Functional near-infrared spectroscopy: Relatively new brain sensing technology that is portable and non-invasive, enabling brain sensing in environments that would not be possible with most traditional imaging techniques.

Motivation

- Study whether fNIRS has promise as an assessment method for in-vehicle tasks
- Determine the feasibility of measuring fNIRS signals during driving tasks
- Investigate sensitivity of fNIRS to working memory demands

Experiment

- Driving task, plus secondary task
- Participants sit in car and drive in the simulated environment, wearing fNIRS
- While driving, they will receive auditory prompts to perform "n-back" tasks of varying difficulty levels.

Working Memory Task (n-back):

- Serves as a proxy for various secondary tasks that a driver may perform
- Well-established capacity for eliciting scaled levels of working memory demand
- Series of 10 single digit number (0-9)
- Numbers presented in random order aurally
- Each task level presented as 30s set
- Demand level approaches "capacity"

Stimulus	6917084352
o-back Response	6917084352
1-back Response	. 6 9 1 7 0 8 4 3 5
2-back Response	6 9 1 7 0 8 4 3

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Brain Sensing with fNIRS in the Car

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- Quick set up time
- Comfortable
- Measures oxygenation and blood flow in brain
- **Practical for real-world settings**
- Goals
- Establish features in the signal that accurately classify the driver's working memory demand
- Develop analysis methods and techniques suitable for such tasks
- Combine fNIRS with other sensors to get a more reliable classification
- Expand this to more realistic tasks, and to realtime assessment



The participants sit in the red car (back, right) and are instrumented with fNIRS and other physiological sensors (EKG, skin conductance). The screen in the front presents the simulated driving environment.

Driving Simulator

- Fixed-base, full-cab Volkswagen New Beetle
- 8 × 8ft projection screen
- Approx. 40-degree view of virtual environment
- Resolution:1024 × 768 pixels
- Graphical updates to virtual world computed based on interaction with wheel, brake, and accelerator
- Additional feedback provided through wheel's force feedback system and auditory cues

