MITSUBISHI ELECTRIC RESEARCH LABORATORIES
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Voice Search “Shortcuts” for In-Car Infotainment

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Last minute speaker change courtesy of volcanic activity, originally

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Context of this talk

- MERL is one of the research labs of Mitsubishi Electric
  - (Not Mitsubishi Motors!)
- MERL speech group focus:
  - Pre/Post processing of speech and audio
  - UI design that can improve the usability of speech interfaces.
- Usability != ASR performance
  - ASR performance affects UI design.
  - UI Design affects ASR performance.

Focus on Push-to-Talk

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State of the Art

- Say anything, anytime? Not exactly.
- System must be told when to listen
- Single push-to-talk (PTT) button launches a dialog
- Content “silos” improve accuracy
  - Single-shot approaches are emerging, but thus far are domain-restricted.

Remix of image by Wikimedia contributor “Cerafino”

What Else are Buttons Good For?

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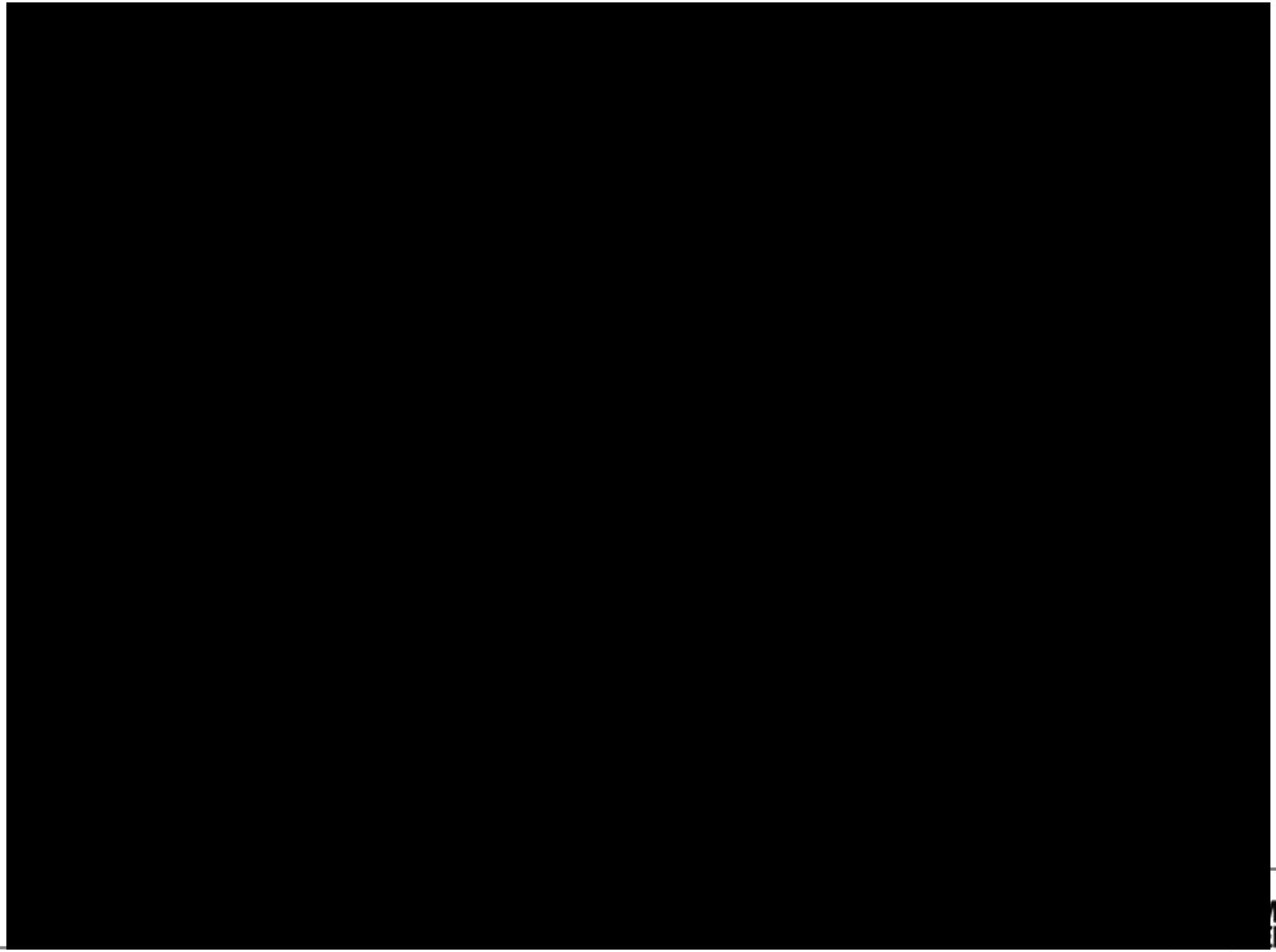
Contextual Push-to-Talk

- *Any* button can be a “listen” button
  - Just tap twice instead of once
- Choice of button provides context to ASR engine
  - Search *what*
  - Shuffle *what*
  - Call *whom*
- Advantages:
  - Skip dialog steps
  - Exploit motor memory
  - Augment rather than replace existing UI

Experimental Validation

- Research Question:
  - Are multiple, contextual push-to-talk buttons better than the conventional, single-PTT approach?
- Hypotheses:
  - Multi-PTT allows for faster task completion.
  - Driving performance and visual attention using Multi-PTT are no worse than Single-PTT.
- Setup:
  - MERL Driving Simulator
  - Eye tracker (Seeing Machines' FaceLAB)
  - 18 subjects (all tried both interfaces and drove a control session)



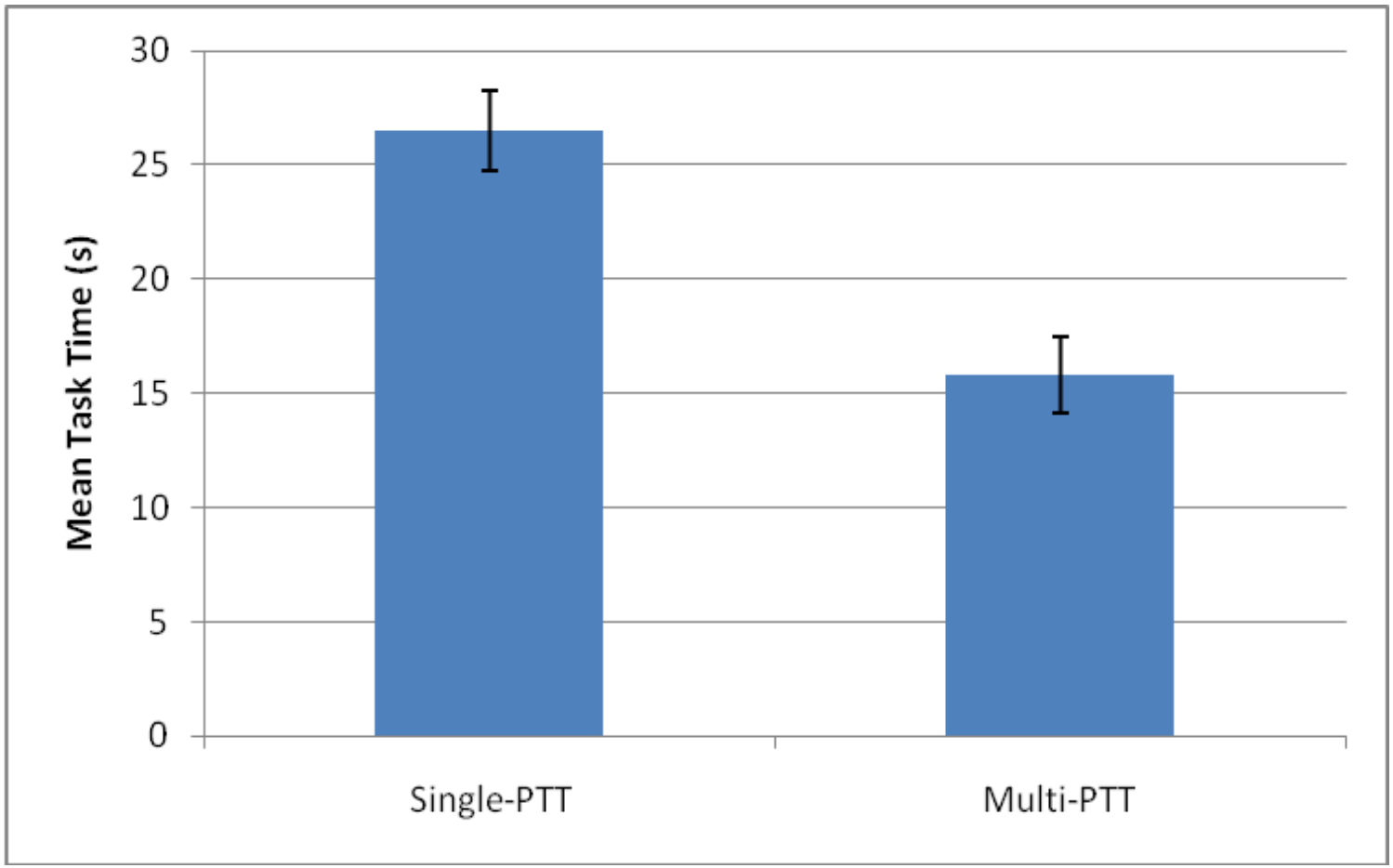
Experimental Results

- No significant difference between Single- and Multi-PTT in steering or lane keeping
- Significant differences found:

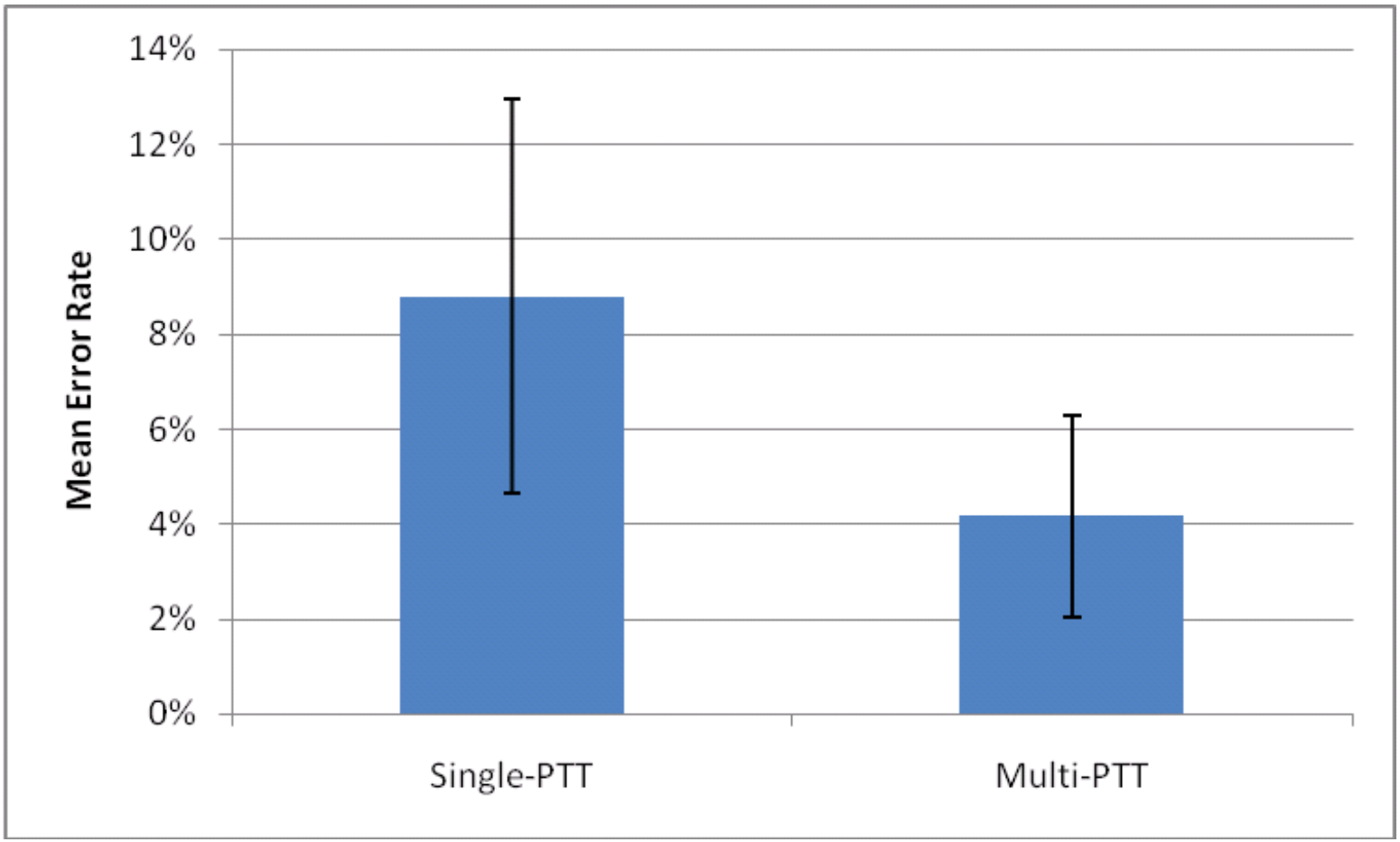
Measure	Single-PTT	Multi-PTT
Variance in following distance (lower is better)	106.7	42.3
Glances away from forward roadway (avg. per task)	11.2	7.9
Workload (NASA Task Load Index) → control session (driving only) rated 29.5	55.2	49.1
Mean task time (seconds)	**26.5**	**15.8**
Mean task error rate	**8.8%**	**4.2%**

- Questionnaire results: 78% of subjects would prefer using the Multi-PTT variant in their cars

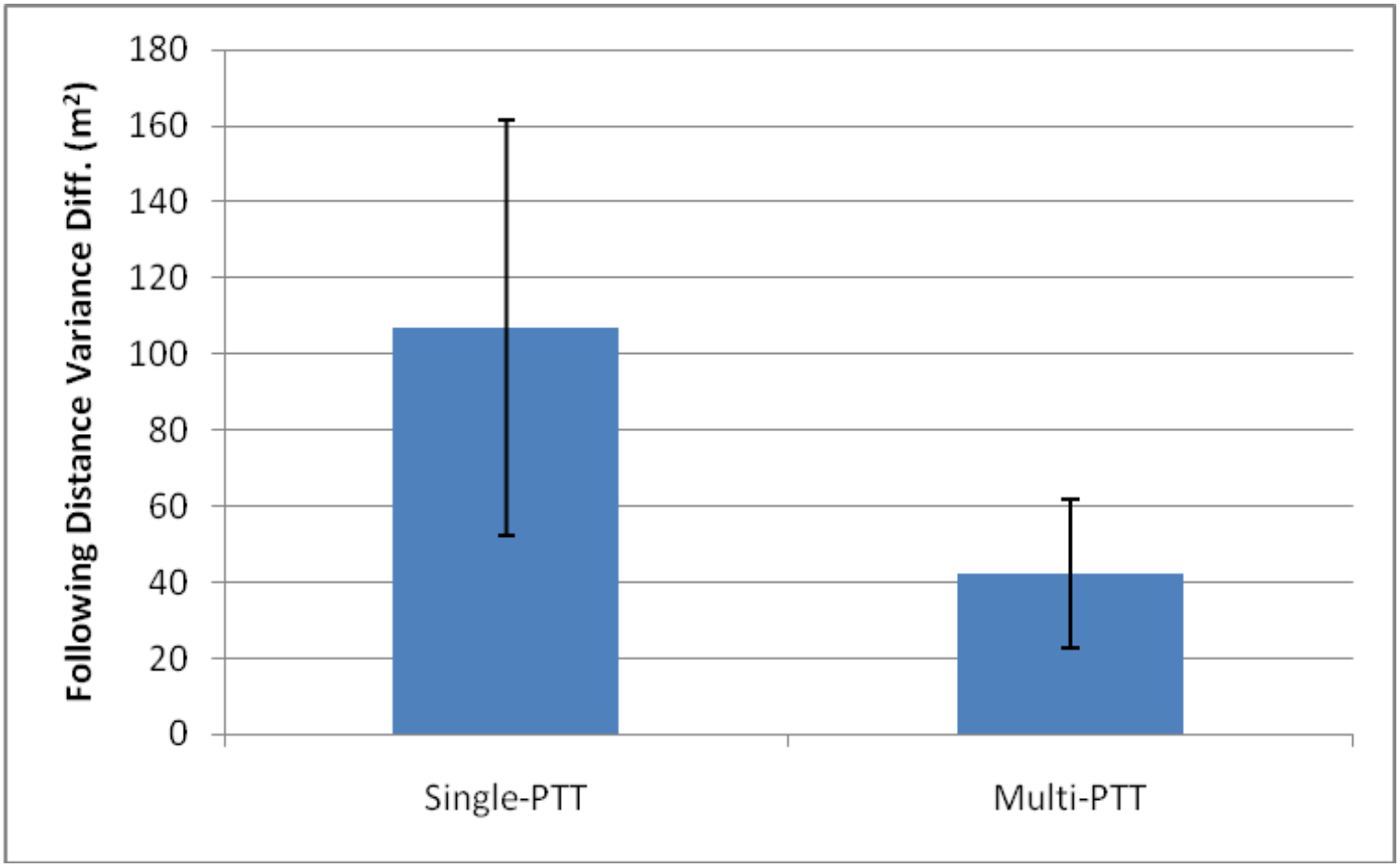
Experimental Results – Mean Task Time



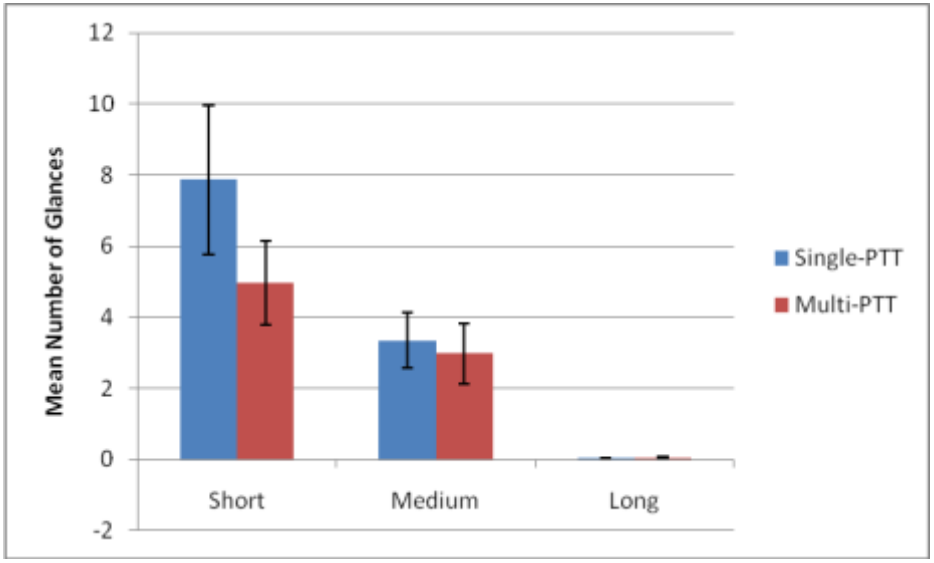
Experimental Results – Mean Task Error Rate

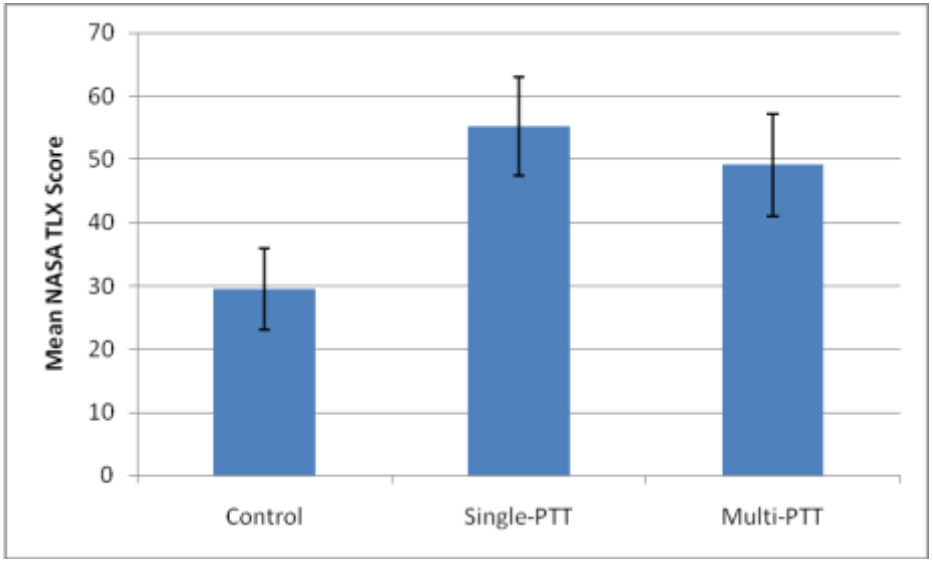


Experimental Results – Variability in Following Distance



Experimental Results – Eye Gaze and Workload





Summary

- We proposed and validated multiple, contextual PTT buttons.
- Interaction durations were reduced, and more attention was paid to the driving task at hand.
- The design is simple and intuitive.

Acknowledgements

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For more details, please see our upcoming publication:

Weinberg, G. et al. “Contextual Push-to-Talk: Shortening Voice Dialogs to Improve Driving Performance.” To appear in *Proceedings of the 12th International Conference on Human-Computer Interaction with Mobile Devices and Services* (MobileHCI 2010).