set by governing bodies or the car manufacturers. In order to compensate for the feeling of loss of control and autonomy, the decreasing workload of the driver provides an opportunity for new forms of entertainment and games grounded in the contextual specificity of the driving situation [13].

Indeed, for entertainment as well as for the ADAS driving, the "superpower" of automation technology

needs to be reflected in the experience of the driving situation. This requires an exploration of novel interface techniques as well as an understanding of the contextual and social nature of the driving situation.

### **The Workshop**

The workshop will collect radical, innovative, versatile and engaging works that challenge or re-imagine human interactions in future automated driving scenarios. It seeks to challenge existing thinking by exploring what is possible now and by the time the autonomous vehicle becomes a standard on our roads. Participants will be encouraged to suggest alternative concepts whether low fidelity, high fidelity, or both. Especially encouraged will be works that are experiential and can be demonstrated hands on. The workshop is an opportunity to re-shape the conversation of automobile technology by introducing the community to a new way of thinking.

### **Objectives**

The workshop's main focus is on user experience research and (semi-) autonomous vehicles. Topic areas of potential interest (not exhaustive) include:

- Driver and passenger interaction with (semi-) autonomous vehicles including handover situations
- User experience factors relevant for autonomous driving (e.g., acceptance, trust and driving fun)
- Novel user interfaces including natural and gaze interaction, subliminal information, and brain computer interfaces
- Experience studies and evaluation methods for autonomous driving
- Entertainment and games in autonomous cars, as well as gameful and playful design approaches

- Ethical issues of autonomous driving

### Conclusion

With autonomous cars on the horizon, the transformation process from a 'joy of driving' to a 'joy while driving' will become the salient challenge in designing the future automotive user experience. In order to enable a fulfilling user experience of all four levels of car automation, it is the responsibility of automotive interaction designers and user researchers to propagate the new degrees of interactive freedom. This would compensate for the loss of operational control, driving competence and the decreased feeling of autonomy, presenting compelling and engaging designs and interaction systems.

This workshop invites a diverse audience of designers and researchers from any background to discuss the potentials and constraints of future driving experience from a multi-disciplinary perspective. Furthermore, the goal is to explore the possibilities of this growing research area by ideating design concepts and prototyping solutions tailored for a specific automation level and its corresponding design space.

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