The Effect of Speech Interface Accuracy on Driving Performance

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In-car speech interfaces can be used for:

- Control of devices in police cruisers (Project54),
- Voice dialing,
- Navigation,
- Music.

Speech interface design factors:

- Speech recognition accuracy,
- Push-to-talk (PTT) button,
- Dialog repair strategy.

Problem

What is the influence of these factors on driving performance?

Factorial design experiment with three factors:

- Speech recognition accuracy (89% and 44%),
- PTT (with and without),
- Dialog repair (misunderstanding or non-understanding).

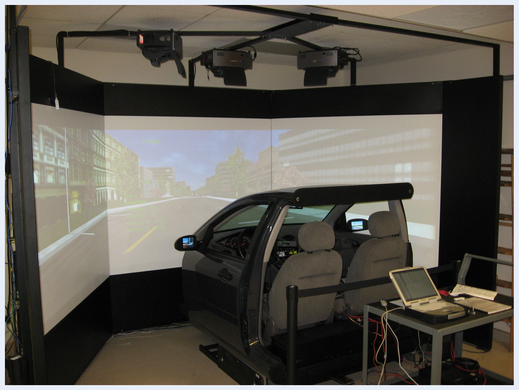
Driving performance measures:

- Lane position,
- Steering wheel angle,
- Velocity.

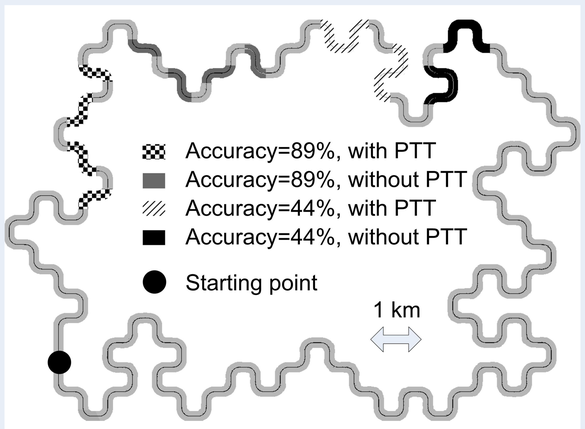
Higher variances of these variables indicate worse driving performance.

Experiment description:

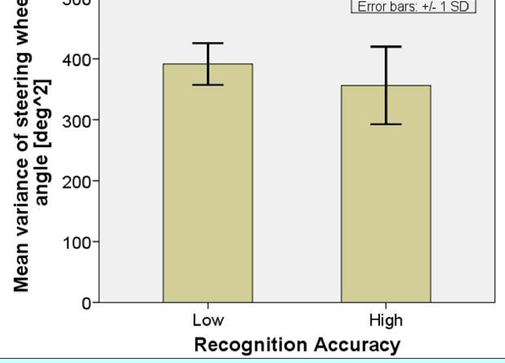
- High fidelity driving simulator



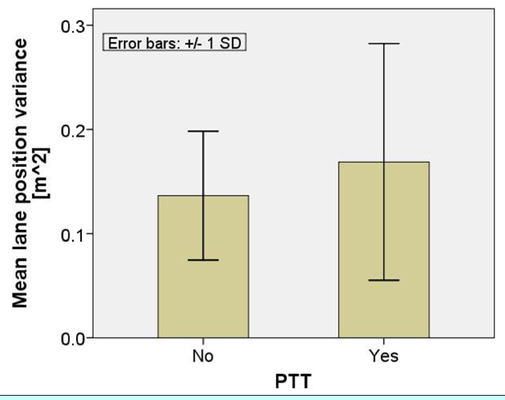
- 20 subjects = 10 misunderstanding + 10 non-understanding
- Within subject variables: PTT, speech recognition accuracy (counterbalanced)
- Between subject variable: dialog repair
- Simulation – curvy road



Steering wheel angle variance is higher (worse driving performance) when the speech recognition accuracy is *Low*.



Lane position variance is higher (worse driving performance) when the speech recognition accuracy is *Low* and the PTT button is used.



Conclusions:

- The level of speech recognition accuracy significantly influenced variance in steering wheel angle ($p<.001$). Low accuracy resulted in worse driving performance (higher steering wheel angle variance).
- Interaction between speech recognition accuracy and the use of PTT significantly affected lane position variance ($p<.05$). When accuracy is very low, operating the PTT button is distracting.

Future direction:

Recognition accuracy and PTT usage indeed influence driving. What are the interactions with other factors that influence driving performance? For example:

- In our experiment, the PTT button was on the center console. How does the PTT button location influence driving?
- Poor recognition causes user frustration. When does frustration occur and what is its influence on driving performance?

ACKNOWLEDGEMENT

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