



Characterising the neurophysiological process underlying expert performance in video games

Naghmeh Moghimi

Supervised by Maria Herrojo Ruiz and Peter Holland

Background

Investigating emotions and the cognitive system is crucial as it provides insights into the manifestation of emotions in the mind and body. Emotions are linked to the autonomic and central nervous systems, offering a better understanding of their expression and experience. Arousal categorized into psychological and physiological aspects, involves sensorimotor responses, emotional reactivity, and sympathetic activation. High arousal reflects intense emotions and heightened physiological responses, while low arousal signifies subdued emotional experiences.

Traditional methods of studying human emotions involve presenting images to participants while recording their EEG activity. However, this approach may not fully capture the richness and complexity of experienced emotions. Studying the process underlying human emotions requires methods that closely resemble real-life experiences.

To address this limitation, shooter video gaming has emerged, which offers a realistic and immersive context for studying emotions, providing dynamic and interactive experiences in this field.

The neural, cardiac and respiratory signals play important roles in regulating behavior during gameplay. Bodily signals can convey important information to the brain, influencing cognitive processes, emotional states, and decision-making.

Aim

Providing insights into the neurophysiological processes underlying expert performance in video games, particularly focusing on the relationship between arousal and alpha power as measured by EEG during different aspects of gameplay.

Hypothesis

- Changes in alpha power during different levels of arousal can be observed in the EEG recordings, replicating the findings of a previous study by Luft and Bhattacharya.
- Clear differences will be observed in EEG data recordings between cut-scenes and action sequences.
- Alpha power supposed to be higher in response to Low-Arousal induction, indicating a contrasting effect in High-Arousal induction.

Experimental Design

Around 30 healthy young professional gamers are recruited as participants to play the shooter game "Outriders" without prior knowledge or rehearsal.

The participants' post-game experiences are captured through questionnaires to determine arousal points based on their reactions.

EEG recordings will be segmented into sections corresponding to high and low arousal periods identified based on the post-game self-reports and EEG data.

Cut scenes and action sequences will be used as different aspects of gameplay to extract short sections of EEG data.

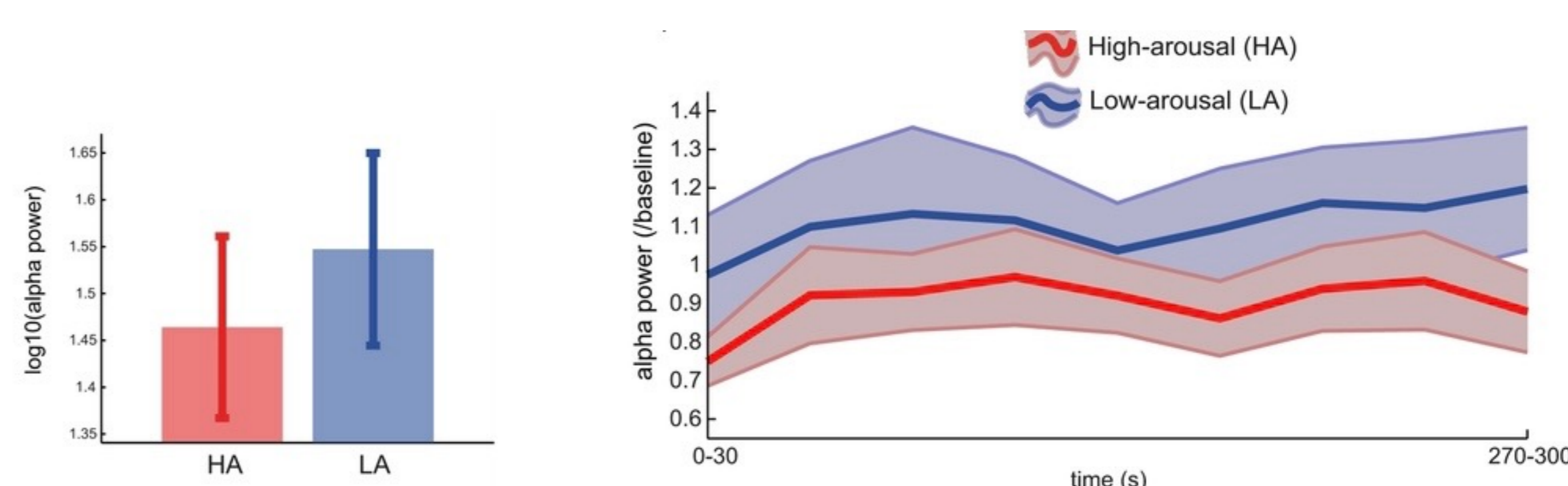
Data analysis

- Standard MATLAB methods to identify differences in arousal levels related to alpha power, focusing on the presence and amplitude of arousal levels measured by EEG.
- Statistical analysis, including two-by-two ANOVA tests, considering arousal level (high vs low), and game event (cut scene vs action) as independent variable.

Preliminary results

No conclusive findings or results are currently available for reporting.

However, the alpha power is expected to be greater during the induction of low arousal mood compared to the high arousal mood.



Summary

- This research extends previous study, aims to shed light on the neurophysiological processes underlying expert video game performance.
- By examining the relationship between emotional arousal and alpha power in EEG recordings, this study seeks to contribute to a better understanding of the cognitive and emotional aspects of gaming expertise.

Bibliography

Caroline Di Bernardi Luft & Joydeep Bhattacharya, 2015. Aroused with heart: Modulation of heartbeat evoked potential by arousal induction and its oscillatory correlates. Scientific Reports | 5:15717 | DOI: 10.1038/srep15717.