Dear JNE Editing Team,

We are happy to submit our original research work entitled “Neural Sources of Prediction Errors Detect Unrealistic VR Interactions” to be considered for publication in Journal of Neural Engineering.

Neural interfaces hold significant promise to implicitly track user experience. Their application in VR/AR simulations is especially favorable as it allows user assessment without breaking the immersive experience. However, administering standard questionnaires requires breaking the immersive experiences. This is still the most established method. In this work, we present a complimentary metric based on a Brain-Computer Interface. More precisely, the objective of our study was to explore EEG and movement signatures with the potential to detect visuo-tactile mismatches in VR.

In the submitted work, we significantly extend our previous data description in [1]. In the present work, we leveraged one EEG event-related potential, the prediction error negativity, for classification as well as source localization while also modeling visuo-tactile mismatches using the movement feature ‘tap time’. Using EEG, we achieved a 77% classification accuracy while classification based on tap time did not exceed chance. We found midline cingulate EEG sources and a distributed network of parieto-occipital EEG sources to enable the classification success. Hence, prediction error signatures from these sources reflect violations of user’s predictions. We believe, our findings are a promising step towards a robust and targeted marker for adaptive AR/VR user interfaces.

We hope to have sparked yours and your readerships’ interest. We believe our work will be of great interest to the readership of the Journal of Neural Engineering. We appreciate your time and look forward to your response.

Sincerely,

Lukas Gehrke

References

[1] Gehrke L, Akman S, Lopes P, Chen A, Singh A K, Chen H T, Lin C T and Gramann K 2019 Detecting visuo-haptic mismatches in virtual reality using the prediction error negativity of event-related brain potentials *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems - CHI ’19* CHI ’19 (New York, New York, USA: ACM Press) pp 427:1–427:11