The Effect Of Concussions on Sensory Integration and Spatial Updating

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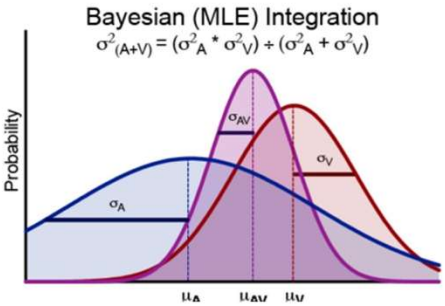
Background

- Humans integrate sensory information in a statistically optimal manner, weighting each cue based on reliability according to the Bayesian principle (Chen et al., 2017).
- Concussions affect central sensory integration, which is used for mobility, navigation, and balance (McFarlane et al., 2020).



Research Questions

1. How do concussions affect spatial updating for complex navigation?
2. What are the differences in self-motion perception and auditory processing between healthy individuals and those with concussions?
3. How do concussions affect optimal integration of sensory information in the context of spatial navigation?

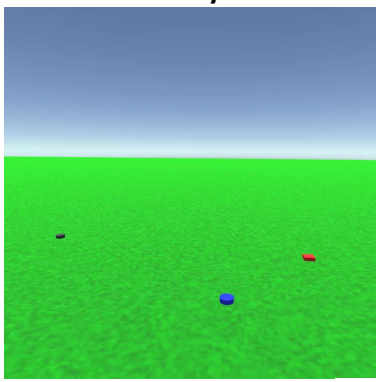
We present preliminary results on healthy participants

Methods

Triangular homing task

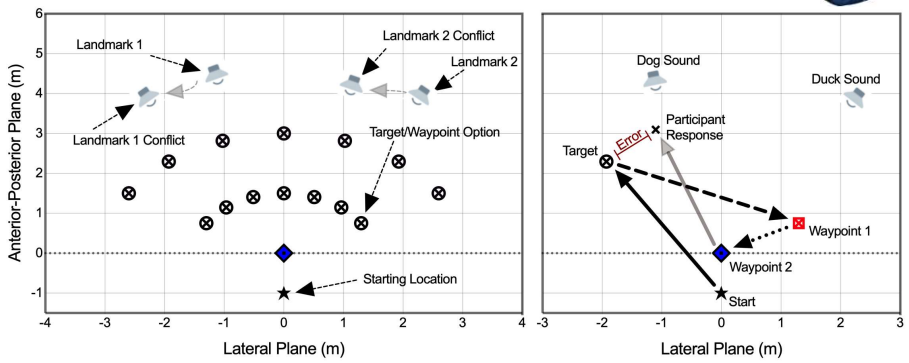
- Participants **(*N* = 3)** walk on a triangular path, receiving self-motion and/or auditory cues, then are asked to return to the starting point.
- The homing task enables the manipulation of sensory information and investigation into participants' cue weighting during navigation.
- Conflict condition of auditory landmark is shifted to determine if participant puts more sensory weight on auditory or visual cues

Virtual Reality Task

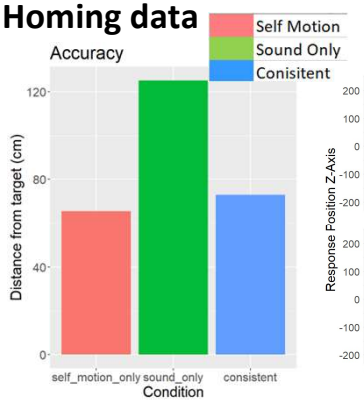


Condition	Manipulation
Self-motion	Auditory landmarks are disabled
Audition	Participant spun in chair to take away self-motion cues
Consistent	Both Self-motion and Auditory Cues are available
Conflict	Auditory landmark covertly shifted 15 degrees

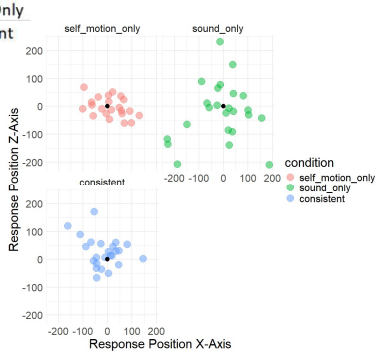
Virtual Reality Headset: Vibe HTC Pro



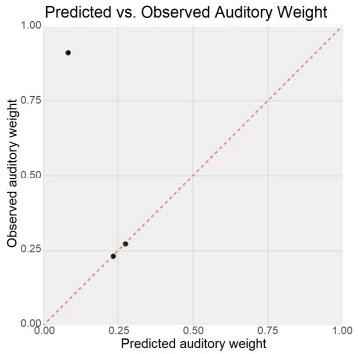
Homing data



Control Group



Cue Weighting



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Hypotheses

H1: Accuracy will improve with two consistent cues compared to sound only.
H2: Predicted and observed weights will correlate in healthy participants, supporting optimal cue combination.
H3: Concussions disrupt cue integration, leading to less benefit of two consistent cues (accuracy will not improve vs. single cues) during spatial updating (TBD)

Discussion

- As of spring 2024, data collection remains on going with current recruitment of concussion patients .
- Although still inconclusive, data from controls aligns with findings from Shayman et al. (2024), suggesting that individuals are more accurate with spatial updating using self-motion cues compared to auditory cues alone.
- Preliminary data suggest control participants optimally weighed visual and self-motion cues according to Bayesian principles, consisted with findings by Chen et al. (2017).

Future Study Plans

- We will be able to compare data from concussed participants with a healthy control group to measure the impact concussions have on sensory integration and spatial updating.
- Examining how our brains integrate sensory information can provide valuable insights into the rehabilitation and management of individuals affected by concussions.

References

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