Supporting human-centred function allocation through animated formal models

Hendrik Oberheid, Bernd Lorenz, & Bernd Werther
German Aerospace Center (DLR)
Braunschweig, Germany

Abstract

Function allocation (FA) refers to the distribution of work across human and machine elements of sociotechnical systems. FA has an important impact on the human operators' roles within the final system and consequently on the systems' safety. It is therefore indispensable that human factors and domain experts' knowledge is integrated in the FA process. There is a need for a suitable design-artefact that facilitates a meaningful communication between engineers, human factors specialists and domain experts for use early in the design cycle. The paper proposes formal process models in combination with graphical animation to support a structured, scenario-based FA process.

Introduction

Function allocation (FA) is a central design step in the development of complex human-machine systems, it's principal aim being to determine which functions of the overall system should be carried out by the human operators and which by machine agents. Besides their criticality for the system's performance and system's safety function allocation decisions are often not made explicit because valid criteria for FA supported by a dedicated FA-method have not been established (Hancock & Scallen, 1996; Sheridan, 2000; Lim & Long, 1994). Instead it is assumed by many system engineering methods that designers will simply know which task are best performed by human operators and which ones should be automated. Extensive empirical evidence reported in human-factors literature and experience with human performance in complex interactive systems prove that this assumption is not a valid one (Parasuraman & Mouloua, 1996; Sheridan, 2002).

Development of FA methodologies

Since the early contributions to the field of function allocation (often also referred to as task allocation) by Fitts (1951) and Jordan (1963) the field has seen a number of notable developments (see Older, Waterson, & Clegg (1997) for a comprehensive survey on function allocation methods). Many of these developments have been reactions to technological advances on the side of automation such as the increasing introduction of higher-level automation, the consequent shifting of operator work to