Highway to the Danger Zone: Fatigue Assessment in a Flight Simulation

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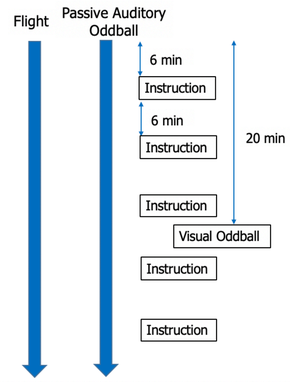
INTRODUCTION

- Fatigue has been identified as one of the leading causes of accidents and performance impairment in the workplace with cognitive fatigue often experienced during prolonged tasks requiring high cognitive effort.[1-5]
- Pilot fatigue is a safety risk in aviation and responsible for 4-7% of civil accidents.[6]
- Both active and passive auditory oddball tasks have been shown to elicit a P300 response, an ERP commonly associated with fatigue and cognitive performance, with the passive test having the advantage of being able to be run simultaneously with another task.[8]
- These unattended tasks have a variety of uses for non-intrusive assessment, such as in fatigue assessment in medical and transport environments[9]
- **Purpose:** Investigate fatigue during flight simulation using EEG and passive auditory oddball to elicit an examinable P300 response.

METHODS

- 10 participants from the University of Victoria have been recruited to date
- Participants completed 6-hour sessions in Microsoft Flight Simulator X Steam Edition, overlaid with a passive auditory oddball that they were not made aware of
- Participants were instructed to fly the aircraft and attend to intermittent in-game instructions provided to them periodically by the experimenter, including a visual oddball
- EEG data was recorded from a MUSE portable EEG device, a 5-channel system designed for portability



RESULTS

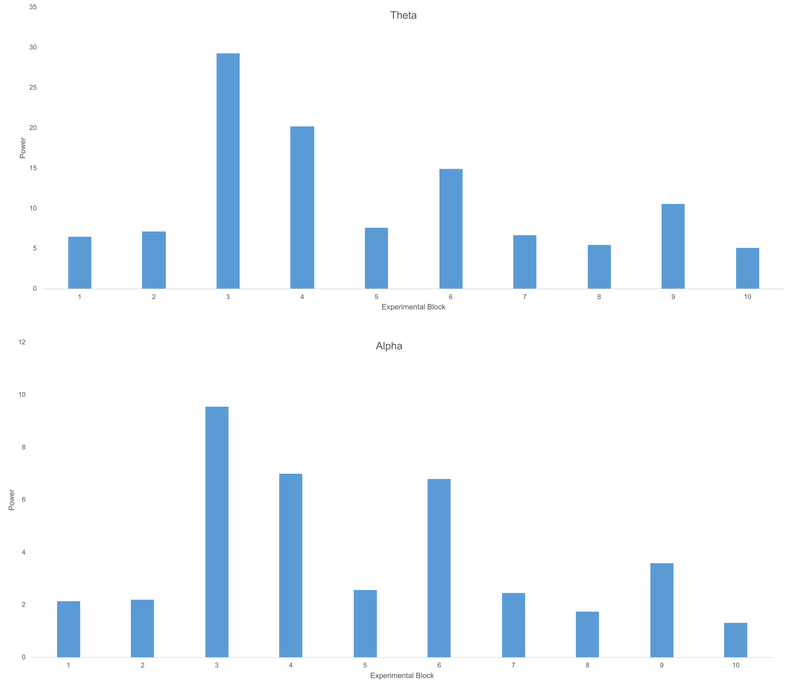
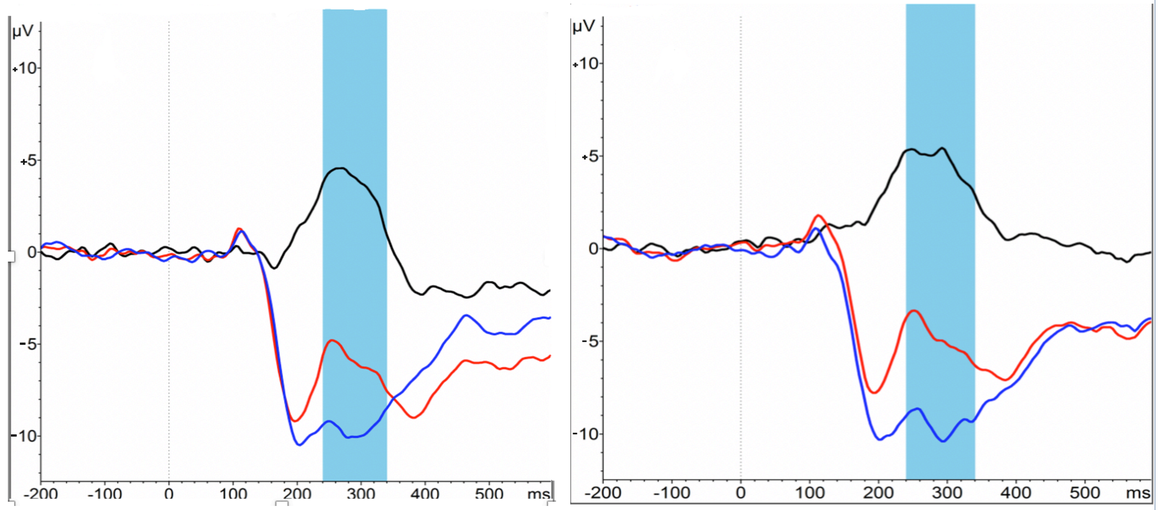


Figure 1. Left. A representation of theta (top) and alpha (bottom) power across time. As displayed, theta and alpha power increase after participants receive a break from the task in blocks 3, 6 and 9. This is consistent with prior fatigue research indicating a pattern of decreased alpha and theta across time, despite the jumps in activity immediately following the breaks.

Figure 2. Right. P300 responses for visual oddball (left) and passive auditory oddball (right) from one participant. The black line is representative of the difference wave between the irregular stimulus (the oddball, in red) and the regular stimulus (the control, in blue). Positive is plotted upwards on these plots.



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CONCLUSIONS

- While more data needs to be collected, our findings are in line with previous findings that theta and alpha decrease across time as fatigue increases
- More data collection is needed to verify the trends seen in the P300 waveforms in association with the visual and auditory oddball tasks, though preliminary data collection looks promising
- Most importantly, further investigation of the changing amplitude of the P300 across time as fatigue increases is needed to demonstrate the validity of the current findings