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Comprehension of uncertainties in decision support systems^{*}

Hasmik ATOYAN^a, Jean-Marc ROBERT^b,
Jean-Rémi DUQUET^c

^a CAE Professional Services, Montreal

^b École Polytechnique, Montreal

^c Lockheed Martin Canada, Montreal

Abstract

Decision Support Systems help the human operators to cope with large amount of information and make decisions. However, in complex dynamic environments automation can create different types of uncertainties in the system, and consequently in the mind of the operator. A comprehensive understanding of these uncertainties in complex environments and their impact on human decision-making is essential to design safe and efficient systems. In this paper we analyze and identify different types of uncertainties that could surface during human-automation interaction. We discuss separately each type of uncertainty and the challenges they can pose to human decision-making. Finally we propose guidelines from a human factors perspective on how to design systems that will support human operators to perform their tasks efficiently while coping with uncertainties.

Key words: Cicero, Decision support systems, reliability, military, decision analysis

1 Introduction

In the past, sometimes users could not perform their tasks efficiently because of a lack of information. Today the problem is the opposite since the users are overwhelmed with information. The development of new technologies and their increasing use allow one receiving a vast amount of dynamic information. The human operator needs to monitor and assess this information, understand the current situation and infer possible future implications, and finally make decisions. For example, an air defense operator needs to monitor and analyze the information received from radars, and decide whether to engage a potentially hostile aircraft; or a risk analyst of financial market needs to evaluate various financial data and decide whether to buy or sell blocks of stock.

Implementation of Decision Support Systems (DSSs) can help human operators to handle information overload. They can help to organize the data in a meaningful way, analyze and correlate the information and make decisions more efficiently. Parasuraman et al. [27] define automation as “a device or system that accomplishes (partially or fully) a function that was previously, or conceivably could be, carried out (partially or fully) by a human operator”. Automation does not mean that the human is replaced. It means that the human should interact with automated system in large scale systems [32]. Large-scale systems are characterized by many sensors, many different computers as well as people performing analyses and making decisions. Human factors engineers

^{*} *Email addresses:* hasmik.atoyan@polymtl.ca (Atoyan Hasmik), jean-marc.robert@polymtl.ca (Robert Jean-Marc), jean-remi.duquet@lmco.com (Duquet Jean-Rémi).