Automated Vehicle Communication and Intent with Shared Road Users

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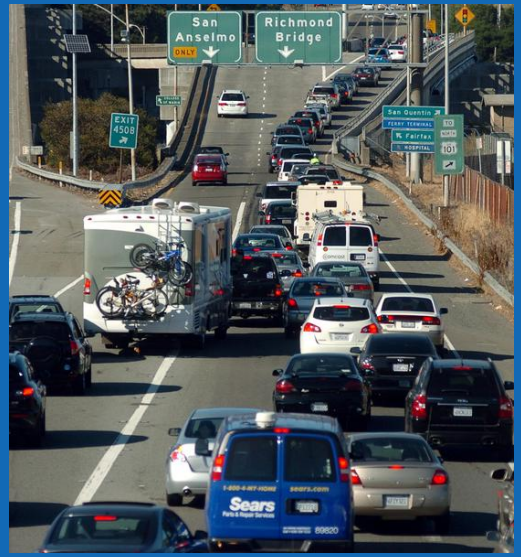
NHTSA
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

Automated Vehicle Communication and Intent with Shared Road Users

- UMTRI / Westat project team
- Project to be completed: July, 2019

What information is communicated by the actions of human drivers to shared road users?

- Road users' interactions depend on
  - Legal / formal norms (e.g. speed limit = 55 mph)
  - Social / informal norms (e.g. match speed of other traffic)
- Communication of intent helps to establish correct expectations for shared road users, especially when planned maneuvers deviate from legal / formal norms



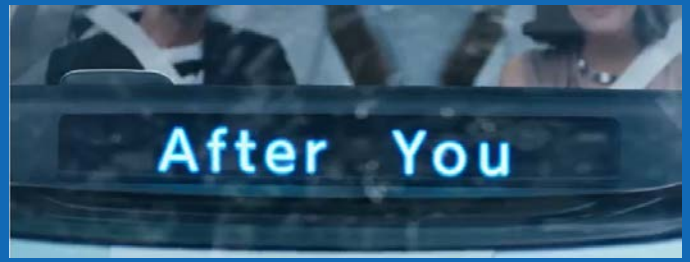
What information is communicated by the actions of human drivers to shared road users?

- Drivers communicate their intentions
  - explicitly (e.g. turn signal, hand gestures, flashing headlamps); automatically (backup lights)
  - implicitly (e.g. speed changes, position in lane, following distance, glance direction)




Problem

- Occupants of highly automated vehicles may be disengaged from the traffic environment, so shared road users cannot rely on them to communicate intent.
- How can automated vehicles communicate intent?



Background

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Project Objectives

- Identify key pieces of information the AV must communicate to shared road users
- Identify ways to measure communication effectiveness between the AV and shared road users
- Provide research to inform human factors guidance regarding communication of AV intent

Major Project Tasks

Phase I: Project Planning

1. Kickoff meeting and Work Plan
2. Literature Review
3. Draft Research, Analysis, Program, and Risk Management Plans
   - ❖ Interviews with stakeholders

Phase II: Project Execution

4. Conduct Studies
5. Draft, Final Report and Briefing

Planned Research

- Study 1: Structured Interviews of Driver Evaluation Experts
- Study 2: Shared Road Users' Determination of Intent of Other Vehicles (Field Study)
- Study 3: Testing Concepts for Communication of Intent (Lab Study)

1. Structured Interviews of Driver Evaluation Experts

- Obtain expert opinions about necessary cues for drivers to determine intent of other drivers.
  - Driver training instructors (novice driver focus)
  - Occupational therapists (rehab. focus)
- Structured interview method
- Incorporate list of observable driving behaviors / cues found in research literature review
- Experts will rate these

2. Field Study of Shared Road Users' Determination of Intent of Other Vehicles

- Determine what key pieces of information shared road users use to understand "intent" of nearby vehicles
- Trained study participants (pedestrians, drivers, bicyclists) perform think-aloud commentary while engaged in travel through specific sites.

2. Field Study of Shared Road Users' Determination of Intent of Other Vehicles

- PLACEHOLDER FOR VIDEO SAMPLE OF PEDESTRIAN PILOT TESTING THINK-ALOUD PROCEDURE

3. Testing Concepts for Communication of Intent (Lab Study)

- Explore methods for lab testing AV communication concepts to assess participants' understanding of messages
- Considering realistic animations, projected images, and virtual reality
- Data to include:
  - Participant's understanding of the meaning of the display
  - Participant's confidence rating in their interpretation
  - Participant's description of how they would react
  - Ambiguities, confusions, safety concerns
- Choice response time may be used for some trials
  - Scenarios involving go / no-go decisions

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