



HAL

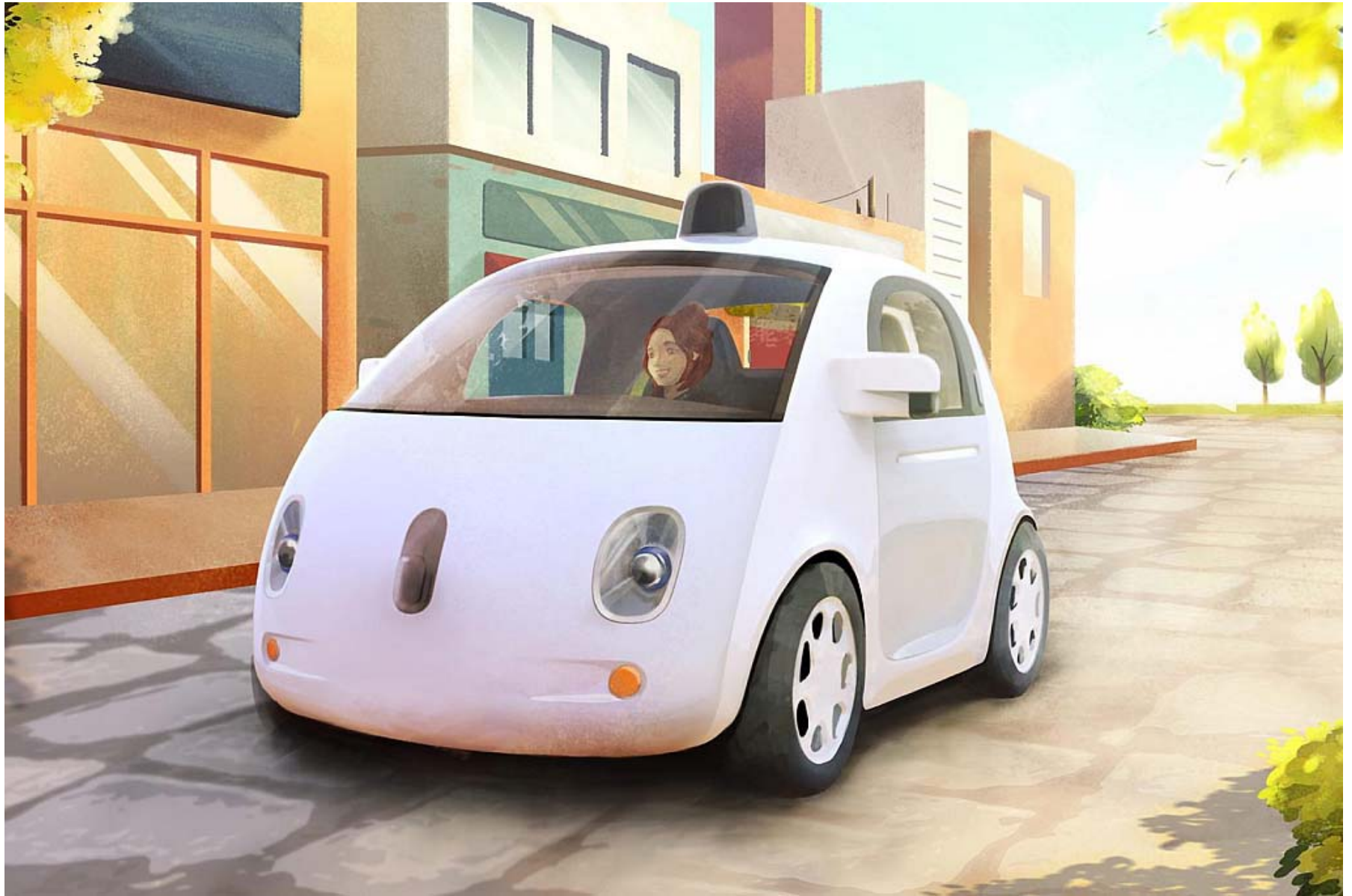
Did It See Me?

Display Design for Autonomous Vehicles

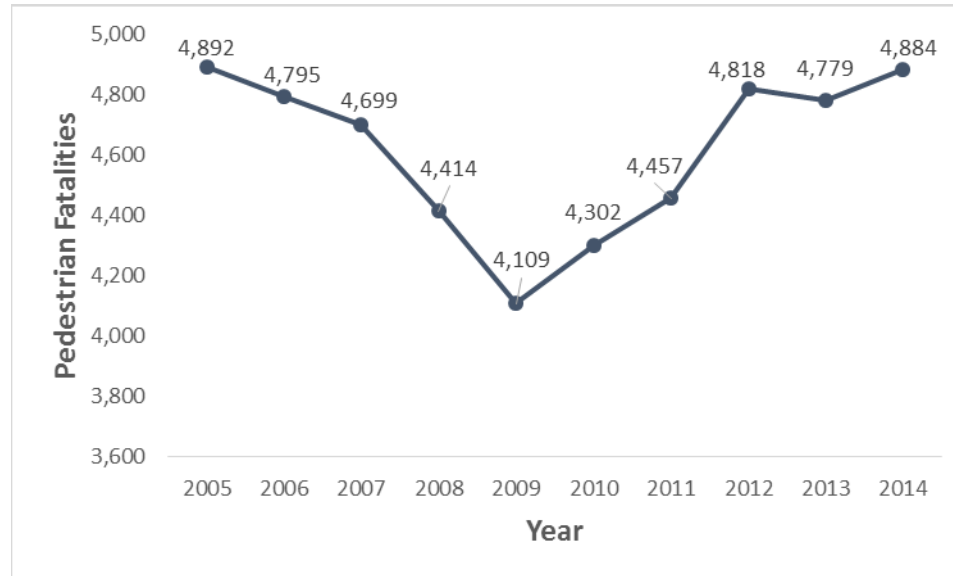
Michael Clamann, PhD, CHFP

May 22, 2017

Duke UNIVERSITY



Pedestrian Fatalities Increasing Over Time



- Emerging technology can:
 - Improve pedestrian detection
 - Improve communication with pedestrians

Source: NHTSA (2016)

Pedestrian Detection Technology Is Imperfect, but Improving

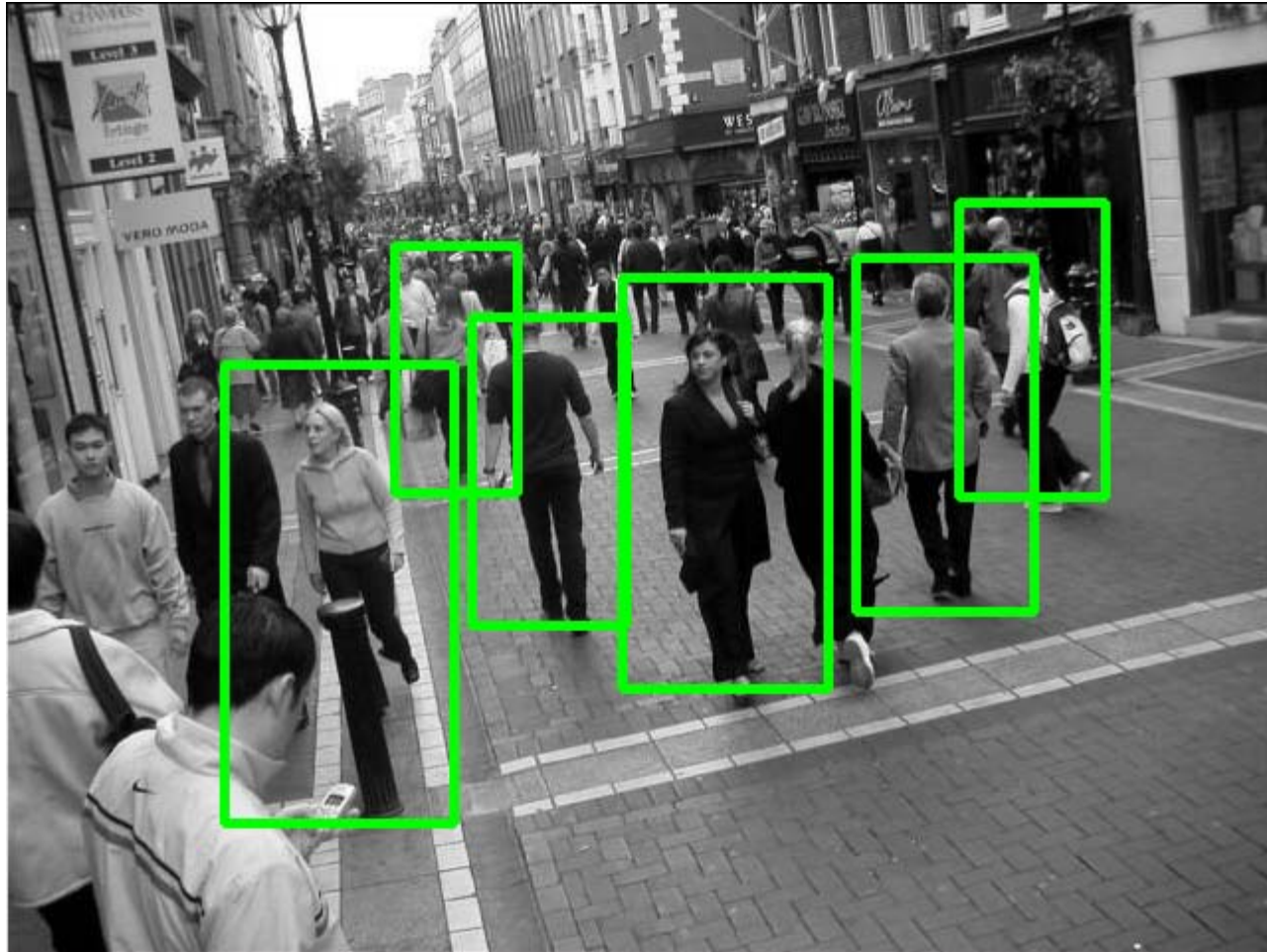
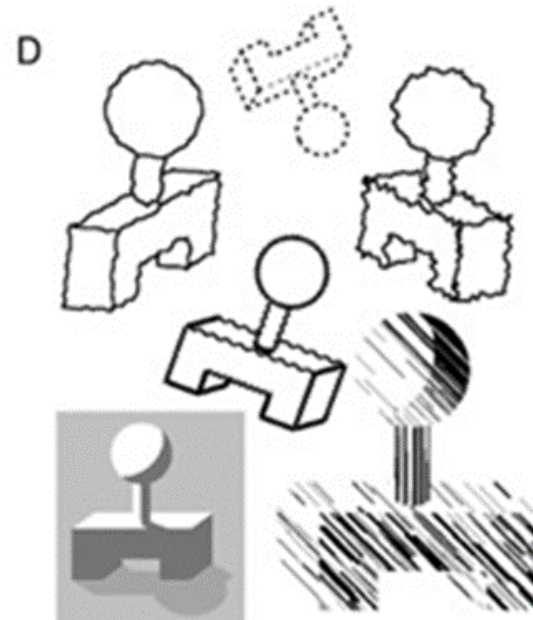
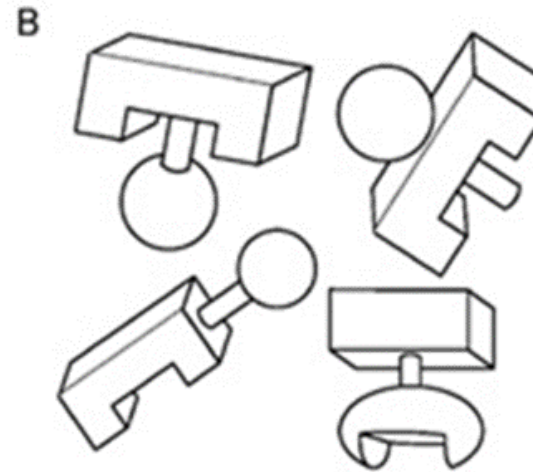
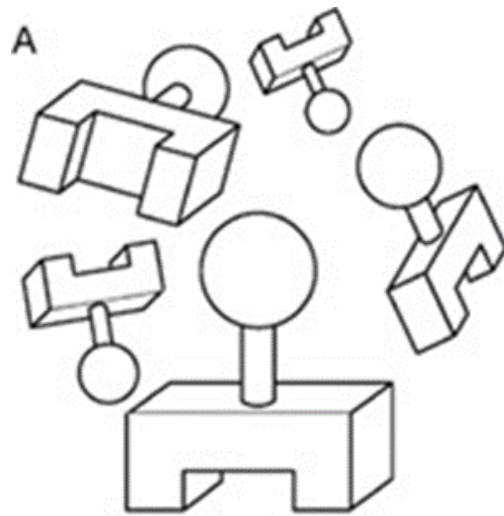


Photo: The Next Platform



What Is Our Model for Pedestrian Communication?





Image: TheOatmeal.com

Federal Automated Vehicle Policy HMI Guidelines Are Ambiguous

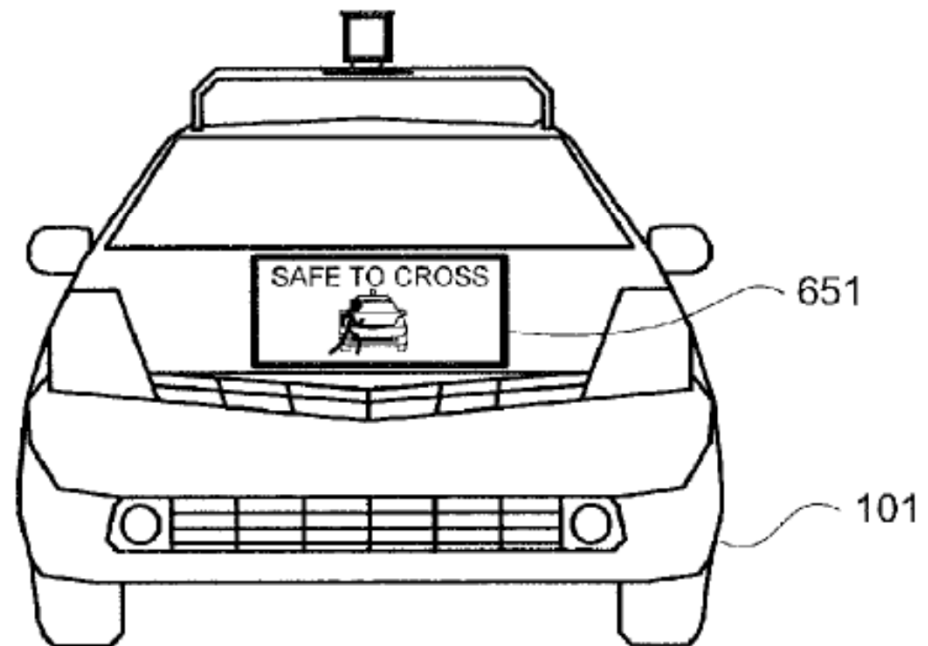
- Manufacturers and other entities should have a documented process for the assessment, testing, and validation of the vehicle human-machine interface (HMI).
- Considerations should be made for the human driver, operator, occupant(s), and external actors with whom the HAV may have interactions (other vehicles, pedestrians, etc.).
- HMI design should also consider the need to communicate information to pedestrians, conventional vehicles, and automated vehicles regarding the HAV's state of operation relevant to the circumstance (e.g., whether the HAV system identified a pedestrian at an intersection and is yielding).



(Federal Automated Vehicles Policy – Human Machine Interface)

Industry Has Several HMI Solutions

of the selected plan of action on an electronic sign mounted on the vehicle. In another example, the notification is provided by displaying text indicative of the selected plan of action on an electronic sign mounted on the vehicle. In another
45 example, the notification includes playing an audible instruction message indicative of the selected plan through a speaker of the vehicle.





Drive.ai Solves Autonomous Cars' Communication Problem

By [Evan Ackerman](#)

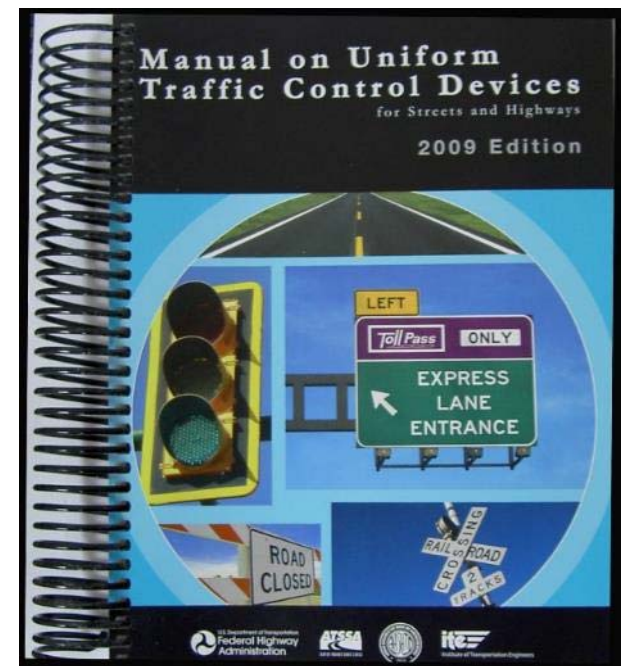
Posted 30 Aug 2016 | 16:00 GMT



Photo-illustration: Drive.ai

Industry Needs Consistent Guidelines for Display Design

- Using current guidelines for viewing at 100 feet:
 - Letters 6-inches tall
 - 47 inches for “Safe to Cross”
 - MUTCD requires 9-inches
 - Would be larger for moving displays



Experiment: Compare Two Display Prototypes

Evaluate two display strategies:

1. Advice
 - Explicit suggestion (walk / don't walk)
2. Information
 - Vehicle intent





Insights on Pedestrian Behavior from Subjective Assessment

“Did you use [the display] to make your crossing decision?”

12% reported using
76% reported seeing

“What was the primary piece of information you used to make your decision to cross?”

4% display
56% vehicle distance
46% vehicle speed
24% traffic density

46% of participants state using a display makes the crossing decision easier.

PEDESTRIAN SAFETY

Whether your kids are walking to school, the park or a friend's house, here are a few simple tips to make sure they get there safely.

The Hard Facts

Unintentional pedestrian injuries are the fifth leading cause of injury-related death in the United States for children ages 5 to 19. Teenagers are now at greatest risk. Teens have a death rate twice that of younger children and account for half of all child pedestrian deaths.

Top Tips

- 1 Teach kids at an early age to look left, right and left again before crossing the street. Then remind them to continue looking until safely across.
- 2 Teach kids to put phones, headphones and devices down when crossing the street. It is particularly important to reinforce this message with teenagers.



Image: Safe Kids Worldwide

Will Overly Polite Self-Driving Cars Brake for Jerks?

By [Philip E. Ross](#)

Posted 26 Oct 2016 | 20:00 GMT



Photo: iStockphoto

Image: IEEE Spectrum

Recommendations for Display Designers

- Displays should be
 - Simple, salient, familiar
 - Consistent
 - Flexible & scalable
- *Testing is vital*



Questions?

michael.clamann@duke.edu
