NATURALISTIC STUDY OF LEVEL 2 DRIVING AUTOMATION FUNCTIONS

Sheldon Russell
Senior Research Associate
Center for Automated Vehicles

Virginia Tech Transportation Institute
Objective

• Investigate driver interaction with market-ready partial driving automation through a naturalistic driving study (NDS)
  – Evaluate how drivers operate vehicles equipped with partial driving automation
  – Monitor internal vehicle data relevant to targeted functions
  – Evaluate how drivers operate vehicles equipped with partial driving automation during longer drives
RESEARCH QUESTION FOCUS AREAS

- Driver Performance
- Driver Engagement
- System Performance
- Driver-System Interaction
- Integrated into focus areas as appropriate
  - Driver interface design
  - Unintended or Improper use
    - Misuse and/or abuse
  - Unintended consequences
  - Safety and security
  - System failures
  - Licensing and training
2017 AUDI Q7

- **Driver Assistance Package**
  - Adaptive cruise control
  - Active lane assist
  - Congestion assist
  - Lane departure warning
  - Side assist
  - Audi pre-sense
• **Dynamic Driver Assistance**
  • Intelligent Cruise Control w/ Distance Control Assist
  • Active Lane Control
  • Lane Departure Warning & Prevention
  • Blind Spot Warning & Prevention
2016 MERCEDES-BENZ E350

- Driver Assistance Package
  - DISTRONIC PLUS with steering assist
  - PRE-SAFE brake with pedestrian recognition
  - BAS PLUS with cross-traffic assist
  - Active blind spot assist
  - Active lane keeping assist
2015 TESLA MODEL S

- Autopilot Tech Package
  - Traffic-Aware Cruise Control
  - Autosteer
  - Auto Lane Change
• **Convenience Package**
  • Adaptive cruise control
  • Lane keeping aid
  • Pilot Assist
PROJECT OVERVIEW

- 10 vehicles with partial driving automation
- 120 participants, balanced for age and gender
- 4-week participation period
- Northern Virginia/Washington, DC area
- Compensation up to $500
RECRUITMENT

- Recruit 120 drivers from the Northern Virginia/Washington, DC region
- Equal number of males and females ages 25-39 years old and 40-54 years old
- Screening for 1,200 miles per month
- Incentive to drive at least 1,200 miles during participation
- Targeting ~15,000 mi per year for each vehicle
- FHWA (2015) national average is 13,476 per year
DAS VIDEO VIEWS

- Forward view
- Driver face
- Over the shoulder (OTS)
- Foot well (pedals)
- Rear view
- Instrument cluster (HMI)
DATA REDUCTION VARIABLES

Driver variables
• Non-driving task engagement, drowsiness/impairment, etc.
• Visual behavior

Vehicle variables
• Speed, lane position, headway, etc.

Environmental variables
• Roadway markings, roadway types, traffic density, relation to junction, weather conditions, lighting conditions, etc.
## SAMPLING PLAN

<table>
<thead>
<tr>
<th>Epoch Type</th>
<th>Total Number of Epochs</th>
<th>Estimated Total per Driver</th>
<th>Estimated Frequency per Week per Driver</th>
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<tbody>
<tr>
<td>2 Functions Active</td>
<td>1,440</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>1 Function Active</td>
<td>1,440</td>
<td>12</td>
<td>3</td>
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<tr>
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<td>1,440</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>MFA Alerts</td>
<td>1,440</td>
<td>12</td>
<td>3</td>
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<tr>
<td>All SCEs</td>
<td>All</td>
<td>All</td>
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</table>
PARTICIPANT TRAINING

Static Orientation

On-road Demo

Participant Practice Drive
PARTICIPANT TIMELINE

<table>
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<tr>
<th>Week 1</th>
<th>Questionnaire</th>
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<tbody>
<tr>
<td>Week 2</td>
<td>Questionnaire</td>
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<tr>
<td>Week 3</td>
<td>Questionnaire</td>
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<tr>
<td>Week 4</td>
<td>Questionnaire</td>
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<tr>
<td></td>
<td>&amp; Debrief</td>
</tr>
<tr>
<td></td>
<td>Vehicle Prep</td>
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- Participants begin driving study vehicle
- Subjective experience and trust
- Subjective experience and trust
- Subjective experience and trust
- Post-drive questionnaire
- Payment
- Vehicle inspection, cleaning and prep
- Data ingestion
PROJECT STATUS

• All 120 participants completed as of December, 2017

• Data analysis and reduction continuing

• Long Drive sub-study awarded May 2017
  – Uses additional Tesla Model S to investigate automation use and driver behavior on ~4-hour drives
  – Data collection currently underway

• Final Report due to NHTSA July 2018
At the end of the study we estimate having:

- 16,000 trips
- 222,000 miles
- On average each participant drives ~1,800 miles during the 4-week exposure
Thank You!

– Sheldon Russell
– Virginia Tech Transportation Institute
– 3500 Transportation Research Plaza, Blacksburg, VA 24061
– 540-231-3302
– srussell@vtti.vt.edu