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CORRELATION ANALYSIS OF SLEEP QUALITY, MOOD AND TELEOPERATION PERFORMANCE IN THE MDRS206 ANALOG MISSION

Abstract

Human space exploration and the development of the new space industry demands specific studies on long-term manned space missions. Spending an extended duration of time in an isolated and confined environment could degrade the cognitive state and performance of the operators within a crew. In the context of Mars exploration or a Lunar base, professional tasks such as teleoperation will be performed, and therefore their outcome might be impacted by the crew's cognitive state. Previous studies have shown evidence of the impact that stressors associated to confinement have on behavioral patterns and sleep quality. This investigation links then the aforementioned stressors to task performance. Hence, in order to investigate whether teleoperation task performance might be impacted by the crew's mental state in a confined and isolated setting, a correlational study was run on data acquired from the Crew 206 of the Mars Desert Research Station (MDRS) in the Utah Desert. The participants were French students (n=5, Mean Age=21,σ=0.707) who underwent a confinement period of 3 weeks. Over these weeks, they performed 7 teleoperation tasks. The task consisted in the guidance of a rover for a sample collection on the lunar surface. Operator performance was measured by recording the completion time and the frequency of errors. The participants' sleep data was measured with the Dreem headband, a portable electroencephalogram (EEG). Only the sleep data from the night before each session was considered. Also, operator cardiac activity was measured during the teleoperation task using a Faros 360 electrocardiography system. Lastly, operator mood was assessed just before performing the task using a shortened version of the PANAS questionnaire. A Spearman correlation run on these data revealed several statistical correlations that uncover links between professional task performance, sleep quality and mood in a confined and isolated setting. Amongst them are notably significant correlations between sleep duration and task completion time (ρ=0.6197, p<0.01), the reported feeling of confinement with the negative affect component of the mood (ρ=0.5797, p=<0.01), the negative affect component and several sleep quality parameters (ρ=0.4686 or 0.4944, p<0.01). In addition to paving the way towards a better assessment of the impact of confinement and isolation on professional tasks, linking these parameters with specific personality traits could help in the selection of candidates for future manned missions, thus increasing mission safety and reliability.