E-Poster

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Cortical Activity During the Execution of an Immersive Virtual Reality Game: A Pilot Study in Healthy Volunteers

Topic: Virtual Reality

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BACKGROUND

The use of virtual reality (VR) for recreational, educational, and therapeutic applications is increasingly common. VR enables enriched environments, facilitates task-specific training, and provides multisensory stimulation (visual, auditory, proprioceptive) through immersion, imagination, and interaction. VR games enhance user engagement, portable, and user-friendly. The integration of VR in clinical settings is expanding, yet validation of its implementation remains necessary. Electroencephalogram (EEG) is recommended for neural-feedback protocols to monitor brain activity during VR activities. This study aims to describe cortical activation patterns using EEG during a VR game in healthy volunteers.

METHODS

The VR game was developed using the Unity platform (Meta Quest®) and Oculus Meta Quest 2® headsets. It simulates canoe navigation, controlled by two-handed paddling, with the objective of reaching the endpoint in the shortest time. The game includes three difficulty levels: adaptation to VR, canoe navigation, and obstacle navigation. Participants, seated on a Bobath ball for balance stimulation, wore the VR headset and completed the game. EEG recordings were obtained from C3, Cz, C4, P3, Pz, and P4 electrodes (10/20 system) at rest and during gameplay. After filtering and artifact removal, alpha (8-13 Hz) and beta (13-30 Hz) rhythms were analyzed using relative power changes.

RESULTS

The study included eight healthy volunteers with an average age of 32 ± 8.14 years, of whom 62.5% were women. Regarding educational attainment, 37.5% had a bachelor's degree, 37.5% a master's degree, and 25% a doctorate. All participants were right-handed (average weight of 66.5 ± 10 kg, average height 164.7 ± 9.15 cm). The average time to complete level 2 of the VR game was 7:36 ± 2:41 minutes, while level 3 was completed in 6:16 ± 3:52 minutes. Reported symptoms: 12.5% dizziness, 12.5% nausea, 12.5% visual fatigue, 50% muscle fatigue. Statistically significant differences in the frequency and voltage of the waves were observed between the different evaluation phases, with a more significant decrease during levels 2 and 3, corresponding to moments of heightened activity and concentration during the video game.

CONCLUSION

Changes in EEG signals are indicative of cognitive and motor activity during the execution of the VR game, with greater changes observed as the game complexity increases. This information provides valuable insights into cortical activity and the potential effects on cerebral neural plasticity.

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