Information Used in Mental Model Formation of Advanced Driver Assistance Systems

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Introduction
- New and changing automated vehicle (AV) technologies pose challenges to the formation and maintenance of accurate mental models of their operation.
- Toyota’s CSRC and GMU’s ArchLab are collaborating on a two-yearlong research project, the purpose of which is two-fold:
  - To determine how users develop and maintain mental models.
  - To explore effective ways of introducing and educating users of new AV safety technologies that foster efficient and appropriate mental model development.
- The present study sought to determine the types and sources of information people use in forming mental models of ADASs and predict persona self-selection.
- The hypothesis: Judged technological self-efficacy will influence the types of information people use to form mental models of ADASs.

Methods
- Participants (n = 434) from Amazon’s Mechanical Turk
  - Mean age = 35.8 years (range 18 - 82)
  - 56% female
  - Mean Socioeconomic Status (SES) = 5.3 (1-10 scale)
  - Median education level = Bachelor’s degree
- Questionnaire designed to assess:
  - Demographics
  - Self-identified Persona (Personas were constructed to vary in technological sophistication and adoption of new technologies – embrace of technology)
  - Likert-type scales assessing
    - Use and perceptions of technology and technical skill
    - Sources of information preferred for learning about ADASs
    - Knowledge and perceptions of ADASs

Analyses
- Correlations
- OLS for Likert type and continuous variables
- Logistic regression for dichotomous variables
- Ordinal Regression to predict self-identified embrace of technology (Persona) and familiarity with ADASs from other questionnaire items.

Personas

<table>
<thead>
<tr>
<th>Persona Information - Varied on technological sophistication</th>
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<tbody>
<tr>
<td>High –&gt; low</td>
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<tr>
<td>Roberts - Tech CEO who uses an autonomous car, travels often, writes code, and tinkers with her 3D printed inventions</td>
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<tr>
<td>Nick - Engineer who owns car w/ ADAS. Buys gadgets early, reads tech news, uses a Raspberry Pi 3</td>
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<tr>
<td>Robin – Grad student who uses common software packages, owns new-ish phone, uses social media, drives 3 year old Camry</td>
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<tr>
<td>Mary – systems analyst, reads Chicago Tribune &amp; Pinterest on older iPad, drives e-car, enjoys baking &amp; painting</td>
</tr>
<tr>
<td>Taylor – Mom of 3, works at Sears, uses phone to call/text, rarely uses FB account her son set up, volunteers for girl scouts</td>
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<tr>
<td>Ralph – Dad of 2 adult sons, doesn’t see need for tech, reads the paper, keeps flip-phone in glove box while hunting/fishing</td>
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</tbody>
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Results
- Embrace of Technology – Technology use (Persona):
  - was predicted by (a) familiarity with ADASs (b) reliance on data-based (e.g., Consumer Reports) vs non-data based (e.g., social media) sources of information (c) self reliance vs dependence in solving technological problems
  - was not predicted by (a) Education (b) SES (c) reliance on technology, (d) beliefs in malleability of technical skill, (e) prior knowledge about ADASs.

Discussion
- Results suggest that both embrace of technology (Persona) and high familiarity with ADASs are associated with preference for data-based over non data-based sources of information.
- Neither are predicted by education, SES, or views about technical skill malleability.
- Results may facilitate development of strategies that aim to improve understanding, acceptance, and safe, effective use of ADASs.

Future Directions
- We are currently running a longitudinal diary study to track the frequency and form of information that people encounter about ADASs.
- We will run verbal protocol studies of ADAS use and neuroergonomic studies investigating brain activity associated with ADAS use during normal and unexpected encounters.

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