

Benefiting from Automation: Trust and Senior Mobility

Bruce Mehler
MIT AgeLab

**Senior Mobility Awareness
Symposium**

Blacksburg, Virginia
December 6, 2012

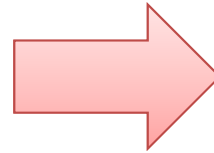
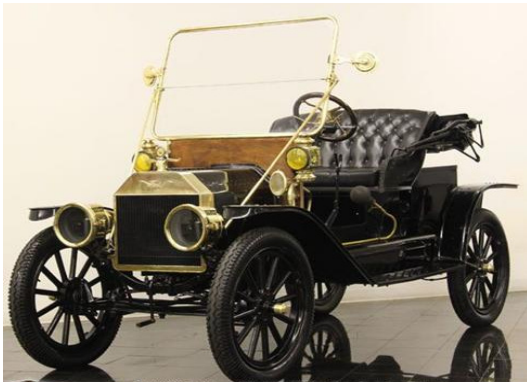


Simplified Outline for this Talk

- Advanced technologies going into today's and tomorrow's cars offer both the promise of increased mobility and present a potential barrier as well
- Some illustrative examples
- How can we contribute to seeing the promise realized?



The Consistent Vehicle Interface



For most of the past 100 or so years, while the outward appearance of vehicles changed, the basic control functions of the driver interface remained relatively the same.



The Changing Vehicle Interface

Until relatively recently, most new technologies clearly benefited the older driver:

- Automatic transmission
- Power steering
- Power brakes



What is all this? Where is the key?

Do I feel assisted or
overwhelmed?

Mental Models

(or teaching “old dogs” new tricks)



Challenge – Novel user interface presents overwhelming complexity to consumers in the US, particularly older drivers

Why?

- Resistance to change or need a reason for change?
- Mental Model (a mouse?)
- Concern over making a mistake

Solution?

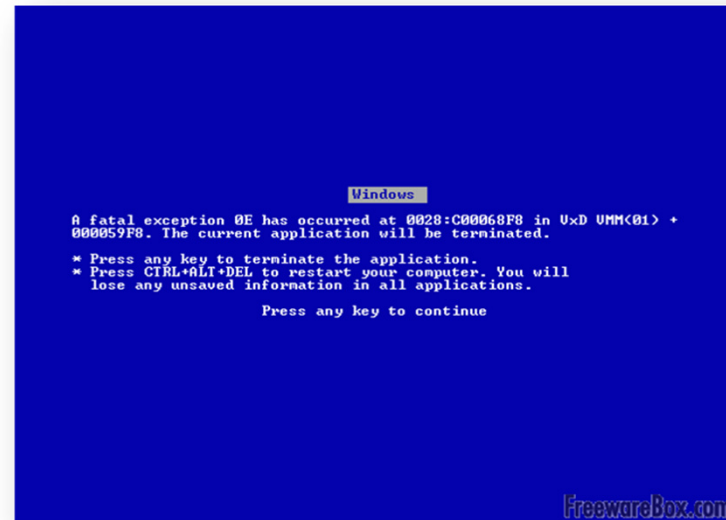
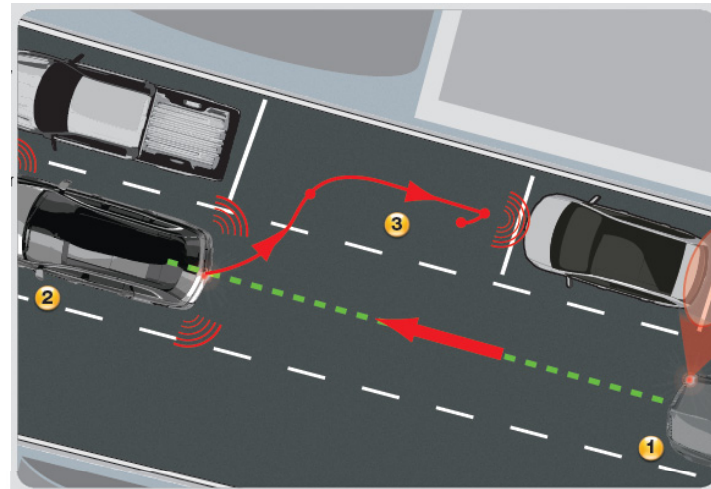
© 2012 MIT AgeLab

Advanced Driver Assistance Systems

- High speed travel
 - Adaptive cruise control
 - Forward collision warning
 - Blind spot detection
 - Lane departure warning
 - Vehicle stability control
 - Anti-Lock braking systems
- Low speed maneuvering
 - Backup cameras
 - Forward and reverse sensing
 - **Cross traffic warning**
 - **Parallel parking assistance**



Active Park Assist

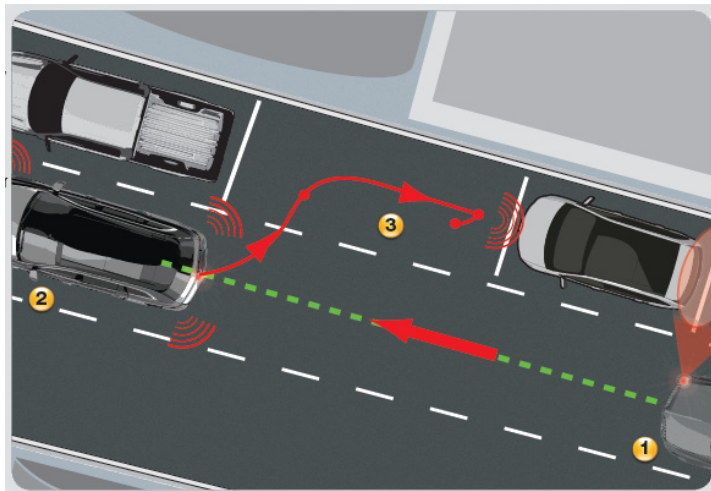


Proper training?

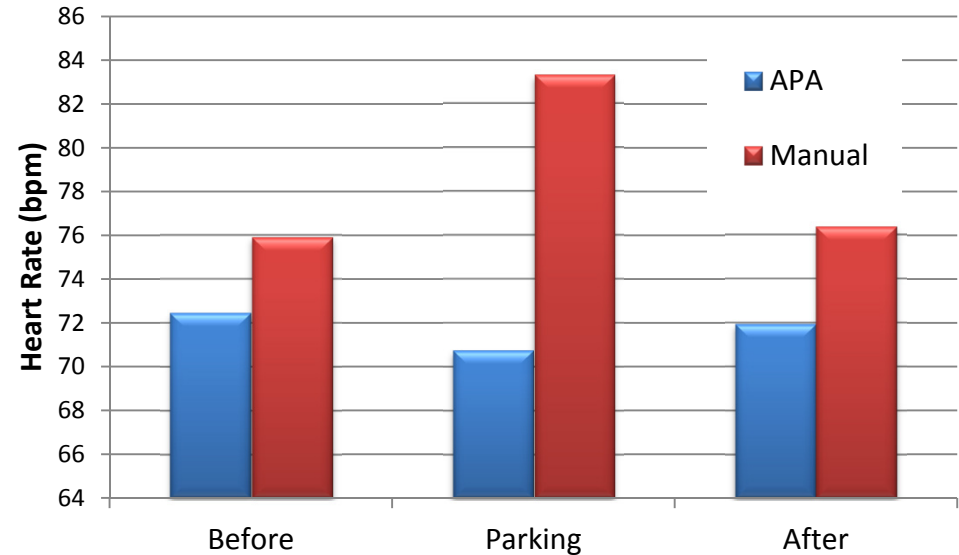
Trust?

Mental model?

Outcome after Hands-on Training



(Reimer, Mehler & Coughlin, 2010)



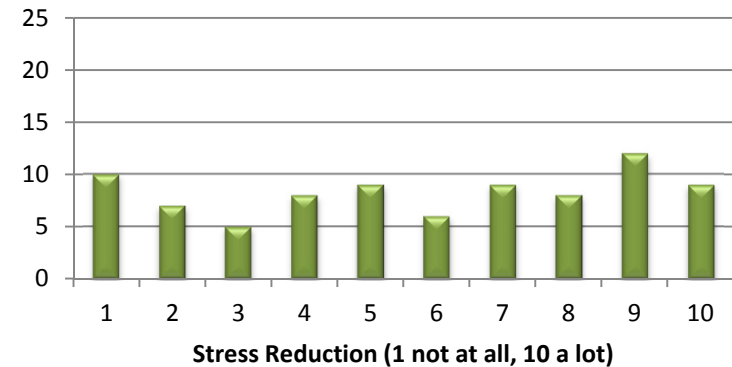
- Heart rate (HR) when using APA was more than 12 BPM lower than during manual parking
- HR 3.4 BPM lower using APA in anticipation of parking
- HR more sensitive statistically than self-reported stress levels

Participants Expectations of Technology

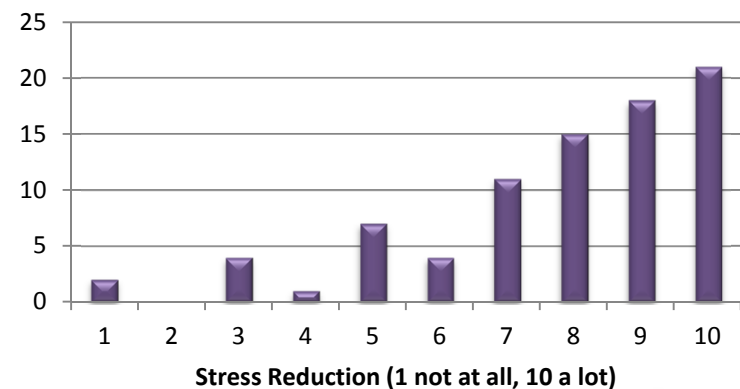
Prior to experiencing the technologies, expectations were relatively modest that the system would reduce stress on a “not likely” to “very likely” (1-10) scale, mean = 5.75. After:

- Made it easier to park: 76.2%
- Would reduce my stress level about parking: 71.4%
- Would you recommend for a family member? 8.1 (1-10)
- Would you be likely to use this technology? Before= 5.7 After=7.5

System that Automated Parallel Parking Would Reduce Stress



System to Notify You of Approaching Vehicles While Backing Up Would Reduce Stress



AgeLab Observations

- The assistive technology worked remarkably well when drivers were given appropriate training
- Additional testing suggested that the tech would allow many drivers to park in spaces they would not have considered trying otherwise – extending mobility options
- Results of field trip to dealers...



Education



“One of the myths about the impact of automation on human performance is as investment in automation increases, less investment is needed in human expertise”

(David Woods as quoted by Robert Sumwalt, 2012)

- Seniors or family members have to know that a technology exists and can be helpful to consider it
- Results of iDrive, park assist, and recent voice-command interface study all show that “older” drivers can master technology comparable to younger drivers if given hands-on instruction
- Doing it successfully yourself leads to a willingness to trust

Some Cautions

- Need to be aware of what systems can and cannot do – when they will and won't work
- Limitations of particular designs (blind spot warning)
- Unintended consequences (turn signal usage)
- Situational awareness & autonomous systems



Highly autonomous vehicles - In many situations automation will outperform human operation, but is it realistic to expect that the driver still assumes ultimate responsibility?

Takeaway Messages

- New technologies are emerging that can assist seniors to drive safer, longer
- Older drivers can learn to use & trust new technologies
- The challenge is to arm the older driver with information on what systems are out there and encourage the development of easy to use training tools / programs
 - Where practical, built-in, hands-on tutorials
 - AARP, AAA, dealers, local support programs, etc.
- Everybody wins – seniors, drivers of all ages, manufacturers, dealers, society

Research Cited

Coughlin, J.F., Reimer, B., & Mehler, B. (2011). Monitoring, managing, and motivating driver safety and wellbeing. *IEEE Pervasive Computing*, 10(3), 14-21.

Reimer, B., Mehler, B., & Coughlin, J.F. (2010). *An evaluation of driver reactions to new vehicle parking assist technologies developed to reduce driver stress*. Technical Report, New England University Transportation Center at MIT, Cambridge, MA. (Available for download on AgeLab website.)

Reimer, B., Mehler, B., & Coughlin, J.F. (2012). Using self-report and heart rate measures to assess stress reduction from a semi-automated parallel parking system. Manuscript under review.

Reimer, B., Niedermaier, B., Bengler, K., Mehler, B., & Coughlin, J.F. (2010). A methodology for evaluating multiple aspects of learnability: Testing an early prototype of the new BMW iDrive. *Proceedings of the 3rd International Conference on Applied Human Factors and Ergonomics*, July 17-20, 2010, Miami, Florida.

Roberts, S., Mehler, B., Orszulak, J., Reimer, B., Coughlin, J.F., & Glass, J. (2011). An evaluation of age, gender and technology experience in user performance and impressions of a multimodal human-machine interface. *Proceedings of the 2011 Industrial Engineering Research Conference*, May 21-25, 2011, Reno, Nevada. (Available for download on AgeLab website.)

MIT AgeLab: Imagining Life Tomorrow

For general information: [agelab.web.mit](http://agelab.web.mit.edu)

On topics in this presentation:

Bruce Mehler – bmehler@mit.edu

