

# 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.
- Hypothesis: Judged technological self-efficacy will influence the types of information people use to form mental models of ADASs and predict persona self-selection.

## Methods

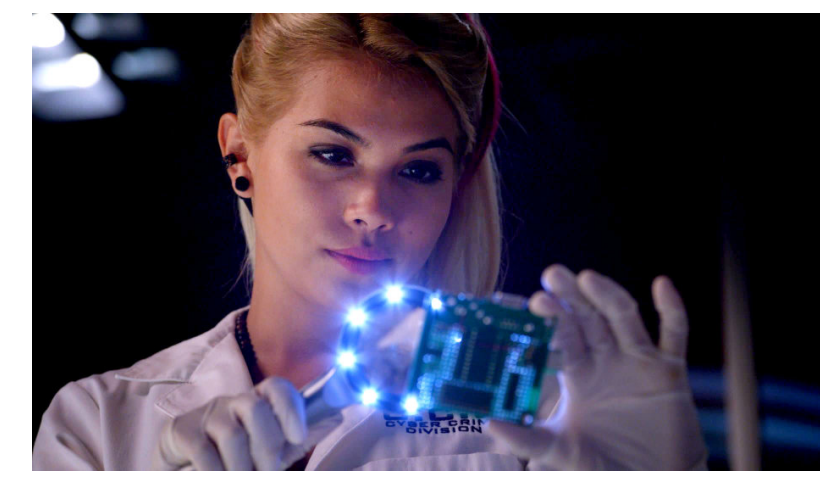
- Participants ( $n = 434$ ) from Amazon's Mechanical Turk
  - Mean age = 35.8 years (range 18 - 82)
  - 56% female
  - Mean Socioeconomic Status (SES) = 5.3 (1-10 scale)
  - Median education level = Bachelor's degree
- Questionnaire designed to assess:
  - Demographics
  - Self-identified Persona (Personas 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 ADAS from other questionnaire items.

## Persona Information - Varied on technological sophistication High $\leftrightarrow$ low

**Roberta** - Tech CEO who uses an autonomous car, travels often, writes code, and tinkers with her 3D printed inventions



**Nick** - Engineer who owns car w/ ADAS. Buys gadgets early, reads tech news, uses a Raspberry Pi 3



**Robin** - Grad student who uses common software packages, owns new-ish phone, uses social media, drives 3 year old Camry



**Mary** - systems analyst, reads Chicago Tribune & Pinterest on older iPad, drives e-car, enjoys baking & painting



**Taylor** - Mom of 3, works at Sears, uses phone to call/text, rarely uses FB account her son set up, volunteers for girl scouts

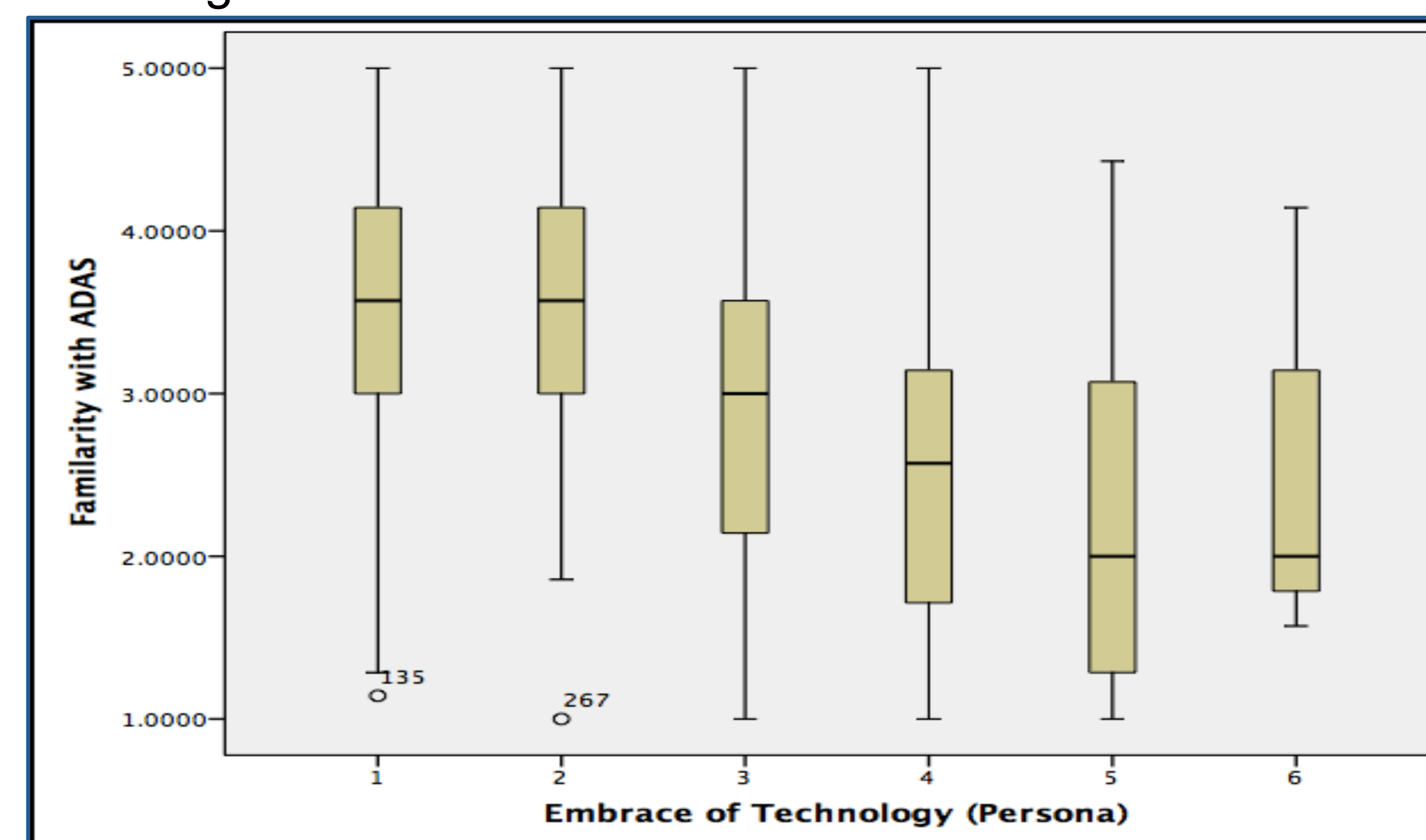


**Ralph** - Dad of 2 adult sons, doesn't see need for tech, reads the paper, keeps flip-phone in glove box while hunting/fishing

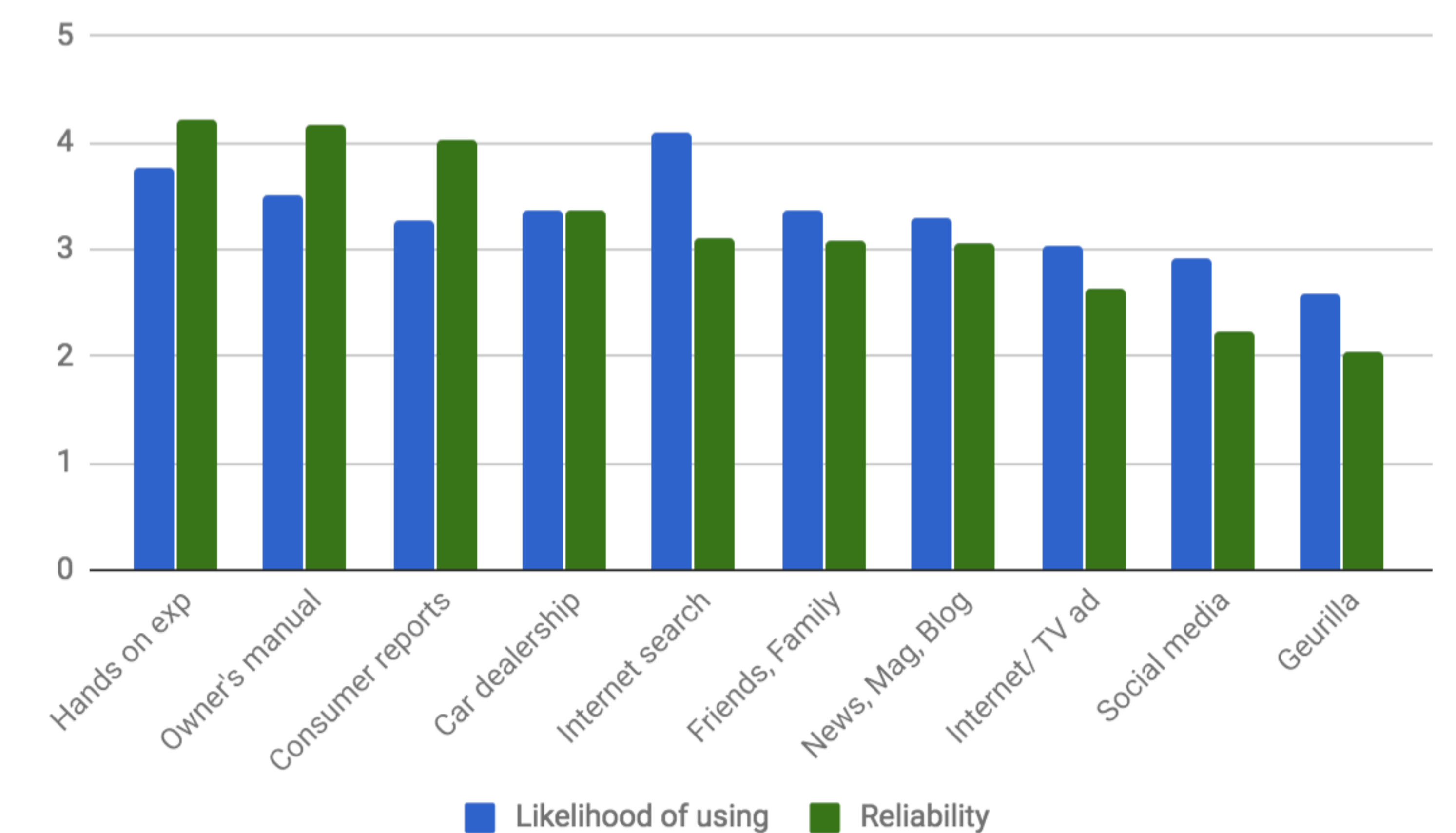


## Results

- 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.



Self-reported likelihood of using sources to learn about ADASs and perceived reliability of each source

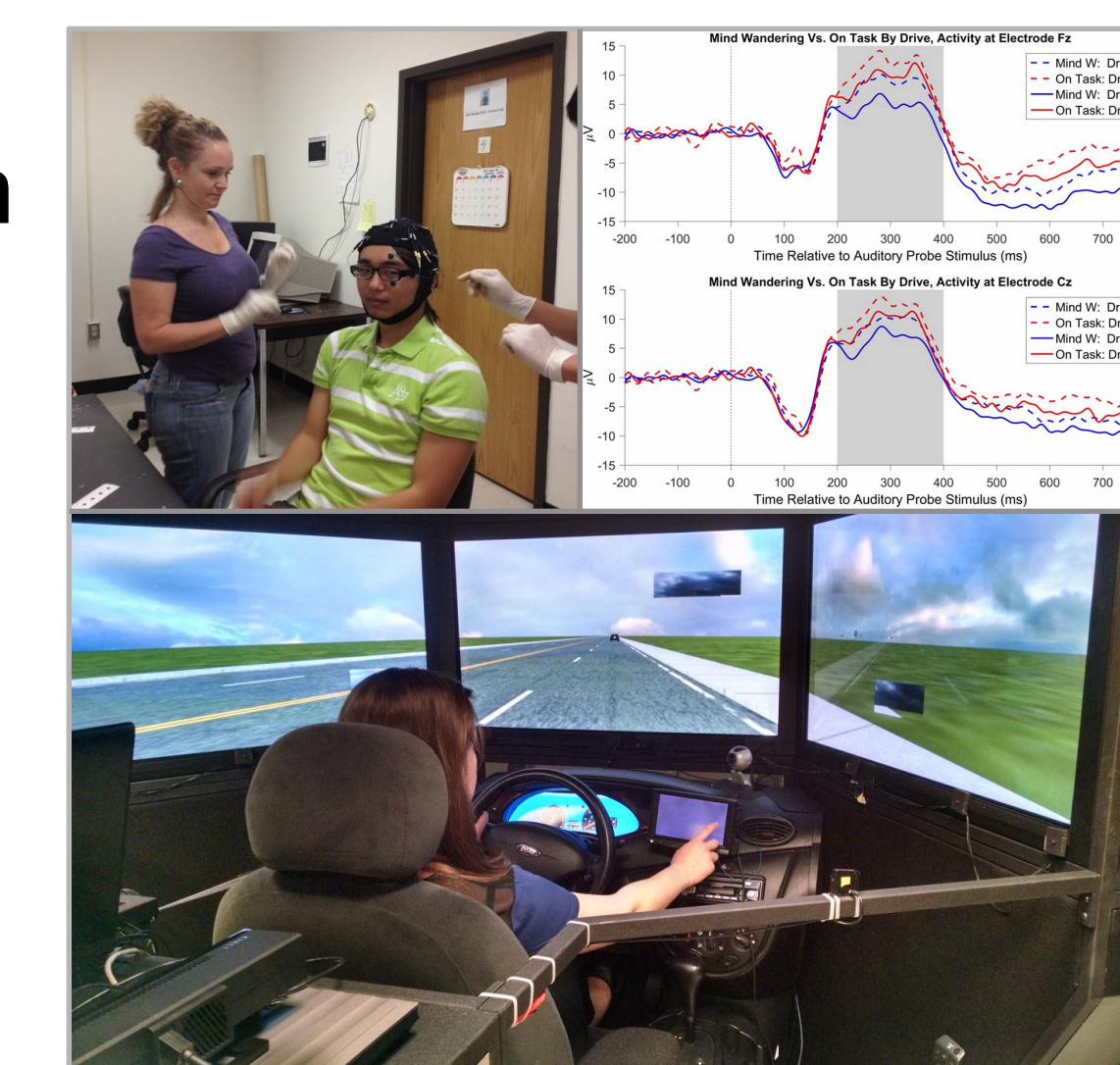


\*likelihood of using a source and that sources reliability correlated at  $r = .663, p = .037$

- Beliefs about flexibility of technical skill related to reported likelihood of using data-based sources (e.g. Consumer Reports, owner's manual;  $r = .194, p < .001$ ), but unrelated to likelihood of using non-data based sources (e.g. TV ads, social media).

## Discussion

- Results suggest that both embrace of technology (Persona) and high familiarity with ADAS 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.