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BREATH-ACTUATED VR EXPERIMENTAL PROTOCOL COUNTERMEASURES: A REPORT
CONTEXTUALIZING AN ANALOG ASTRONAUT HCI USER-STUDY

Abstract

Virtual Reality (VR) is purported as a portable, non-pharmacological, and non-invasive countermeasure to combat diverse symptoms caused by human exposure to extreme environments and prolonged absence from the sanctuary of normal home life, but user studies are limited. This study investigates the effectiveness of a breath-actuated game as an attention-restoration-theory (ART) based therapeutic VR countermeasure in support of space analogue crews. ART suggests that spending time in nature or other restorative environments can help replenish our cognitive resources and improve our ability to focus and sustain attention to enhance overall well-being. We test an experimental prototype combining a commercial Breathing+™ apparatus with a custom VR game called LifeTree. The user experience examines the effects of the intervention on two cohorts: the first "SPECTRA Mission" at LunAres in an isolated bunker and a black-out crater (simulating missions to the far side of the Moon) in Poland, and the second "Mars Academy USA" crew are in hypoxic high radiation conditions (simulating the high plains on Mars) in Nepal. We report that 75 percent of the crew fulfilled the study and achieved rhythmic respiration in VR and demonstrated decrements in resting heart rate. Data indicates a relationship between the system use, adaptation, acclimatization, and well-being. Our discussion helps human-computer interaction designers contextualize specific design opportunities and challenges of transposing terrestrial user study models with space analogue crews. Sharing these results addresses a need to report on analogue intervention design understandings for future pervasive computing in space scenarios. This study helps human-computer interaction designers, mission architects and flight surgeons to face the exceptional opportunities and challenges emerging with the use of extended reality technologies in extreme environments by space crews.