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VIRTUAL REALITY RESCUE TRAINING SIMULATION- ADDRESSING RETENTION OF SKILLS IN EXTREME ENVIRONMENTS

Abstract

Deep space missions share many similarities with prolonged stays in isolated and confined extreme (ICE) environments, such as wintering-over in Antarctica research stations. Some of these bases have been used for decades as space analogues, to further gain knowledge on how to prepare humans for extended stays beyond our low-Earth orbit. One element being investigated is the degradation in cognitive and motor skills, in the setting of a strenuous but also constraining and monotonous environment. This is especially concerning for tasks which will be required infrequently, such as responding to emergencies and more specifically rescuing injured crew members. A rescue procedure integrates not only medical knowledge, but also human factors such as efficient communication, all while performing stressful and time-dependent critical tasks, often using equipment and evacuation techniques which participants may be unfamiliar with. Simulation training ensures familiarisation and retention of knowledge and skills. However, whether during the extremes of the Antarctica polar night, or in the vacuum of space, simulations in ICE settings risk exposing crew members to significant hazards, and may be considered impractical. Virtual reality training is one method of circumventing this obstacle.

In the present study, we describe the design and implementation of virtual reality training exercises at Concordia station in Antarctica, located at 7505'59.9"S 12319'57.4"E on the East Antarctica plateau. The polar night lasts approximately 3 months, and the temperature can fall below - 80C in the winter. No rescue is possible during the 9 months of isolation, requiring complete autonomy of the team. Environmental conditions preclude any outdoor simulation exercises for much of the year. Despite this, throughout the winter, researchers at Concordia work in outdoor underground shelters and access equipment installed at significant heights. The risk of injuries, although minimized through mitigation strategies, is not insignificant. In addition, similarly to space missions, any rescue attempts will depend on a crew of largely non medical staff. Given this, we are developing a program of virtual reality training, targeted at the specific hazards located at Concordia station. The teaching provided is fully immersive and hands-on, reproducing clinical scenarios with high fidelity. Skills retention and other performance metrics will be assessed, including improvement in user confidence. The experience gained in this setting can facilitate developing similar programs for astronauts, including adaptations for just-in-time guidance in response to new events, particularly in long-duration spaceflight.