
Autonomous Vehicles: Human-Robot Interactions with Place

Henriette Cramer

Yahoo

Sunnyvale, CA, USA

henriette@yahoo-inc.com

henriettecramer.com

Abstract(ed Introduction)

Trust in autonomous vehicles is crucial to their adoption by their 'drivers', passengers, other road users and the various legal systems around the world. Autonomous vehicles combine mayor research themes: interaction with autonomous vehicles as a specific case of *human-robot interaction*, the potential of autonomous vehicles to lead to new types of *location-based interactions* while (not) driving, and the *ecosystem* surrounding autonomous vehicles and their potential macro influence on cities and their social & physical infrastructure. I here outline my related experiences from human-robot and mobile interaction.

Author Keywords

Cars; robots; mobile; urban surroundings; ecosystems

Autonomous things & transportation

Autonomous vehicles highlight the importance of people's trust in embodied autonomous systems – as well as the need for considering the whole ecosystem that surrounds these interactions: passengers, road users, services, societal, physical, communication and energy infrastructure, etc. Transport has appeared in the sidelines of my work on both autonomous agents/robots and mobile, location-based services, and for me personally highlighted specific questions on the future of autonomous vehicle interactions:

Driving contexts & attitudes. In a video-based study [2] we saw the interaction between autonomy of an assistive in-car agent (providing information vs. explicit instructions to take action), individual traits and context (high, low density traffic): attitudes were most positive towards instructive agents in light traffic. Dislike of driving and driver aggression increased the traffic situation's perceived urgency. Even though the study by now appears outdated, it still highlights situational and individual adaptation needs, as well as their interplay with contextual factors. The qualities that are most enjoyed about actual driving and iconic experiences such as road trips, rather than transportation from A-to-B, have to be preserved.

Driving cultures & body language Interaction with adaptive systems is a feedback loop; a system reacts to humans, who adjust their behavior based on their perceptions of the system, to which the system reacts and learns. In addition, the 'body language' of a robot affects other people than only its primary user [6]. Communicating intent without a driver to look in the eyes can be a challenge. Both concepts were illustrated by the recent story of the dance between a confused autonomous Google car and a cyclist doing a track-stand¹. This begs the question how driving cultures and traffic contexts in different locales will affect acceptance of autonomous vehicles – and whether they in turn will homogenize these cultures. Different locales have different 'acceptable' driving practices, local safety efforts and physical barriers. It is unclear whether one 'autonomous' culture will arise, or that localization and local players will prevail. Perhaps it is likely that

¹washingtonpost.com/news/innovations/wp/2015/08/26/how-fixed-gear-bikes-can-confuse-googles-self-driving-cars/

different usage cultures will still occur – one local service can still result in different social norms in different user groups [3]. However, cars have to adjust to local circumstances, and local circumstances will likely change as well.

Role: service, robot, room or entertainment. In 2014, I was a 'local expert' for a workshop on the 'future of the connected car' by CCA (SF) and Audi. Most interesting was the role that the students' design concepts assigned to future cars, ranging from a robotic 'pet' to build a relationship with; a movable room or temporary dwelling; to an entertainment-during-transport capsule. Industries have to shift from designing transport artifacts to designing transportation services; from vehicle ownership to transportation networks instead.

Transportation modes & (mobile) service usage. In [1] we found that usage of different modes of transport was correlated with differences in services usage and city knowledge. New services will compete for people's time spent non-driving, and will allow for development of in-car experiences that increase attention to other aspects of the local environment than while driving. This could allow for more enjoyable rides and discovery of pleasant surroundings close to home [1,3] - or will perhaps rather fully isolate from it in a virtual entertainment capsule.

Physical infrastructure & city environment. Cars and their infrastructure do not necessarily have aesthetically pleasing effects on cities [5]. Transport as a service rather than vehicle ownership, may have positive effects, but also highlights that owning vehicle-

and energy- infrastructure brings a certain power – in both interpretations.

Public transport, drivers & human meetings.

Autonomous vehicles can be part of public transportation networks, or privately controlled. Support will be necessary to facilitate transitions between private vs. public networks. On a micro-level, if networks turn out mostly private and individual, this could mean less meetings with (familiar) strangers, fellow riders and of course drivers. Perhaps ride-sharing services like Lyft Line or Uber Pool actually encourage such meetings and conversations in simply different ways, but fully private autonomous vehicles would lose out on certain human serendipity. The question remains however whether all socio-economic strata are actually 'meeting', and how to best serve a wide variety of groups by future transportation networks. Similarly, while autonomous cars can provide independence for those not currently served by existing transportation options, there is also a potential loss of independence that disappearing old-style vehicle ownership may bring.

Gartner has put autonomous vehicles at peak hype², illustrating both the excitement, but also the looming challenges ahead. I look forward to a great discussion.

References

1. F. Bentley, H. Cramer, S. Basapur, W. Hamilton (2012) Drawing the city: Differing perceptions of the urban environment. Proc. CHI'12.
2. H. Cramer, V. Evers, N. Kemper, B. Wielinga (2008) Effects of Autonomy, Traffic Conditions and

² <http://www.gartner.com/newsroom/id/3114217>

Driver Personality Traits on Attitudes and Trust towards In-Vehicle Agents, HAI'08 at WI-IAT'08.

3. Cramer, H. Rost, M., Holmquist, L.E. (2011) Performing a Check-in: Emerging Practices, Norms and 'Conflicts' in Location-Sharing. Proc. MobileHCI'11
4. H. Cramer (2013), Understanding 'there' on a human scale, GeoHCI'13.
5. D. Quercia, H. Cramer, N. O'Hare (2014) Aesthetic Capital: What Makes London Look Beautiful, Quiet, and Happy. CSCW'14
6. S. Ljungblad, J. Kotrbova, M. Jacobsson, H. Cramer, K. Niechwiadowicz (2012) Hospital robot at work: Something alien or an intelligent colleague? CSCW'12.

Bio

I'm a research scientist at Yahoo in Sunnyvale, California. My data & design research revolves around people's interaction with systems that learn and adapt to behavior, and the resulting data feedback loop. Throughout my research, this has involved human-robot interaction, mobile location-based interactions focused on perceptions of cities and places, and the ecosystem of different 'users' in both research and product settings.

Prior to Yahoo, I was a researcher at the Mobile Life Centre in Stockholm, where I led projects on human-robot, and mobile interaction. My PhD from the University of Amsterdam focuses on people's interaction with autonomous and adaptive systems, and the effects of user control and social expectations. This spring, I instruct a studio on 'autonomous things' within Stanford's HCI design course.