Title: Bridging Dual Mechanisms of Cognitive Control, Situational Awareness, and Cognitive Workload in Undersea Warfare

PI: Jason Ralph, PhD
USW Trainer Technology Development Branch, Code 2532
Naval Undersea Warfare Center, Division Newport

Academic Collaborators : Todd Braver, PhD – Washington University, St. Louis
Suzanne Jaeggi – Northeastern University

Naval platforms of the (near) future will require human operators to integrate new technology/automation/AI into existing workflows. Previous work has demonstrated negative consequences with respect to operator Situational Awareness (SA) caused by newly automated capabilities, leading to increased experienced workload and critical errors. In this project, we examine the relationship between cognitive control and SA, testing the hypothesis that the ability to project future states (e.g. SA) is a critical causal determinant of the mode of cognitive control employed in a given moment. This relationship forms the core of a new model incorporating cognitive control modes, SA, and cognitive workload, with potential to enable predictions of how increased automation will affect human cognitive performance, provide tremendous value for training systems and help guide user interface design of new control workstations. Our initial work will apply machine learning approaches to the analysis of physiological measurements, leveraging an existing task battery developed by Dr. Braver as part of the Computational Cognitive Neuroscience Framework for Attentional Control Traits and States (CCN-FACTS) MURI project. Successful modeling of proactive and reactive control will allow us to use submarine simulation tools to validate our model of the relationship between cognitive control and SA. Going forward, we plan to leverage our findings to the development of cognitive training applications which focus on the enhancement of attentional control capacity.