Another look at scanpath: distance to nearest neighbour as a measure of mental workload

Francesco Di Nocera, Michela Terenzi, & Marco Camilli
Cognitive Ergonomics Laboratory, Department of Psychology,
University of Rome "La Sapienza", Italy

Abstract

Visual scanning strategies have been often related to mental workload. In this study it has been investigated the relation between fixations distribution and workload on the basis of the consideration that low workload may be associated with regular patterns, indicating a regular check of the interface layout. According to this hypothesis, statistical indices providing information about the dispersion of point patterns should indicate differential patterns in the case of low and high workload. Participants were engaged in a simple visuo-motor task: the PC-based game known as "Asteroids". The game was modified to suit the experimental purposes. Participants were engaged in two experimental conditions: they were either requested to fire the randomly moving asteroids, or to avoid collision with the asteroids without shooting them. These conditions generated different amount of mental workload since collision avoidance was perceived as harder than shooting. The number of asteroids on screen was kept constant along blocks. Eye movements were recorded during the sessions and were analyzed using spatial statistics algorithms. Preliminary results showed sensitivity of spatial dispersion indices to variations in mental workload and their potential utility as triggers for adaptive automation.

Introduction

Adaptive Automation (AA) is a set of technologies in which automation support is dynamically adjusted in response to environmental events and the human operator's functional state. One of the most important issues for effective implementation of AA is the choice of the index to use for triggering the system when the functional state of the operator significantly deviates from optimal levels. Several indices have been discussed in the literature (see Hockey, Gaillard, & Burov, 2003 for a recent account). Most of them are psychophysiological, representing the physiological response to events mediated by the cognitive system, and it is commonly believed they represent the most valid and reliable method of obtaining real-time information about the state of the operator (Scerbo et al., 2001). Nevertheless, great care should be taken when selecting the index to use. Sensitivity of a parameter may be affected by different factors such as the number of samples used to compute it. One may find, for example, that the selected measure can work well in one task environment but not