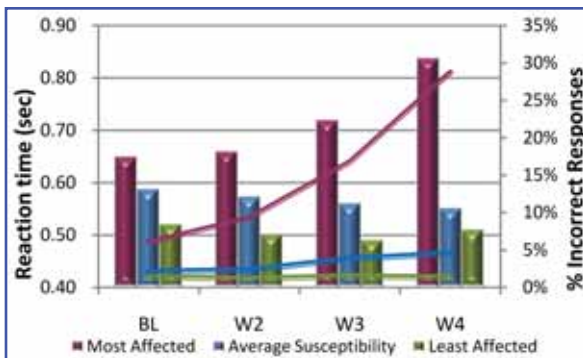
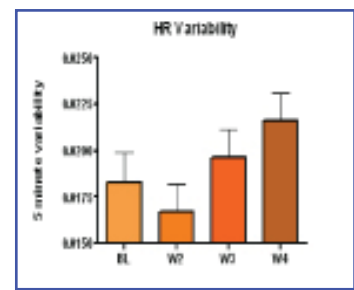
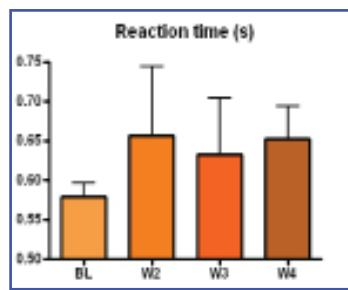
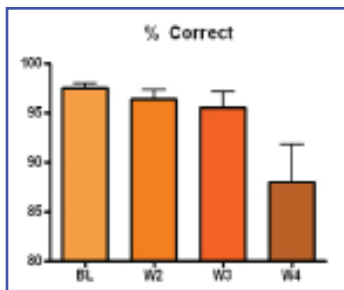


Operational Profiling Sleep Deprivation and Stress

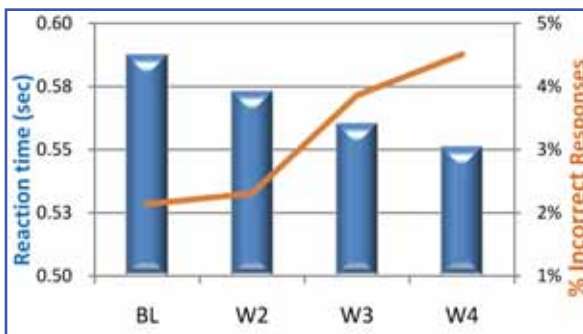
U.S. Marine Corps troops experience combined stressors including sleep deprivation, physical exertion and threat of enemy fire that can impair vigilance and decision-making with potentially dangerous consequences. In this study USMC battalion/platoon leaders (n=17) were evaluated during a 28-day, continuous live-fire training exercise. Prior to the start of the exercise and then once a week wireless EEG and EKG were acquired in the field during a 20-minute, 3-Choice-Vigilance-Test (3C-VT). Physiological measures of engagement, distraction/drowsiness, heart rate variability, performance were assessed along with self-reported stress, fatigue and mood were assessed with Profile of Mood States, Stanford Sleepiness Scales, Brief Fatigue Inventory and Perceived Stress Scale.



Repeated measures analysis of variance revealed significant interaction effects ($p < .0001$) across quartiles over time in the 3C-VT with increased Distraction/Drowsiness, decreased High-Engagement, decreased accuracy and increased reaction times across weeks of training. Heart rate variability, suggesting increased levels of stress, also increased significantly. Significant changes in self-report measures included only decreased POMS-Vigor.



This study confirmed the Marines also exhibit trait characteristics in susceptibility to sleep deprivation. The graph to the left shows a change in reaction times (histograms) and percentage of incorrect responses (lines) across weeks during the 28-day exercise. After normalizing the data to account for the fact that Marines as a group tend to be less susceptible to sleep deprivation than the general population, we found that speed and accuracy were highly affected in 11% of the Marines by the end of the training exercise. Conversely, performance in 35% of the group was minimally affected by sleep deprivation.



A closer investigation of the group with average susceptibility revealed a pattern that should be taken into consideration by those responsible for managing fatigue and situational awareness. The graph to the left shows that the speed of decision making (reaction time) increased during sustained operations which resulted in chronic sleep deprivation. The increase in decision making speed, however, contributed to a doubling in the number of incorrect decisions. Yet none of the questionnaire responses indicated that the Marines acknowledged the impact of the fatigue on their capabilities.