Neuroergonomic Differentiation: Mobile Navigation Displays

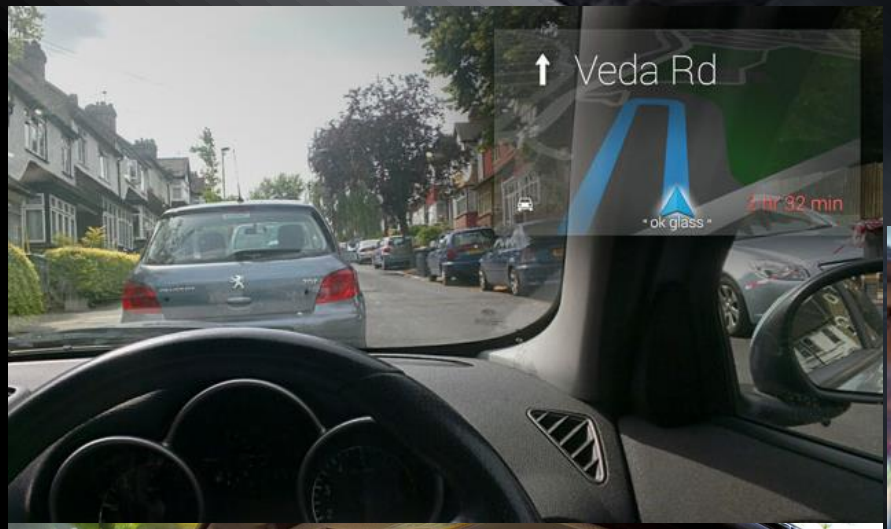
THE VALUE OF PERFORMANCE.
NORTHROP GRUMMAN

3/7/17

Ryan D. McKendrick PhD
Applied Cognitive Scientist

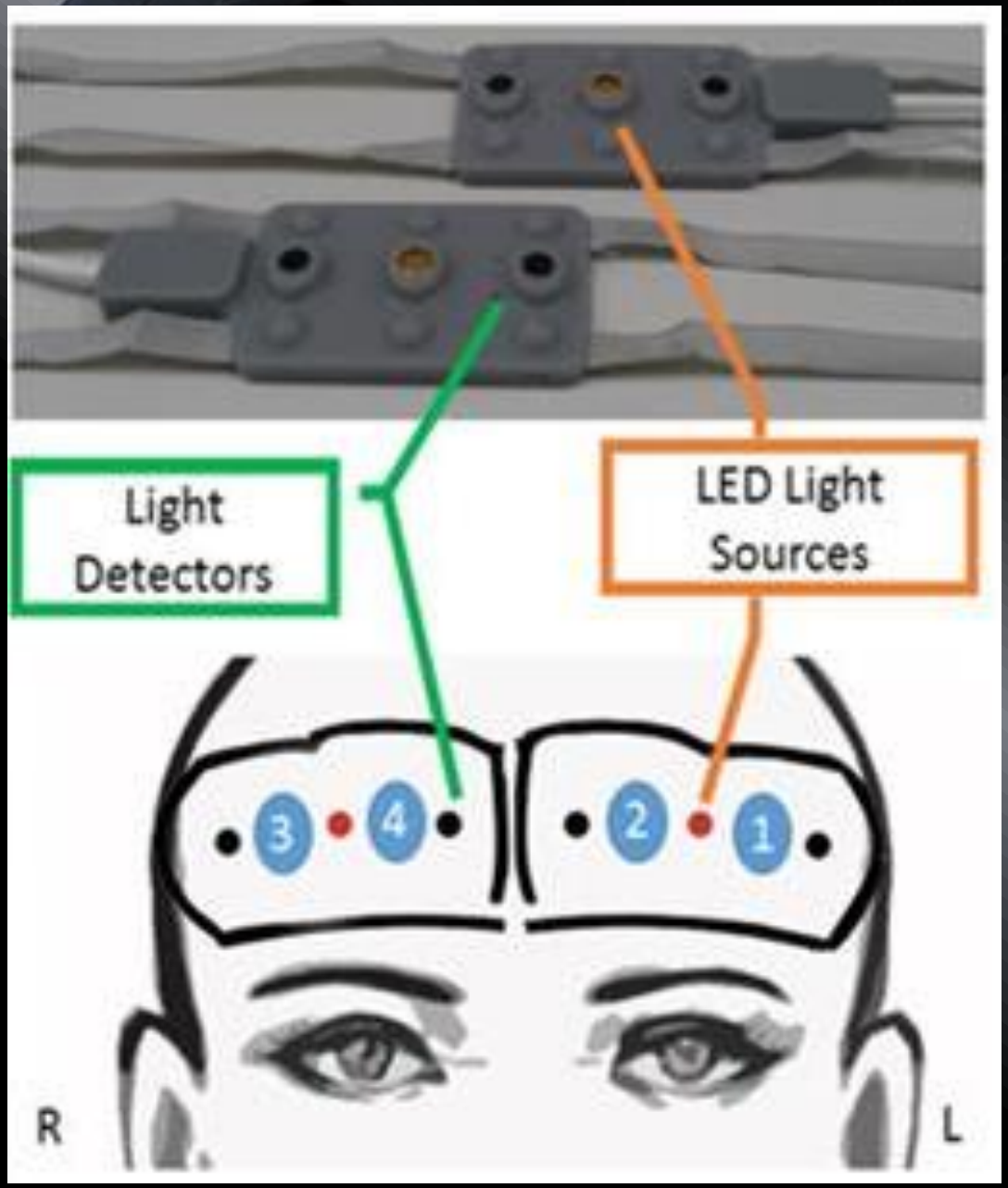
Augmented Reality Wearable Displays (ARWD)

Observed Benefits



Potential Downsides

Objective Assesment



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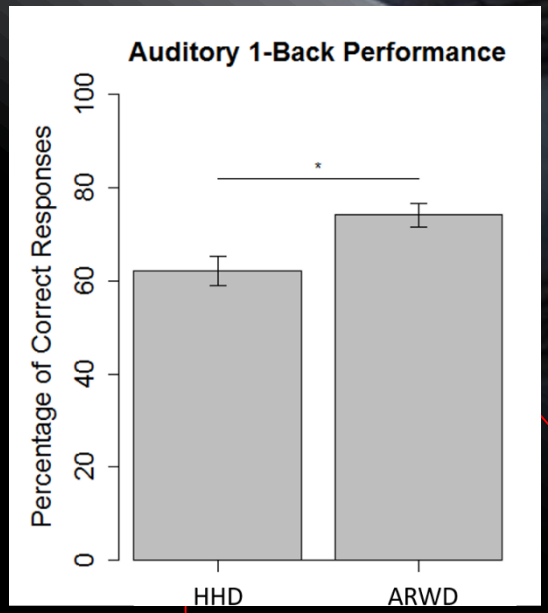
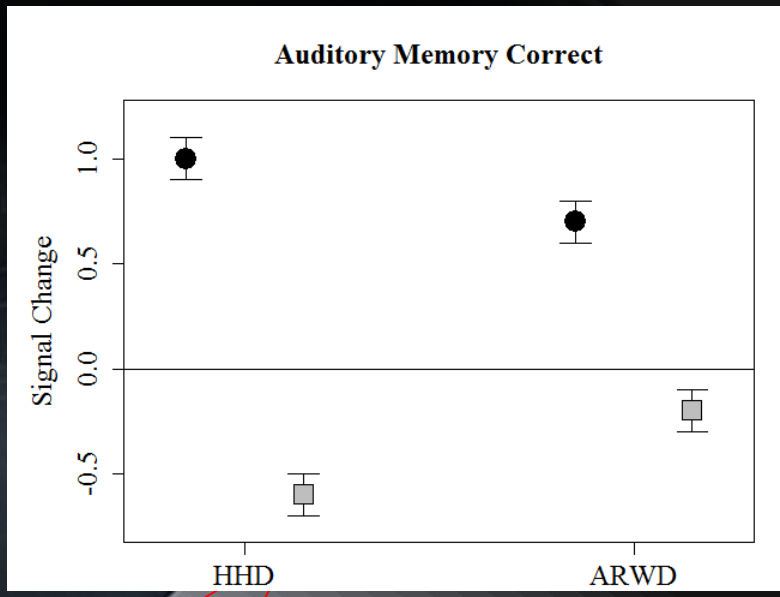
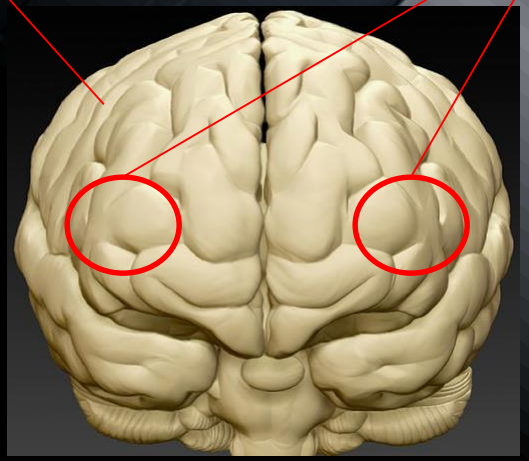
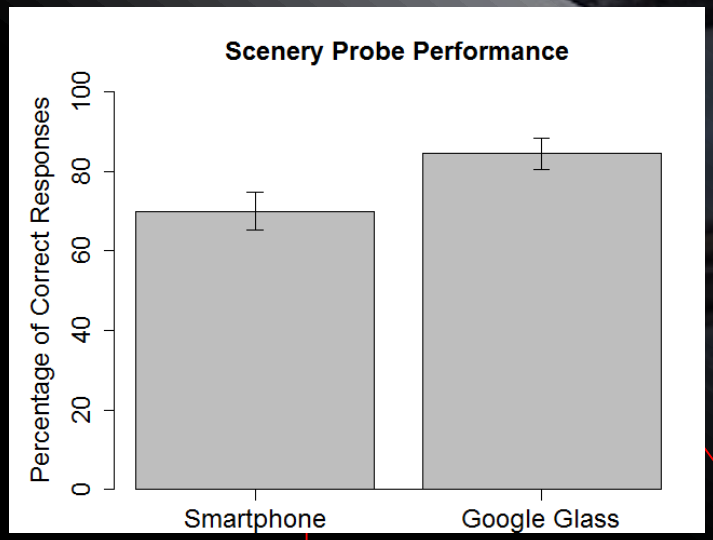
Hypotheses: Cognitive Load

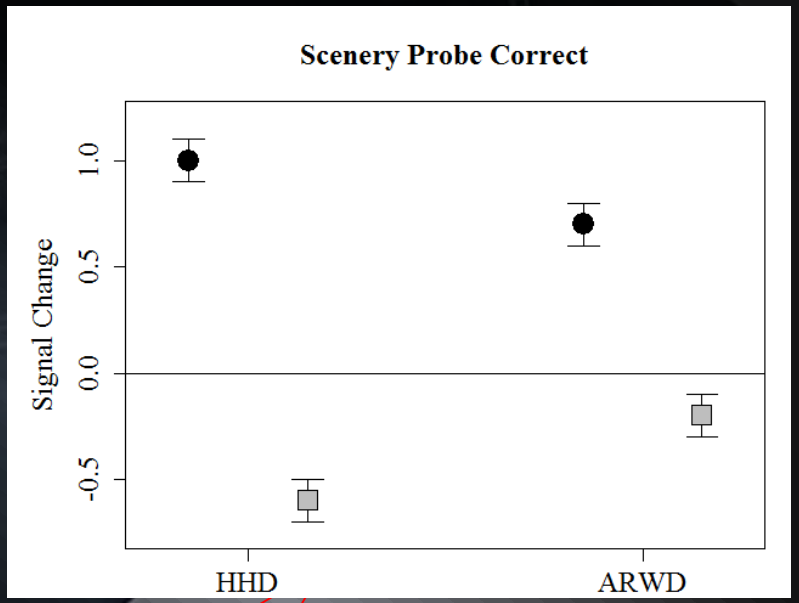


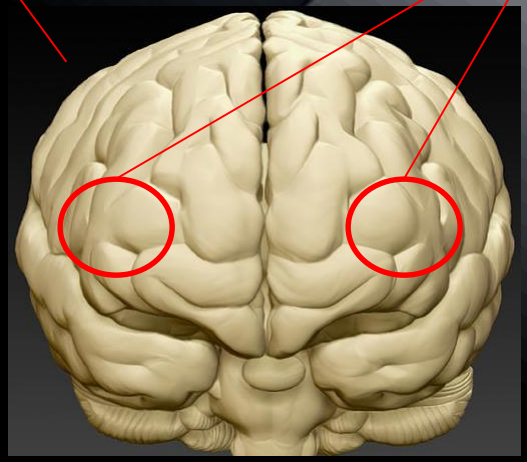




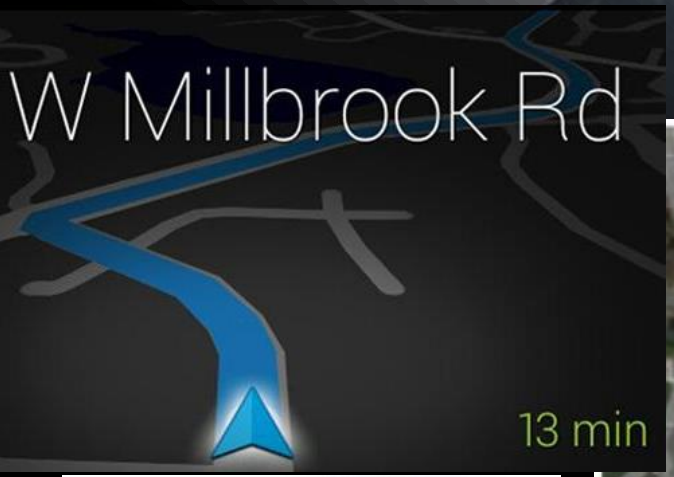
Hypotheses: Situation Awareness

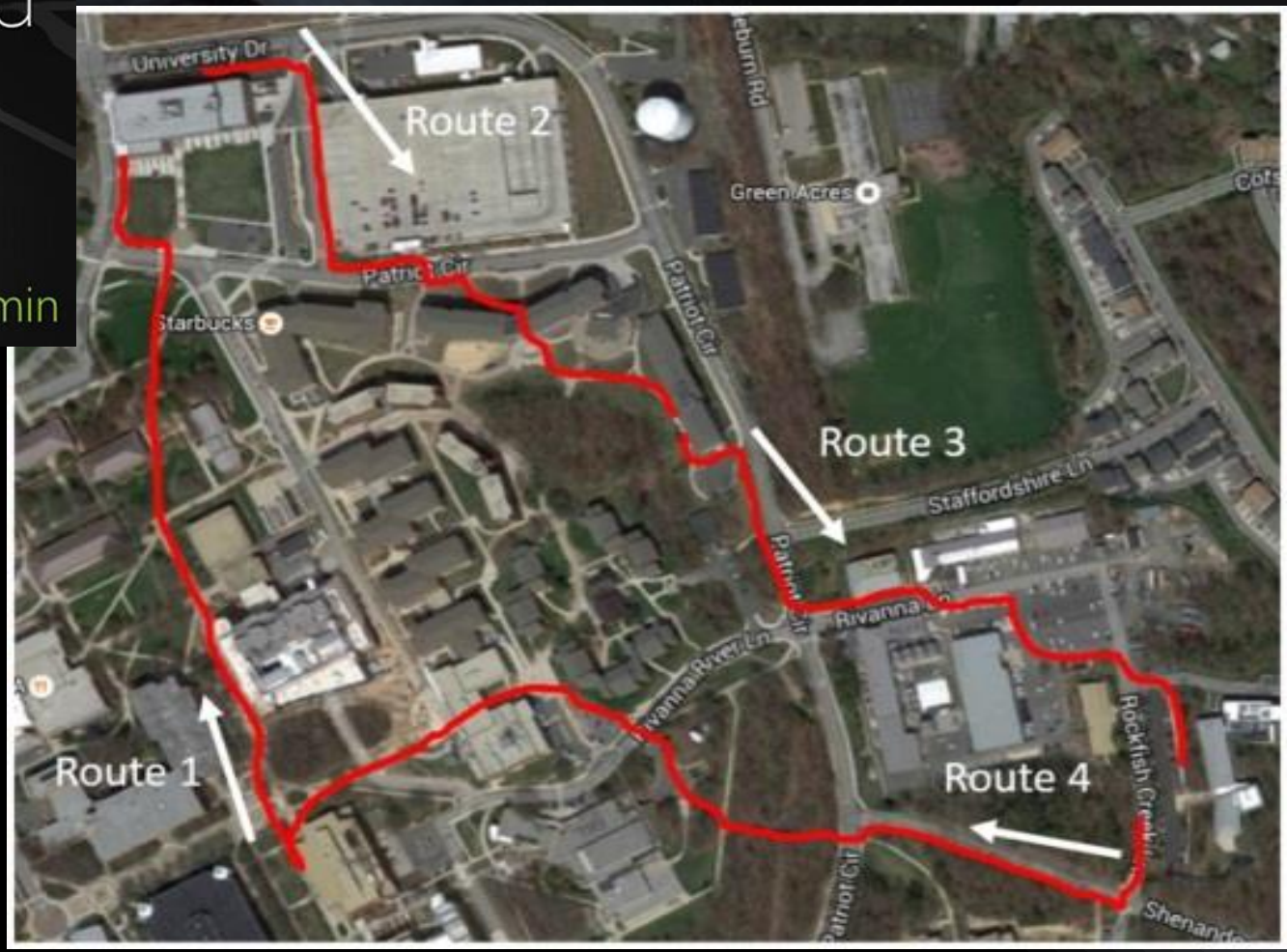






Primary Task: Visual Route Following





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Secondary Task: Cognitive Load

One-back Auditory Memory (AM) Task

Count the matched triplets

Match!

Beep-Bop-Boop……Bop-Bop-Beep…..

Beep-Beep-Boop…..Beep-Beep-Boop…..

Bop-Bop-Bop…..Beep-Bop-Bop

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Secondary Task: Situation Awareness

Scenery Probe (SP) Task

Did You see an American flag?

Yes!

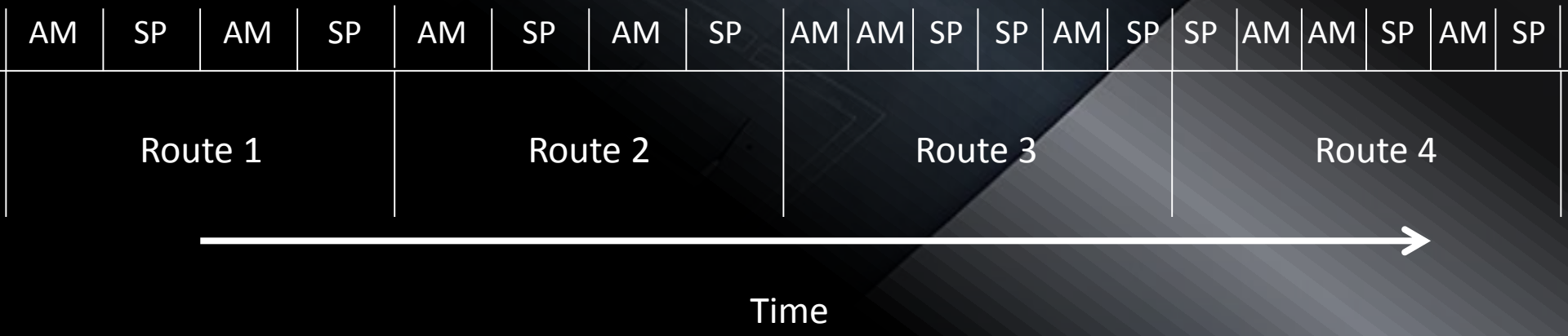
Did You see a water fountain?

No!

Primary and Secondary Task Scheduling

Scenery Probe (SP)

Auditory Memory (AM)



Functional Near Infrared Spectroscopy (fNIRS): Setup and Processing

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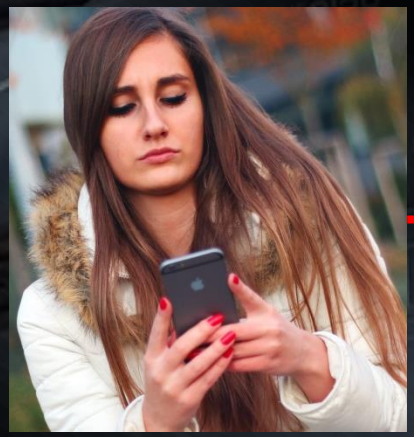
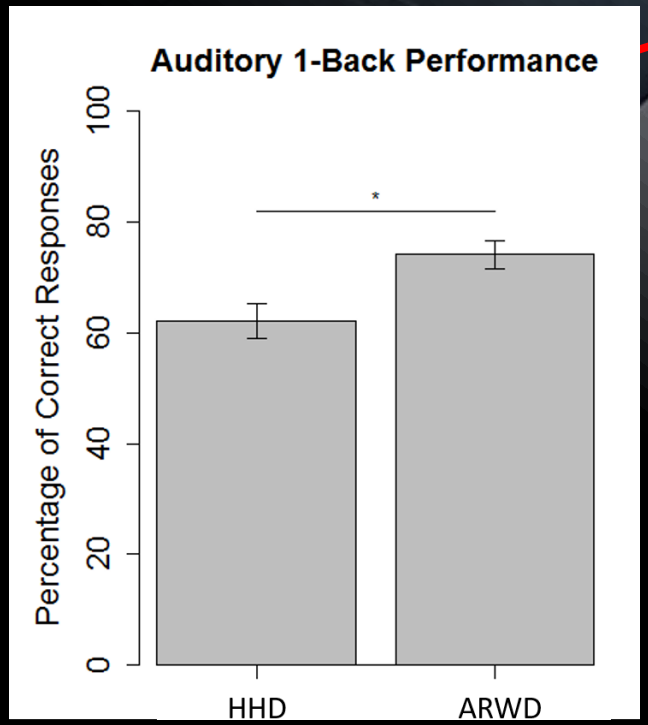
Behavioral Results: Auditory Memory

vs.





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Behavioral Results: Scenery Probe

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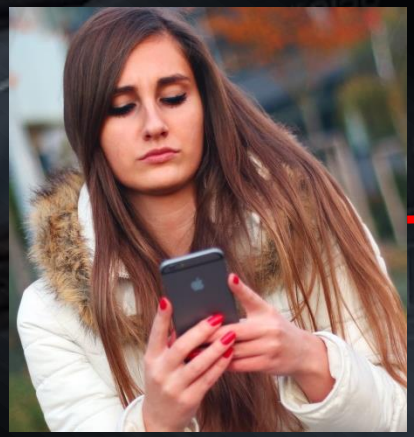

Did You see an American flag?

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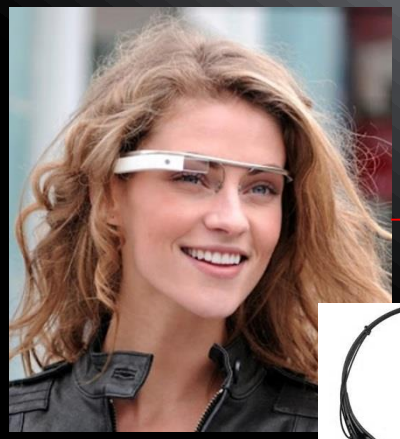
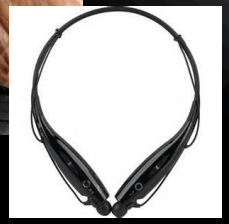
fNIRS: Auditory Memory Results





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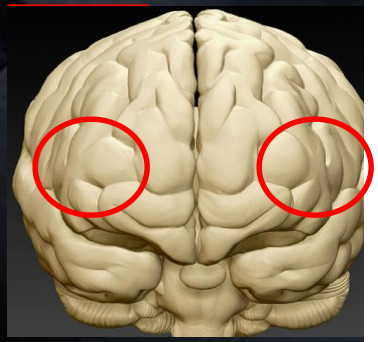

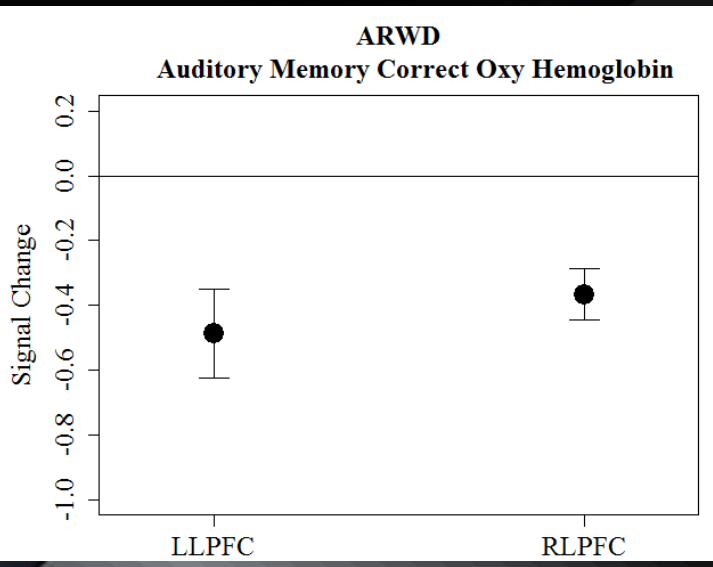

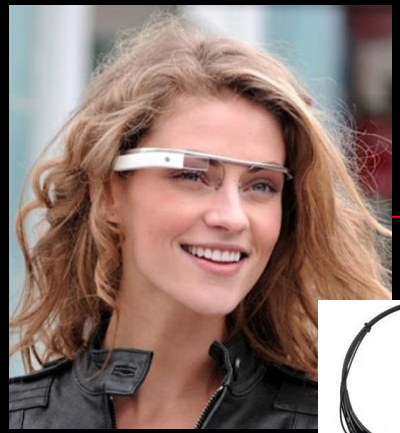

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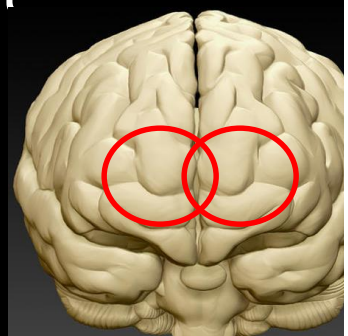

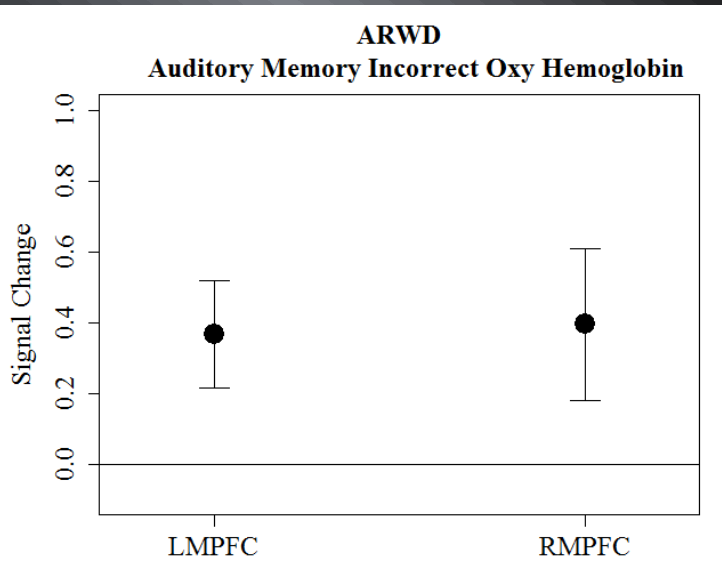

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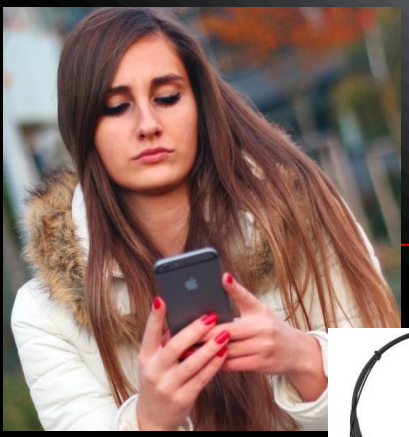
fNIRS: Auditory Memory Results



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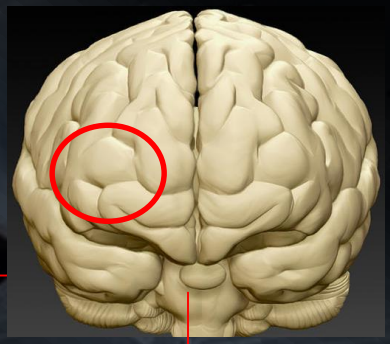
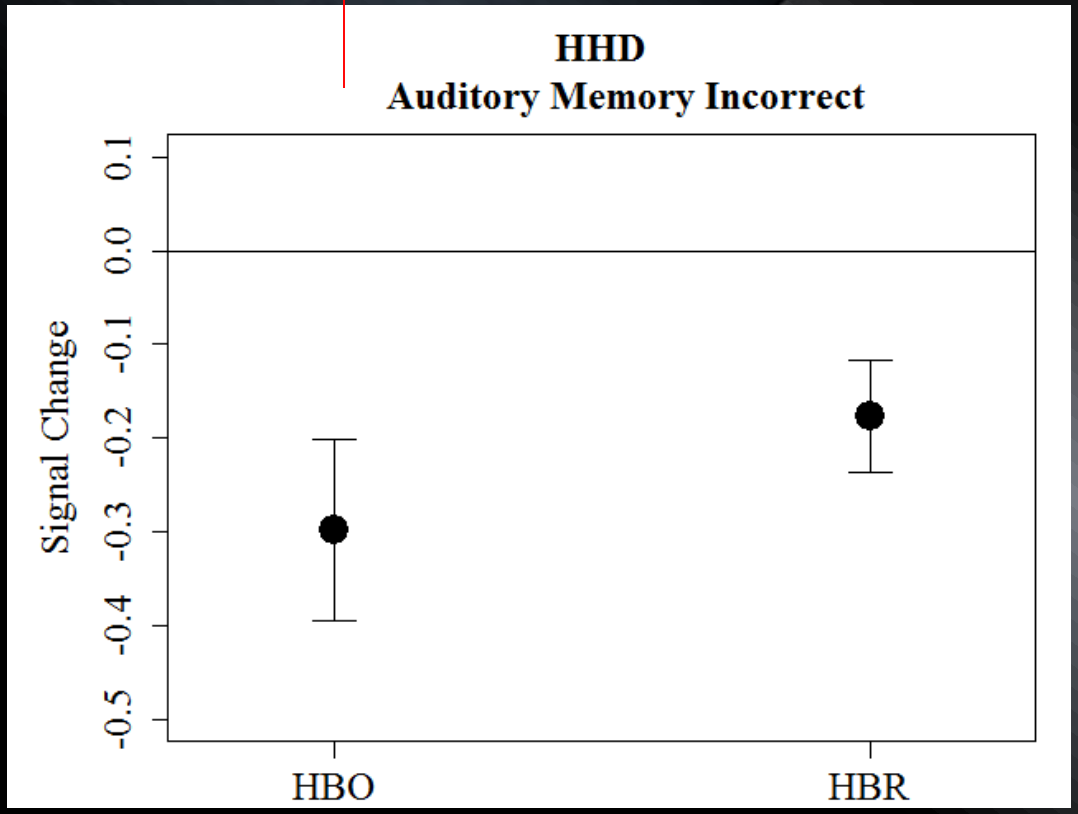
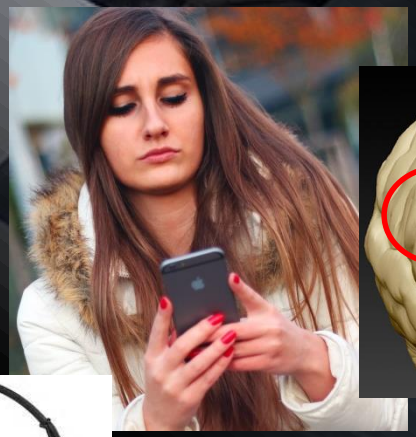




fNIRS: Auditory Memory Results

vs.



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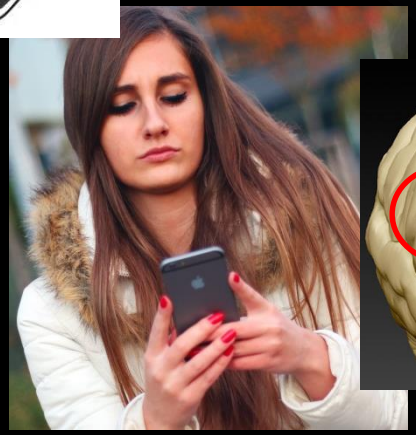
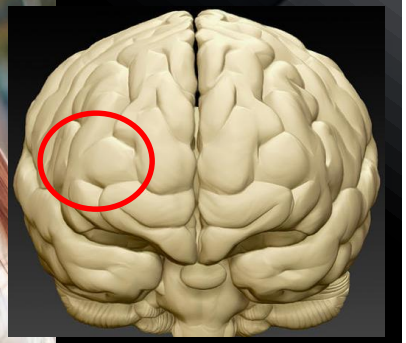
vs.





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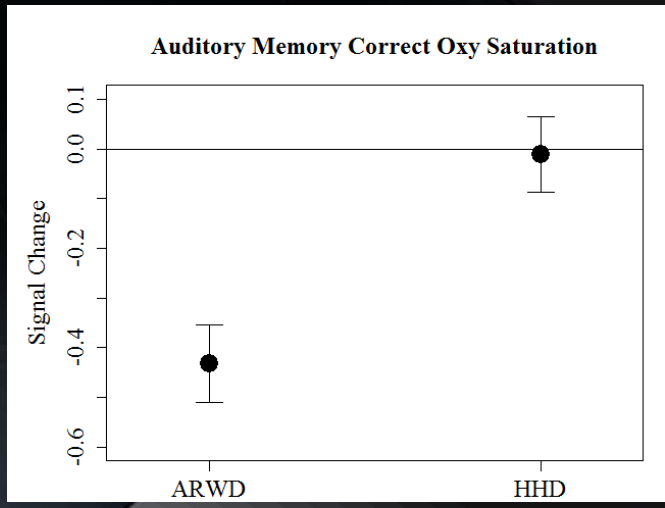

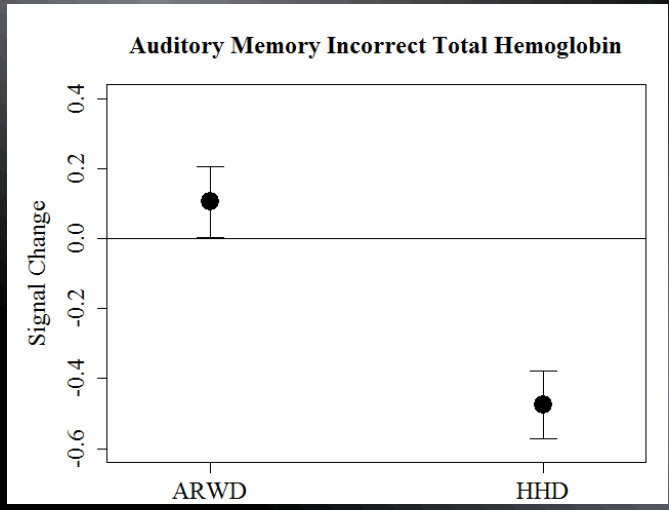

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fNIRS: Scenery Probe Results

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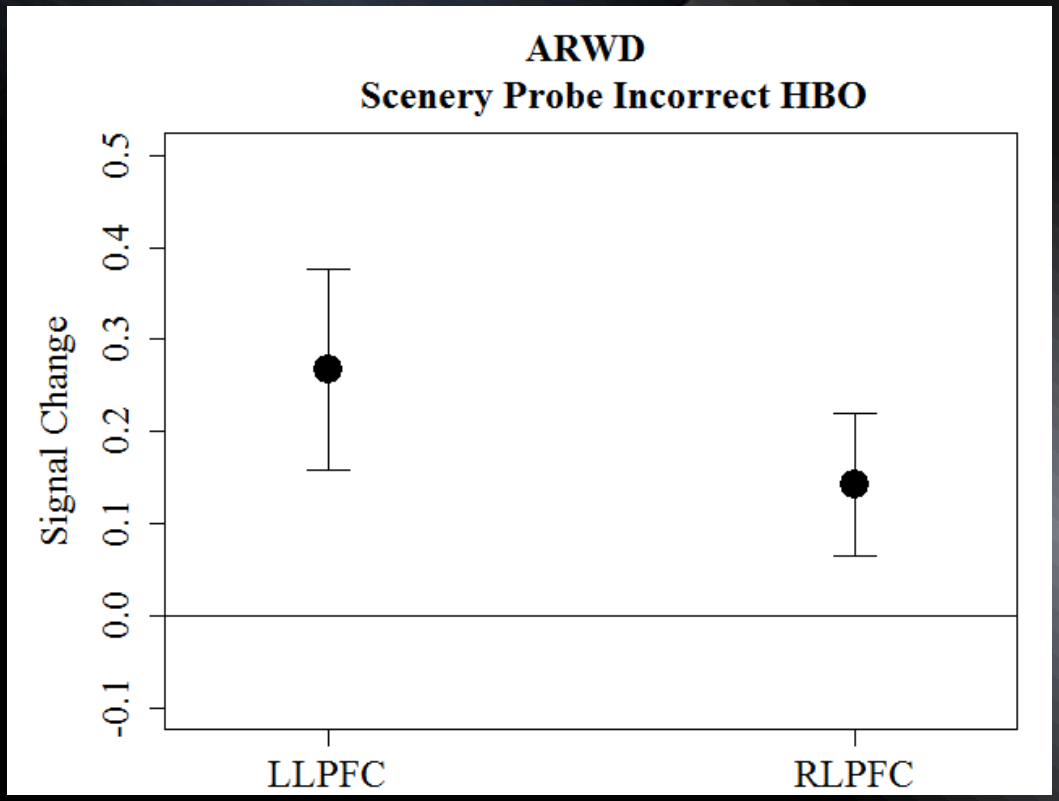

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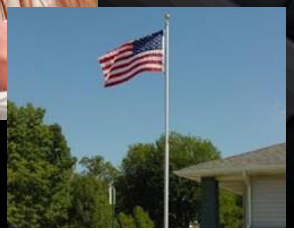

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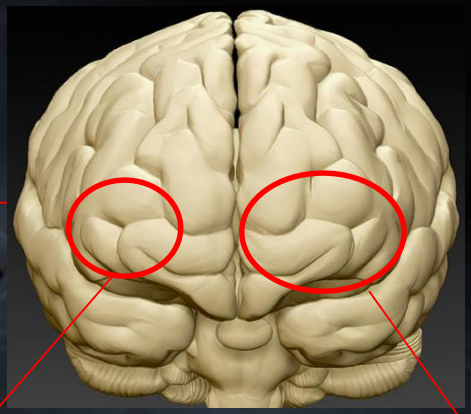

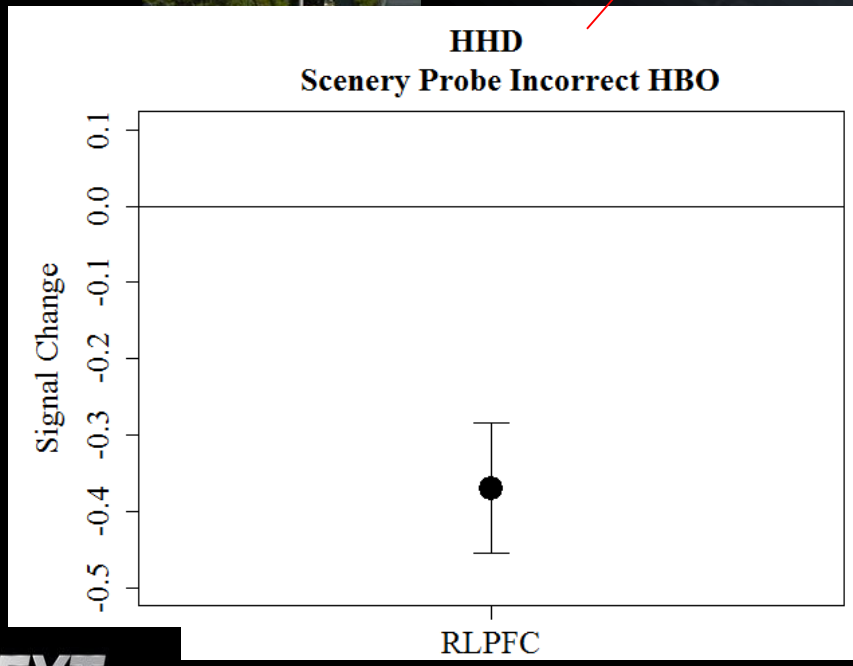

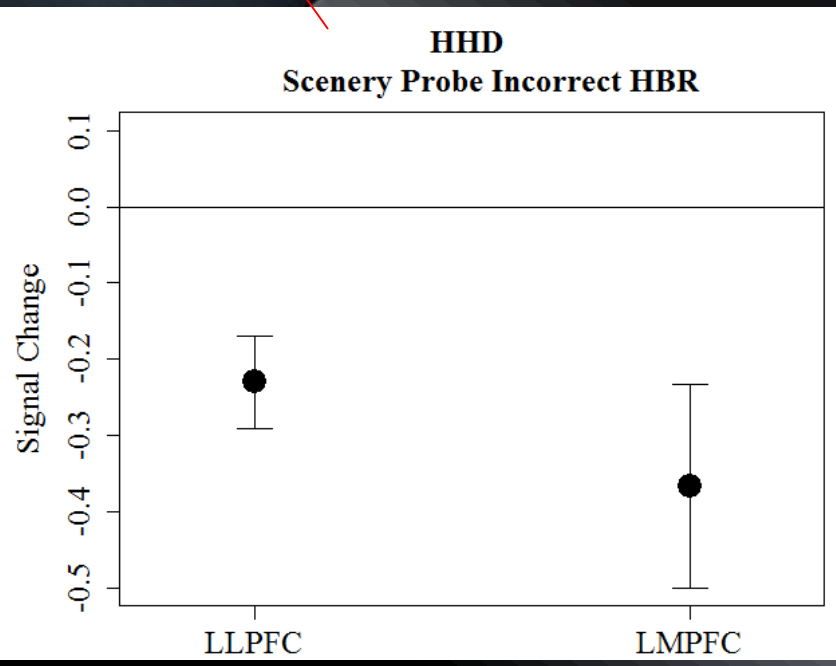

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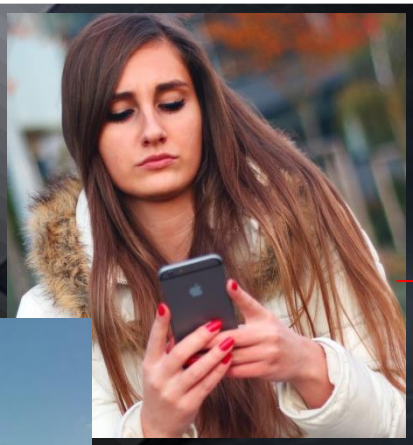

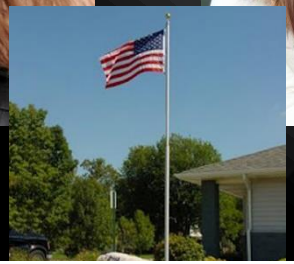

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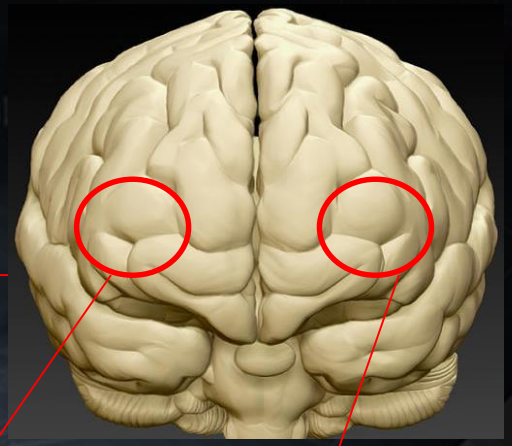

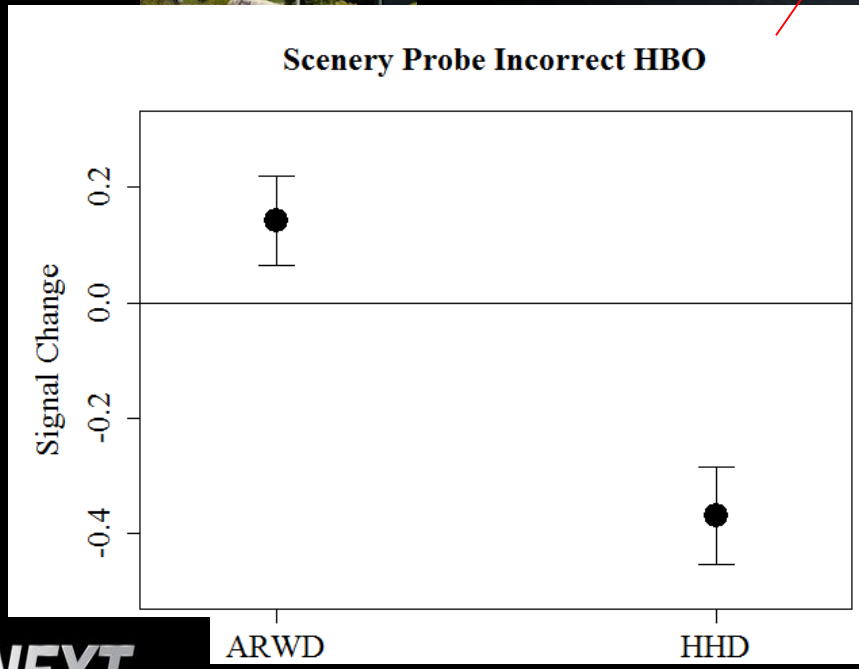

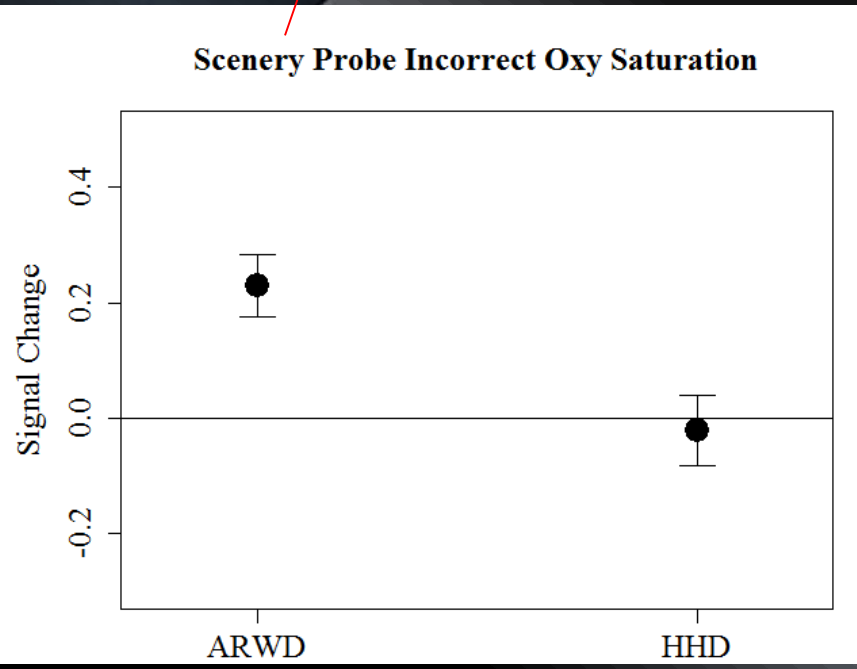

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Conclusions

- ARWDs more efficiently use cognitive resources during ambulatory navigation

- Scenery errors differed, the direction of neural effects suggests cognitive capture for ARWD and task shedding for HHD

Limitations

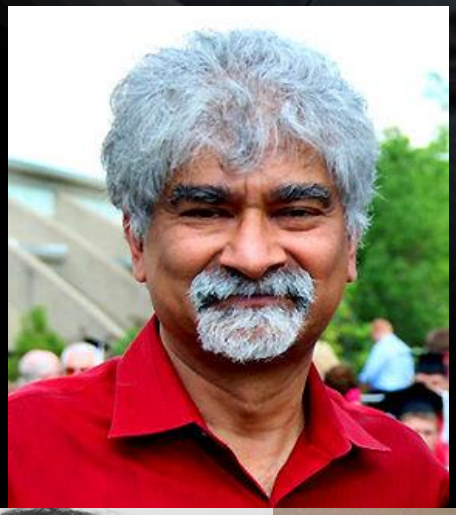
- Imaging area was Limited
- Improved paradigm validity for warfighter

Next

- Eye-tracking to validate cognitive capture in ARWDs during mobile work
- Parametric load, relevant to displayed information

Dedications and Questions

McKendrick, R., Parasuraman, R., Murtza, R., Formwalt, A., Baccus, W., Paczynski, M., & Ayaz, H. (2016). Into the wild: Neuroergonomic differentiation of hand-held and augmented reality wearable displays during outdoor navigation with functional near infrared spectroscopy. *Frontiers in human neuroscience*, *10*.



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