VISUAL DEFICITS FOLLOWING PROLONGED EXPOSURE IN A VIRTUAL ENVIRONMENT

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Purpose. To investigate the visual adaptation effects caused by extended exposure within a virtual environment (VE). VE observers report symptoms related to motion sickness after a relatively short period of time (Ungs, 1989). The cause of VE sickness is unknown, but it is thought to be a mismatch between the vestibular cues and visual inputs (Ebenholtz, 1992). It was hypothesized that a virtual environment simulator will cause an operator's visual system to adapt and then reorganize to match the modified synthetic environment. **Methods.** Forty subjects were randomly assigned to one of four display formats, no exposure (control condition), CRT (29 deg FOV), three-panel display (132 deg FOV), and a HMD (Virtual Research VR8 helmet with a 60 deg FOV). The three-panel and HMD groups were immersed within a driving simulation model, while the CRT group played a video game. A battery of tests (motion sickness questionnaire MSQ, depth perception, smooth pursuit (5,10,20,30, and 36 deg/sec), and nystagmus (5, 12, 18, and 25 deg/sec sinusoidal grating on the VR8 display)) were administered before and after a 25 minute treatment exposure. **Results.** Subjects within the HMD showed the highest MSQ scores followed by the three-panel, CRT, and control subjects. Depth perception showed no significant difference between display formats. There was a significant difference between the three-panel and HMD groups compared to the CRT and control groups for the smooth pursuit task for subjects who reported a history of motion sickness. This suggests that immersion may have reorganized the visual system to adapt to the virtual interface. **Conclusions.** The results of this study may provide a metric to predict initial onset of post-exposure performance degradation as well as establish standards that specify how many hours an observer may be susceptible to VE adaptation effects.

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