Chapter 82

Neuroergonomics In Situ: Differentiation Between Naviation Displays

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Highly mobile computing devices promise to improve quality of life, productivity, and performance. Increased situational awareness and reduced mental workload are two potential means by which this can be accomplished. However, it is difficult to measure these concepts in the "wild." We employed ultraportable battery-operated and wireless functional near-infrared spectroscopy (fNIRS) to noninvasively measure hemodynamic changes in the brain's prefrontal cortex. Measurements were taken during navigation of a college campus with either a handheld display, or an augmented-reality wearable display. Hemodynamic measures were also paired with secondary tasks of visual perception and auditory working memory to provide behavioral assessment of situational awareness and mental workload. Navigating with an augmented-reality wearable display produced the least workload during the auditory working-memory task, and a trend for improved situational awareness in our measures of prefrontal hemodynamics. The hemodynamics associated with errors were also different between the two devices. Errors with an augmented-reality wearable display were associated with increased prefrontal activity and the opposite was observed for the handheld display. This suggests that the cognitive mechanisms underlying errors between the two devices differ. These findings show fNIRS is a valuable tool for assessing new technology in ecologically valid settings and that augmented-reality wearable displays offer benefits with regard to mental workload while navigating, and potentially superior situational awareness with improved display design.

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