Letter to the Editor re: The Persistent Issue of Simulator Sickness in Naval Aviation Training

Dear Editor,

We read with interest the review article, "The Persistent Issue of Simulator Sickness in Naval Aviation Training" (Vol. 89, No. 4, April 2018).[4] The paper provides a broad review of the topic with many important issues discussed. We would like to highlight what appears to be an oversight related to the application of galvanic vestibular stimulation (GVS) in simulation and simulator sickness (SS). The summary statement on GVS, "neither GVS nor GC is sensitive or specific enough to warrant usage in military flight simulators," may lead the reader to dismiss the value of the technology in this domain or be unaware of previously related work.

Moore et al., 2015,[5] showed the preadaptation to noisy GVS is associated with enhanced sensorimotor performance in vestibular environments. They implemented a simple simulation using a full-motion simulator developed for a NASA flight experiment showing the beneficial aspects of GVS. Reed-Jones and colleagues[6] showed that the technique of using GVS successfully provided a preventive effect in a driving task, regardless of whether the stimulation was applied during curve maneuvers or intermittently throughout the task. Aoyama et al., 2015,[1] showed new findings that contribute to the clinical and anatomical understanding of GVS using a four-pole electrode paradigm that highlighted the potential importance in virtual reality to improve vehicular simulations.

We would like to point out two other articles published in the *Aerospace Medicine and Human Performance* journal related to the technique of oculovestibular recoupling (OVR) in the mitigation of simulator sickness [2,3]. The OVR approach generated GVS stimuli in controlled patterns synchronized with a moving visual field to mitigate sensory conflict. Implementation of GVS in a visual flight simulator was shown to mitigate all SS categories, with the most notable results for symptoms of nausea, vomiting, and dizziness. The initial findings from 2012 were later validated in 2014 using electrogastrography (EGG), a diagnostic test for the objective clinical evaluation coupled with recording of symptoms of nausea, vomiting, and other gastric symptoms. EGG and interbeat intervals were sensitive indices of autonomic changes in subjects undergoing flight simulation. These data demonstrated the potential of OVR to stabilize gastric activity and cardiac autonomic changes altered during flight simulation.

We appreciate the authors' review article and hope that the above expands the literature highlighting the value of GVS in flight simulation and mitigation of simulator sickness as described and confirmed by independent research groups. We believe it is an area of great potential provided that a carefully integrated, real-time, proportional, and directional delivery of GVS is implemented.

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