Older Adults’ Perceptions of Autonomous Vehicle Technologies

Sherrilene Classen¹, Justin Mason¹, James Wersal¹, & Virginia Sisiopiku²

¹Dept of Occupational Therapy, University of Florida
²Dept of Civil, Constr., and Env. Engineering, University of Alabama-Birmingham
Outline

Background
Purpose & Objective
Analysis
Results
Discussion
Study Impacts
Next Steps
Background

• Older adults (65+) 20% of US population

• Driving is a preferred mode of transportation
  – Risk
  – Driving cessation

• Autonomous vehicles (AVs) may hold health and safety benefits for older adults – if they accept or adopt them

• Recent perceptions were measured by survey only

• We expect that user perceptions, values, beliefs, and attitudes will change after being exposed to “driving” the simulator and/or the autonomous shuttle (Level 4, SAE)

---

1 US Census Bureau, 2017  
2 Brummelen et al., 2018  
3 Hutchins & Hook, 217  
4 Nees, 2016  
5 Society of Automotive Engineers International, 2018
Purpose
Understand the barriers (e.g., discomfort or insecurities) and the facilitators (e.g., readiness or willingness) of various groups of transportation users in adopting AV technology.

Objective
Obtain and analyze information on the perceptions of older drivers about AV technology before and after a) “driving” a simulator (Level 4, SAE Guidelines) and b) riding in a highly autonomous shuttle (AS) (Level 4, SAE Guidelines).
Methods

**Ethics:** IRB-01 Approved

**Design:** Repeated measures crossover design

**Participants: (N=106)**

Inclusion Criteria
- ≥ 65 years of age
- Valid driver’s license

Exclusion Criterion
- MoCA

**Equipment:**
- RTI High Fidelity Driving Simulator
  - Acclimation drive
  - Sub-urban scenario
- Transdev Easy Mile EZ10
  - Route

---

1 Society of Automotive Engineers International, 2018
2 Wersal, Classen, Mason, Sisiopiku, OTJR, in preparation

---

Figure 1. RTI High Fidelity Simulator (SAE Level 4) ¹

Figure 2. Transdev: EasyMile EZ10 (SAE Level 4) ¹
Methods

Visit 1: Baseline Measures
- Demographics
- Trail-Making Test A & B
- AV User Perception Survey
- Technology Acceptance Model
- Technology Readiness Index
- Driving Habits Questionnaire
- Life Space Questionnaire

Visits 2 and 3: Post-Visit Measures
- Simulator (SAE Level 4)
- Simulator Sickness Questionnaire
- Autonomous Shuttle (SAE Level 4)
- AV User Perception Survey

Group 1: n=31
Group 2: n=38
**Simulator/ Shuttle Route**
Sub-urban in downtown Gainesville, FL
Parking garage → Right on SW 2nd St
- Right onto SW 2nd Ave heading west
- Loops around
- East on SW 2nd Ave
- Left to SW 2nd St
- Left to the parking garage
12 minutes

**Road Dynamics**
**Intersections**
- 2 primary; 2 x 4-way stops
- 9 secondary westbound
- 6 secondary eastbound

**Pedestrian crosswalks**
- 7 complete pedestrian crossings
- 4 at intersections

**Roundabouts x 2**

**Road Dynamics**
- SW 2nd Ave corridor is lined with **cyclist lanes** on W and E side
- **Bus route** road
- **Vehicle parking** on W and E side
- **Pedestrians/cyclist/scooters**
- Construction of a **new building** westbound near SW 8th St
- **Solar glare** am and pm
Methods

- Alternate Shuttle Route (8 min)
Data Collection:
- Trained Research Assistant
- REDCap
- Target number of participants: N=106

Analysis:
- SPSS version 25
- Descriptive Statistics
- Interim Analysis: N=69, to compare users’ perceptions
Results: Demographics (N=69)

**Sex**
- Females: 40 (58%)
- Males: 29 (42%)

**Race**
- Black: 6 (9%)
- Other: 3 (4%)
- White: 60 (87%)

**Age (Years)**
- Mean Age of Participants:
  - Female: 73 (n=20)
  - Male: 77 (n=18 for Shuttle, n=20 for Simulator)

**First Exposure (Groups)**
- Shuttle: 73 (n=20), 77 (n=18)
- Simulator: 72 (n=20), 77 (n=11)

**Education**
- MS: 73%
- Doctorate: 23%
- BS: 15%
- AS: 12%
- Some College: 8%
- Technical School: 4%
- HS/GED: 3%
Results: Exposure Effect (N=69)
Results: Exposure Effect (N=69)

![Graph showing users' perceptions (VAS) across baseline, SIM, and SHUTTLE]

- **Social Influence**: Values range from 63.88 to 74.17
- **Intention to Use**: Values range from 67.09 to 74.17
- **Cost**: Values range from 63.88 to 70.20

Values represent average user perceptions with error bars indicating variability.
Results: Exposure Effect (N=69)
Paired t-tests: Groups 1 & 2

Group 1: Sim → Shuttle (n=31)

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>p</th>
<th>Change</th>
<th>Cohen’s $d^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention to Use</td>
<td>.868</td>
<td>-0.69 (4.09)</td>
<td>-.03</td>
</tr>
<tr>
<td>Trust</td>
<td><strong>.008</strong></td>
<td>7.78 (2.75)</td>
<td><strong>.55</strong></td>
</tr>
<tr>
<td>Perceived Usefulness</td>
<td>.244</td>
<td>3.86 (3.25)</td>
<td>.02</td>
</tr>
<tr>
<td>Perceived Ease of Use</td>
<td>.894</td>
<td>-0.58 (4.30)</td>
<td>-.03</td>
</tr>
<tr>
<td>Safety</td>
<td><strong>.008</strong></td>
<td>5.82 (2.04)</td>
<td><strong>.32</strong></td>
</tr>
<tr>
<td>Control/Driving Efficacy</td>
<td>.087</td>
<td>6.86 (3.88)</td>
<td>.36</td>
</tr>
<tr>
<td>Cost</td>
<td>.272</td>
<td>4.11 (3.68)</td>
<td>.23</td>
</tr>
<tr>
<td>Authority</td>
<td>.202</td>
<td>4.48 (3.43)</td>
<td>.21</td>
</tr>
<tr>
<td>Media</td>
<td>.147</td>
<td>8.90 (5.98)</td>
<td>.36</td>
</tr>
<tr>
<td>Social Influence</td>
<td>.131</td>
<td>7.74 (4.99)</td>
<td>.31</td>
</tr>
</tbody>
</table>

Group 2: Shuttle → Sim (n=38)

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>p</th>
<th>Change</th>
<th>Cohen’s $d^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention to Use</td>
<td><strong>.039</strong></td>
<td>6.65 (3.11)</td>
<td><strong>.22</strong></td>
</tr>
<tr>
<td>Trust</td>
<td>.090</td>
<td>-3.80 (2.19)</td>
<td>-.35</td>
</tr>
<tr>
<td>Perceived Usefulness</td>
<td>.448</td>
<td>-1.57 (2.05)</td>
<td>-.35</td>
</tr>
<tr>
<td>Perceived Ease of Use</td>
<td>.935</td>
<td>.29 (3.53)</td>
<td>.09</td>
</tr>
<tr>
<td>Safety</td>
<td>.763</td>
<td>.83 (2.74)</td>
<td>.05</td>
</tr>
<tr>
<td>Control/Driving Efficacy</td>
<td>.085</td>
<td>-5.04 (2.85)</td>
<td>-.26</td>
</tr>
<tr>
<td>Cost</td>
<td>.968</td>
<td>-.12 (2.89)</td>
<td>-.01</td>
</tr>
<tr>
<td>Authority</td>
<td>.676</td>
<td>-1.13 (2.68)</td>
<td>-.06</td>
</tr>
<tr>
<td>Media</td>
<td>.483</td>
<td>-1.82 (2.57)</td>
<td>-.09</td>
</tr>
<tr>
<td>Social Influence</td>
<td>.613</td>
<td>-1.43 (2.81)</td>
<td>-.08</td>
</tr>
</tbody>
</table>

---

1 Cohen, 1988
Discussion

Overall analysis:

– **Exposure to AV technology** positively affects older adults’ perceptions to this emerging technology.

– **Perceived safety** shows the highest percentage points of increase after being exposed to AS.

– Except for **intention to use**, all other variables of perception are more positively affected after AS exposure.

Within group analysis:

– **Trust** and **safety** significantly increased after being exposed to the AS last.

– **Intention to use** significantly increased after being exposed to the simulator last.
Study Impacts

• Study findings will inform transportation researchers, AV industry representatives and healthcare providers of older adults’ perceptions and attitudes toward AV use.

• The knowledge gained through this research will help to identify
  – opportunities and methods to overcome barriers to improve older drivers’ interaction with AV
  – facilitate their ease-of-use practices
  – empower older drivers to adopt these technologies.

“Consumer acceptance will be the constraint to the growth of the Autonomous-Vehicle industry”
Transportation Secretary Chao, 7/6/19
Next Steps

- **Gender** and **age** interactions will be assessed during the final analysis from 106 participants.

- Future research (Phase II) will be conducted in 2020-2021 to explore the perception, values, beliefs and attitudes of **young and middle age** drivers. This will provide a meaningful comparison and perspective of drivers across the lifespan.
Acknowledgement

Funding Agency
U.S. DOT, Office of the Assistant Secretary for Research and Technology (OST-R) through the Southeastern Transportation Research, Innovation, Development, and Education (STRIDE) Center (Project D2).

Stakeholders
- Transdev
- City of Gainesville
- Oak Hammock

Project Team
- Sherrilene Classen, PhD (PI)
- Justin Mason, PhD
- James Wersal, OTD
- Virginia Sisiopiku, PhD
- Jason Rogers, BE
- Melissa Varela, BHS
- Kasey Clark, BHS
Questions and Comments

Contact

Dr. Sherrilene Classen: sclassen@phhp.ufl.edu
I-MAP website: https://mobility.phhp.ufl.edu/
UAB TREND Lab website: http://www.uab.edu/engineering/trendlab/