Adaptive Automation enhances human supervision of multiple uninhabited vehicles

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Abstract

Human operators supervising multiple uninhabited air and ground vehicles (UAVs and UGVs) under high task load must be supported appropriately in context by automation. We examined the efficacy of such *adaptive* automation in a simulated high-workload reconnaissance mission involving four sub-tasks: (1) UAV target identification; (2) UGV route planning; (3) communications, with embedded verbal situation awareness probes; and (4) change detection. Three automation conditions were compared: manual control; static automation, in which an automated target recognition (ATR) system was provided for the UAV task; and adaptive automation, in which individual operator change detection performance was assessed in real time and used to invoke the ATR if and only if change detection accuracy was below a threshold. Change detection accuracy and situation awareness were highest and workload was lowest in the adaptive automation condition compared to the two other conditions. The results show that adaptive automation leads to a levelling of workload and enhances performance both within and across operators under conditions of high task load. The results point to the efficacy of adaptive automation as it is *tailored* to unique human operator needs. We further describe results from a second experiment where the efficacy of adaptive automation was examined in a high-fidelity uninhabited vehicle simulation environment.

Introduction

Uninhabited vehicles (UVs) and other robotic systems are being introduced in rapid fashion into the military to extend manned capabilities, provide tactical flexibility, and act as “force multipliers” (Barnes, Parasuraman, & Cosenzo, 2006; Cummings & Guerlain, 2007). In the US Army’s Future Combat Systems (FCS), for example, battlefield force structures will be redesigned to be flexible, reconfigurable components tailored to specific combat missions. The human operators of these systems will be involved in supervisory control of UVs with the possibility of occasional manual intervention. Soldiers will operate multiple systems while on the move and while under enemy fire, as a result of which they will operate under high stress. Because of the consequent increase in the cognitive workload demands on the soldier, automation will be needed to support human-system performance.

In D. de Waard, F.O. Flemisch, B. Lorenz, H. Oberheid, and K.A. Brookhuis (Eds.) (2008), *Human Factors for assistance and automation* (pp. 285 - 300). Maastricht, the Netherlands: Shaker Publishing.