Barriers and Facilitators of People with and without Disabilities in Accepting Autonomous Shuttle Services

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Acknowledgement

Funding Agency

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Stakeholders

• Transdev
• City of Gainesville
• Oak Hammock Residential Community
• UF Transportation Institute
• FDOT
• Center for Independent Living of North Central Florida
• Norman Fixel Institute for Neurological Diseases
• Division of Vocational Rehabilitation, Gainesville
• Participants

Project Team

• Sherrilene Classen, PhD (PI)
• Virginia Sisiopiku, PhD (co-PI)
• Justin Mason, PhD
• Nichole Stetten, PhD
• Wencui Yang, PhD
• Seung Woo Hwangbo, OTD
• Brandy McKinney, MBA
• Joseph Kwan, BS
• Transportation is a barrier to full independence for the 41 million community dwelling people with disabilities (PWDs)$^{1,2}$
• Autonomous vehicles (AV) hold health and safety benefits and increased community mobility options; yet has limited evidence for PWDs$^3$
• Florida leads the U.S in aging demographics, many with disabilities, and is an ideal AV testbed$^4$
• Although ADA guidelines indicate transportation equity, PWDs are not uniformly included in autonomous shuttle (AS) research studies$^{5,6}$
• We do not yet know:
  – PWDs’ lived experiences before, during, and after (AS) exposure or
  – How their perceptions compare to able bodied adults through the lifespan

$^1$ Erickson et al., 2017
$^2$ American Association of Retired Persons, 2018
$^3$ Claypool et al., 2017
$^4$ The Florida Senate, House Bill 311
$^5$ The Americans with Disabilities Act, 2018
$^6$ Guidry-Grimes et al., 2020
Objectives

• To quantify perceptions of PWDs after riding in an AS, and compare it to younger, middle-aged, and older adults’ experiences obtained from previously collected data.\textsuperscript{1,2}

• To understand the perceptions of all participants (with and without disabilities) before and after exposure to an AS.

\textsuperscript{1} Classen et al., 2021
\textsuperscript{2} Classen et al., 2023
Methods

Ethics: IRB-01 Approved

Design:

- **Prospective**: A pre-post experimental design with baseline survey, exposure to the AS, and post-exposure survey
- **Retrospective**: Combined the prospective data with previously collected data from adults across the lifespan

Participants: Prospective Sample (n=42)

Inclusion Criteria

- PWDs: Self-reported visual (n=12), hearing (n=5), ambulatory (n=23), sensory (n=5), self-care (n=17), and/or independent living impairment (n=24)

Exclusion Criteria

- Not communicate in English
- Not institutionalized
- <11 Mini Montreal Cognitive Assessment (MoCA)

Retrospective Sample (n=101)

Inclusion Criteria

- 18-90+ years of age

Exclusion Criteria

- Not English speaking
- MoCA = < 18

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

- **Validation** paper for shuttle route\(^1\)
- Drives in **autonomous mode** on the pre-mapped route
- No primary controls – a **safety operator** may manually operate via a joystick
- Uses sensors, light detection, GPS tracking system, and LIDAR to map its environment to execute the **safest motion**
- Achieves a max speed **25 m/hr**
- Accommodates **12 passengers**: 6 seats and 6 standing

1 Classen, Wersal, Mason, et al., 2020
https://doi.org/10.3389/ffutr.2020.596620

EasyMile EZ10 Automated Shuttle (SAE Level 4)
Methods: Shuttle Route

- Route
  - 20 minutes
  - Traffic, roadworks, road users, traffic circles
  - Low speed (~10 mph)
  - Downtown Gainesville
  - To and from a parking garage (220 SE 2nd Ave, Gainesville FL → 2nd Avenue S → SW 2nd Ave W → three traffic circles → SW 12th Str → SW 4th Ave → SW 13th Str → SW 3rd Ave → SW 12th Str)

Figure. Autonomous shuttle route in downtown Gainesville, Florida
Methods: Recruitment, Screening, Enrollment

**Recruitment**
- Stakeholder networks
- Center for Independent Living
- Norman Fixel Institute for Neurological Diseases
- Local communities (e.g., libraries, churches)

**Screening**
- Potential participants were screened according to study criteria via a scripted telephone interview

**Enrollment**
- Participants who were screened positive:
  - Enrolled in the study
  - Provided written informed consent
  - Were compensated ($25 - retrospective study; $30 - prospective study)
Methods: Data Collection

Pre-Exposure Measures
• **Independent Variables**
  • Demographics
  • Trail-Making Test A & B
  • Technology Acceptance Model (TAM)
  • Technology Readiness Index 2.0 (TRI)
  • Driving Habits Questionnaire (DHQ)
  • Life Space Questionnaire (LSQ)
• **Dependent variables**
  • **AV User Perception Survey (AVUPS)**\(^1,2\)
    – Consists of 24 items
    – Visual analog scale (0=disagree to 100=agree)
    – 4 open-ended questions
  • The AVUPS had four domains:
    - *Intention to Use*
    - *Perceived Barriers*
    - *Well-being*
    - *Acceptance*

**Shuttle Exposure**

Post-Exposure Measures
• AVUPS

\(^1\) Mason et al., 2020
\(^2\) Mason et al., 2021
**Data Collection:**
- Trained Research Assistants
- Research Electronic Data Capture (REDCap)

**Data Management:**
- All data were stored, and managed in REDCap
- Data analyst provided quality control
- No missing data were detected
- Due to the number of inactive drivers (n=26), driver status (active vs. inactive) was used to explore the effects of maintaining an active driver’s license
- Due to small sample of younger and middle-aged adults, older adults were contrasted to a combined group (younger + middle-aged adults)
- Coefficient variables were compared because variables in the model were scaled to control for the level of measurement
- The independent variables (*active driving status, age group, disability status, employment, race/ethnicity, gender, and marital status*) were categorized as dummy variables and relabeled
Methods: Data Analysis

- **Objective 1:** To quantify perceptions of PWDs after riding in an AS, and compare it to younger, middle-aged, and older drivers’ experiences

  - Descriptive Statistics, ANOVA, Post-hoc analysis
    - Data normality: *i.e.*, probability plots, histograms, stem and leaf plots, Fisher’s skewness and kurtosis, Shapiro-Wilks tests
  - A series of repeated measures ANOVAs
    - PWDs’ perceptions: Intention to Use, Perceived Barriers, Well-being, and Acceptance
  - Two-way mixed ANOVAs
    - Between-subjects differences (*disability status*)
    - Within-subjects differences (*time, i.e., exposure to the AS*)
  - Post-hoc power analysis
    - *Intention to use* (Cohen’s $d$ effect size=0.5) as the main outcome variable for 42 PWDs and 101 able-bodied adults (alpha = 0.05; power = 0.771)
Methods: Data Analysis

• **Objective 2**: To understand the perceptions of all participants (with and without disabilities) before and after exposure to an AS

  **Linear Regression Models**
  • **Independent Variables**
    • Age, gender, driver status, disability status, employment, education, marital status, race/ethnicity
    • Optimism, perceived ease of use, life space
  • **Dependent Variables**
    • Four AVUPS scores: Intention to Use, Perceived Barriers, Well-being, Acceptance

**Data Processing**
• R Studios and R version 4.0.4
• “MASS” and “CAR” packages
• \( p = 0.05 \)
Methods: Qualitative Analysis

• **AVUPS Questions 25-28**
  • Describe what promotes your willingness to use AVs
  • Describe what deters you from using AVs
  • Describe potential benefits of AVs
  • Describe disadvantages of AVs

• Currently in the process of comprehensively analyzing the narrative responses
### Results: Descriptive Results

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>PWDs Frequency (%)</th>
<th>Able-bodied drivers Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian/Pacific Islander</td>
<td>0 (0%)</td>
<td>18 (18%)</td>
</tr>
<tr>
<td>African American/Black</td>
<td>25 (60%)</td>
<td>10 (10%)</td>
</tr>
<tr>
<td>White</td>
<td>14 (33%)</td>
<td>64 (63%)</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>0 (0%)</td>
<td>5 (5%)</td>
</tr>
<tr>
<td>Multiracial</td>
<td>2 (5%)</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Would rather not say</td>
<td>0 (0%)</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (2%)</td>
<td>1 (1%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education</th>
<th>PWDs Frequency (%)</th>
<th>Able-bodied drivers Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No high school diploma</td>
<td>4 (10%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>High school graduate</td>
<td>14 (33%)</td>
<td>3 (3%)</td>
</tr>
<tr>
<td>Some college credits</td>
<td>8 (19%)</td>
<td>16 (15%)</td>
</tr>
<tr>
<td>Trade, technical, vocational training</td>
<td>1 (2%)</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Associate degree</td>
<td>1 (2%)</td>
<td>11 (11%)</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>9 (22%)</td>
<td>28 (28%)</td>
</tr>
<tr>
<td>Master’s degree</td>
<td>4 (10%)</td>
<td>28 (28%)</td>
</tr>
<tr>
<td>Doctorate</td>
<td>1 (2%)</td>
<td>14 (14%)</td>
</tr>
</tbody>
</table>
## Results: Descriptive Results

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Value</strong></td>
<td>PWDs Frequency (%)</td>
</tr>
<tr>
<td>Single</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Married or domestic partnership</td>
<td>25 (60%)</td>
</tr>
<tr>
<td>Widowed</td>
<td>14 (33%)</td>
</tr>
<tr>
<td>Divorced</td>
<td>0 (0%)</td>
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</table>

<table>
<thead>
<tr>
<th>Employment</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Value</strong></td>
<td>PWDs Frequency (%)</td>
</tr>
<tr>
<td>Part-time</td>
<td>4 (10%)</td>
</tr>
<tr>
<td>Full-time</td>
<td>14 (33%)</td>
</tr>
<tr>
<td>Retired</td>
<td>8 (19%)</td>
</tr>
<tr>
<td>Unable to work</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>Student</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>Homemaker</td>
<td>9 (22%)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>4 (10%)</td>
</tr>
</tbody>
</table>

- Marital Status: Widow represented as 67% in the table, indicating a higher frequency.
- Employment: Student and Homemaker have the highest frequencies in their respective categories.
Results: Within (PWDS) Group Differences

- Increase Acceptance ($F(1,41) = 22.93, p < 0.001$)
- Increase Intention to Use ($F(1,41) = 22.05, p < 0.001$)
- Decrease Perceived Barriers ($F(1,41) = 15.75, p < 0.001$)
- No SS Well-being ($F(1,41) = 3.83, p = 0.057$)
Results: Between Group Differences

No SS for AVUPS domain scores (range p’s = 0.406 - 0.986 for group effect)
No SS group-by-time interactions for AVUPS domain scores (range p’s = 0.419 - 0.826)
### Results: Objectives 2—Descriptives of All Participants

<table>
<thead>
<tr>
<th>Variables</th>
<th>Value</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver status</td>
<td>Active</td>
<td>117 (81.8)</td>
</tr>
<tr>
<td></td>
<td>Inactive</td>
<td>26 (18.2)</td>
</tr>
<tr>
<td>Age group</td>
<td>Older adult</td>
<td>58 (40.5)</td>
</tr>
<tr>
<td></td>
<td>Younger to Middle-aged adult</td>
<td>85 (59.5)</td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>63 (44.1)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>80 (55.9)</td>
</tr>
<tr>
<td>Disability status</td>
<td>PWD</td>
<td>42 (29.4)</td>
</tr>
<tr>
<td></td>
<td>Able-bodied adult</td>
<td>101 (70.6)</td>
</tr>
<tr>
<td>Employment</td>
<td>Full-time and Part-time</td>
<td>109 (76.2)</td>
</tr>
<tr>
<td></td>
<td>Other classification</td>
<td>34 (23.8)</td>
</tr>
<tr>
<td>Education</td>
<td>Bachelor’s, Master’s, or Doctorate degree</td>
<td>84 (58.7)</td>
</tr>
<tr>
<td></td>
<td>Other classification</td>
<td>59 (41.3)</td>
</tr>
<tr>
<td>Marital status</td>
<td>Married or domestic partnership</td>
<td>61 (42.7)</td>
</tr>
<tr>
<td></td>
<td>Other classification</td>
<td>82 (57.3)</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td>White</td>
<td>89 (62.2)</td>
</tr>
<tr>
<td></td>
<td>Other classification</td>
<td>54 (37.8)</td>
</tr>
</tbody>
</table>
## Results: Objectives 2—Descriptives of All Participants

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Min</th>
<th>Max</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimism (TRI)</td>
<td>143</td>
<td>4.43</td>
<td>0.55</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Perceived ease of use (TAM)</td>
<td>143</td>
<td>5.13</td>
<td>1.07</td>
<td>5</td>
<td>2</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Life space</td>
<td>143</td>
<td>5.34</td>
<td>1.15</td>
<td>5</td>
<td>0</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Age</td>
<td>143</td>
<td>53.42</td>
<td>20.99</td>
<td>59</td>
<td>19</td>
<td>85</td>
<td>-</td>
</tr>
<tr>
<td>AVUPS Intention to Use (Pre)</td>
<td>143</td>
<td>69.58</td>
<td>15.32</td>
<td>68</td>
<td>0</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>AVUPS Perceived Barriers</td>
<td>143</td>
<td>33.33</td>
<td>19.46</td>
<td>31</td>
<td>33</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>AVUPS Well-being</td>
<td>143</td>
<td>69.81</td>
<td>22.42</td>
<td>74</td>
<td>0</td>
<td>89</td>
<td>100</td>
</tr>
<tr>
<td>AVUPS Acceptance</td>
<td>143</td>
<td>67.13</td>
<td>15.44</td>
<td>65</td>
<td>3</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>AVUPS Intention to Use (Post)</td>
<td>143</td>
<td>75.60</td>
<td>15.86</td>
<td>78</td>
<td>31</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>AVUPS Perceived Barriers</td>
<td>143</td>
<td>24.63</td>
<td>16.24</td>
<td>24</td>
<td>0</td>
<td>64</td>
<td>100</td>
</tr>
<tr>
<td>AVUPS Well-being</td>
<td>143</td>
<td>75.88</td>
<td>19.56</td>
<td>79</td>
<td>0</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>AVUPS Acceptance</td>
<td>143</td>
<td>73.61</td>
<td>15.17</td>
<td>76</td>
<td>34</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
Results: Regression Modeling

*Intention to Use:*

- Optimism, perceived ease of use, driver status (inactive), and race/ethnicity (White) were positive predictors of *Intention to Use*
- 25.8% of the variance ($R^2=0.258$; $R_{\text{adjusted}}^2=0.231$; $F(5,137) = 9.543; p < 0.001$)

<table>
<thead>
<tr>
<th>Variables</th>
<th>$\beta$</th>
<th>SE</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>1.03</td>
<td>3.03</td>
<td>0.338</td>
<td>0.736</td>
</tr>
<tr>
<td>Optimism (TRI)</td>
<td>6.68</td>
<td>2.15</td>
<td>3.11</td>
<td>0.002</td>
</tr>
<tr>
<td>Perceived Ease of Use (TAM)</td>
<td>5.32</td>
<td>1.13</td>
<td>4.72</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Driver Status (Active)</td>
<td>-7.75</td>
<td>3.19</td>
<td>-2.43</td>
<td>0.017</td>
</tr>
<tr>
<td>Marital Status (Married/Domestic Partnership)</td>
<td>4.66</td>
<td>2.542</td>
<td>1.83</td>
<td>0.069</td>
</tr>
<tr>
<td>Race/Ethnicity (White)</td>
<td>5.34</td>
<td>0.47</td>
<td>2.16</td>
<td>0.032</td>
</tr>
</tbody>
</table>
Results: Regression Modeling

Perceived Barriers:

- Optimism, perceived ease of use, and race/ethnicity (White) were predictors of Perceived Barriers
- 23.8% of the variance ($R^2=0.238$; $R_{adj}^2=0.216$; $F(4,138) = 10.77$; $p < 0.001$)

<table>
<thead>
<tr>
<th>Variables</th>
<th>β</th>
<th>SE</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>6.04</td>
<td>2.01</td>
<td>3.01</td>
<td>&lt;0.003</td>
</tr>
<tr>
<td>Optimism (TRI)</td>
<td>-7.22</td>
<td>2.22</td>
<td>-3.26</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Perceived Ease of Use (TAM)</td>
<td>-5.20</td>
<td>1.15</td>
<td>-4.53</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Life Space Questionnaire (LSQ)</td>
<td>1.79</td>
<td>1.09</td>
<td>1.65</td>
<td>0.102</td>
</tr>
<tr>
<td>Race/Ethnicity (White)</td>
<td>-9.71</td>
<td>2.58</td>
<td>-3.76</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Results: Regression Modeling

**Well-being:**
- Optimism, perceived ease of use, driver status (inactive), and age group (older) were predictors of *Well-being*
- 27.4% of the variance ($R^2=0.274$; $R_{adj}^2=0.253$; $F(4,138)=13.00; p < 0.001$)

<table>
<thead>
<tr>
<th>Variables</th>
<th>$\beta$</th>
<th>SE</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>2.30</td>
<td>3.38</td>
<td>0.682</td>
<td>0.497</td>
</tr>
<tr>
<td>Optimism (TRI)</td>
<td>11.00</td>
<td>2.62</td>
<td>4.20</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Perceived Ease of Use (TAM)</td>
<td>4.89</td>
<td>1.37</td>
<td>3.56</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Driver Status (Active)</td>
<td>-8.81</td>
<td>3.86</td>
<td>-2.28</td>
<td>0.024</td>
</tr>
<tr>
<td>Age Group (Older)</td>
<td>12.10</td>
<td>3.09</td>
<td>3.91</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Results: Regression Modeling

**Acceptance:**
- Optimism, perceived ease of use, driver status (active), marital status (married/domestic partnership), and race/ethnicity (White) were predictors of *Acceptance*
- 30.7% of the variance ($R^2=0.307$; $R_{\text{adjusted}}^2=0.277$; $F(6,136) = 10.05; p < 0.001$)

<table>
<thead>
<tr>
<th>Variables</th>
<th>$\beta$</th>
<th>SE</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>-0.170</td>
<td>3.01</td>
<td>-0.057</td>
<td>0.955</td>
</tr>
<tr>
<td>Optimism (TRI)</td>
<td>7.11</td>
<td>2.02</td>
<td>3.53</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Perceived Ease of Use (TAM)</td>
<td>5.40</td>
<td>1.05</td>
<td>5.14</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Life Space Questionnaire</td>
<td>-1.49</td>
<td>1.03</td>
<td>-1.46</td>
<td>0.148</td>
</tr>
<tr>
<td>Driver Status (Active)</td>
<td>-7.53</td>
<td>3.08</td>
<td>-2.44</td>
<td>0.016</td>
</tr>
<tr>
<td>Marital Status (Married/Domestic Partnership)</td>
<td>5.03</td>
<td>2.36</td>
<td>2.13</td>
<td>0.035</td>
</tr>
<tr>
<td>Race/Ethnicity (White)</td>
<td>6.72</td>
<td>2.34</td>
<td>2.87</td>
<td>0.005</td>
</tr>
</tbody>
</table>
Qualitative Results

Qualitative Responses from AVUPS (PWDS only)

• Content and Themes
  – **Safety** (e.g., ability to keep pedestrians, cyclists, passengers, and drivers safe in traffic)
  – **Availability** of the shuttle (i.e., expansion of schedules to nights and weekends)
  – **Adaptability** (i.e., securement of passengers of all mobility levels)
  – **Affordability** (i.e., will cost be a limiting factor in using the shuttle)
  – **Accessibility** (i.e., the installation of handrails or ramps for wheelchair users)
  – **Acceptability** (e.g., desire for human intervention when sharing space with other able-bodied persons in the shuttle)
Summary

**Objective 1**

- PWDs expressed increased *Intention to Use* and *Acceptance*, and decreased *Perceived Barriers* after riding the AS.
- This suggests a *positive shift in perception of the PWDs* pertaining to these domains, showing consistent results with recent AV studies\(^1\),\(^2\)
- This information may positively influence\(^3\)
  - industry’s marketing and deployment strategies
  - policy makers passing laws to increase access for PWDs
  - advocacy organizations to disseminate information on AS

**Objective 2**

- No SS differences between PWDs and able-bodied persons, *suggesting the perceptions were similar*
- No significant group-by-time interactions existed for AVUPS scores between PWDs and able-bodied persons, *suggesting the perceptions were similar*

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1. Classen et al., 2021
2. Classen et al., 2023
3. Howard & Dai, 2014
Summary

Intention to Use:

- Optimism, perceived ease of use, driver status (inactive), and race/ethnicity (White) positively predicted Intention to Use.
- This suggests that White Americans who show optimism and find the AS easy to use, prefer not to drive/use public transportation/or who are transportation-challenged, may more readily adopt the AS.

Perceived Barriers:

- Optimism, perceived ease of use, and race/ethnicity (White) predicted Perceived Barriers.
- This suggests:
  - These predictors must be considered by transportation providers, policy makers, industry partners, and advocacy organizations, for future deployment decisions of ASs.
  - Focus on the groups who did not show these characteristics to identify limiting factors for adopting the AS.
Summary

Well-being:

• *Optimism, perceived ease of use, (inactive) driver status, and older age predicted Well-being.*

• For adoption of ASs, industry partners and policy makers may want to focus on *deployment in communities with similar characteristics; and further understand the limiting factors among those with different characteristics.*

Acceptance:

• *Optimism, perceived ease of use, driver status (inactive), marital status (married/domestic partnership), and race/ethnicity (White) predicted Acceptance.*

• For adoption of the AS: *Industry partners may want to deploy the AS in communities with similar characteristics; and understand limiting factors among those with differing characteristics.*
Summary

Qualitative Responses

- Early identified themes suggest *industry partners and policy makers must consider*
  - on-board attendant (acceptability)
  - cost (affordability)
  - design issues (acceptability)
  - schedules, time of night/day/weekends (availability)
  - implications of ADA legislation (accessibility; adaptability)
Limitations

• Over or underrepresented variables (*e.g.*, education), self-report (*e.g.*, life space) may have influenced the estimates of this study.

• The AS route was extended on June 1, 2021 (*adding four more right turns, one left turn, and one stop*), and this was not controlled in the analysis.

• Due to weather (*e.g.*, thunderstorm) and mechanical issues (*e.g.*, battery required replacement taking weeks, issues with rebooting), participants had to be rescheduled on short notice which could have led to participant bias.

• Convenience sample of PWDs.

• Inadequate power to run analyses between different groups of PWDs to assess differing perceptions of AS.

• Biases (*e.g.*, selection bias, spectrum bias, response bias, racial bias, interpretation bias).

• This study’s findings are only generalizable to study participants and settings that fit the demographic profile and context of this study.
Strengths

• Participants (N=143) were from three different cohorts, exposed to the AS
• Despite only enrolling 42 PWDs, the findings for the PWDs have a bigger than moderate effect size (0.5) and power of 77%
• Predictors of user Acceptance include optimism, ease of use, driver status, marital status, and race/ethnicity
• This study utilized collaborations between two universities, the city’s transportation department, industry partners, independent living facilities, and various rehabilitation and community facilities
• We used team science, rigorous analyses, and predictive models to better understand the AS acceptance practices of younger, middle-aged, and older persons who are able-bodied or who are living with disabilities
Because PWDs experience an increase of *Intention to Use and Acceptance*, this may suggest *plausibility for them using the AS in future*.

Positive predictors: Among all participants, those who were *optimistic* and reported *ease of use* identified *Perceived Barriers* to a lesser extend; and demonstrated an increase in *Intention to Use, Well-being, and Acceptance* of AS.

Negative predictors: *Driving status* (active) negatively predicted *Intention to Use, Well-being, and Acceptance* – therefore those who drive (vs. those who do not drive) are less likely to use and accept the AS.

Overall, predictors of user *Acceptance of AS* include *optimism, ease of use, driver status, and race (White)*, with a third of the variance explained – suggesting that other predicting factors still need to be uncovered.

All groups *(i.e., younger, middle-aged, older adults, and PWDs)* showed *enhanced perceptions of the AS after exposure* – suggesting that this mode of transportation may be suitable for individuals, with and without disabilities, through the lifespan.
Automated Vehicle User Perception Survey:


Driving Scenario Validation:


- Simulated driving scenario: [https://www.youtube.com/watch?v=kDObiycJUxA](https://www.youtube.com/watch?v=kDObiycJUxA)
Simulator and Motion Sickness with AV Technology:


Older Drivers' Experiences with AV Technology:


Published Manuscripts

Experiences of Drivers Across the Life Span with AV Technology:


• Classen, S., Sisiopiku, V. P., Mason, J. R., Yang, W., Hwangbo, S. W., McKinney, B., & Li, Y. (2023). Experience of drivers of all age groups in accepting autonomous vehicle technology. *Journal of Intelligent Transportation Systems*, 1-17. DOI: [10.1080/15472450.2023.2197115](#)


• Classen, S., Sisiopiku, V. P., Mason, J. R., Stetten, N. E., Hwangbo, S. W., Kwan, J., & Yang, W. Barriers and Facilitators of People With and Without Disabilities Before and After Autonomous Shuttle Exposure. *Future Transportation*. (Under review)
Final Reports:


Questions & Survey

Please enter your questions in the Chat Box.

Please complete our very brief survey by clicking on the link in the chat box.