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**Neuro-optimization for accelerated learning pace and elevated comprehension:
Military Applications**

JJ Walcutt, none

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Abstract: Advances in technology, digital connectivity, and doctrine to embrace all domain warfare will continue to increase the complexity of tasks for warfighters at every echelon. The ability of servicemembers to train faster and within more cognitively demanding battlespaces is equally as important as maintaining a technological advantage. Cognitive optimization, however, is hindered by natural human limits to knowledge and skill acquisition. The effects of overloading the brain with data and stress has repeatedly been shown to lead to constrained information intake, reduced focus and understanding, and at worst, Post Traumatic Stress Disorder (PTSD). The imperative to optimize the capability of the warfighters creates the necessity of conducting training within a human-technology hybrid system, a requirement. Substantial research has been conducted in the area of personalized learning informed by both performance and neuro-physiological data. The data collected has been largely unreliable, inexact, and delayed, leading to extensive lab-based studies but fewer successful applied hybrid training programs. As both the technology validity and reliability have improved over the past 20 years, the data we can extract has the potential to not only optimize the way we do training but raise the cognitive advantage across our forces. This paper presents data from 3 experiments that show: (1) the most reliable combinations of EEG features for measuring cognitive load across a variety of tasks; (2) changes in EEG measured cognitive load when learning new material; and (3) real time changes in how audiovisual complexity lead to reliable changes in cognitive load. The war of cognition requires our servicemembers to train faster, better, and cheaper in order to maintain our advantage but we must first overcome the limits of the human mind to ensure that we can optimize all warfighters while also protecting the human mind from harm due to overuse, data overload, and stress.

AuthorNames: JJ Walcutt, Walt Yates, Dhiraj Jeyanandarajan

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Prefix: Dr.

First Name: JJ

Last Name: Walcutt

Company/Organization: none