

Modeling the Cognitive Task Load and Performance of Naval Operators

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Abstract. Operators on naval ships have to act in dynamic, critical and high-demand task environments. For these environments, a cognitive task load (CTL) model has been proposed as foundation of three operator support functions: adaptive task allocation, cognitive aids and resource feedback. This paper presents the construction of such a model as a Bayesian network with probability relationships between CTL and performance. The network is trained and tested with two datasets: operator performance with an adaptive user interface in a lab-setting and operator performance on a high-tech sailing ship. The “Naïve Bayesian network” tuned out to be the best choice, providing performance estimations with 86% and 74% accuracy for respectively the lab and ship data. Overall, the resulting model nicely generalizes over the two datasets. It will be used to estimate operator performance under momentary CTL-conditions, and to set the thresholds of the load-mitigation strategies for the three support functions.

Keywords: mental load, emotion, Bayesian networks, cognitive engineering, Defense and Space operations.