Evaluating Likelihood Alarm Systems as an alternative to Binary Alarm Systems

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Abstract

Operators monitoring and controlling complex systems are mostly supported by alarms. Dealing with alarms involves decision-making under uncertainty because alarm systems are not perfect. Operators have to decide whether to respond immediately to a given alarm, to cross-check it towards raw data, or to ignore its occurrence. As several studies suggest, particularly false alarms often lead to less optimal behaviour. Operators either tend to ignore all alarms or to check every alarm. Whereas ignoring leads to a decrease in safety performance, "over-checking" can compromise performance in concurrent tasks. One possible solution is the implementation of likelihood alarm systems (LAS). LAS have more than two stages, each of them corresponding to different probabilities of correctly detected critical events. An experimental laboratory study was conducted to evaluate the costs and benefits of a 3-stage LAS compared to a binary system. The setting was a multi-task environment with and without the possibility to cross-check the validity of given alerts. Results show a general advantage of LAS over binary alarm systems. The use of the LAS led to better decision-making and thus to an improvement in safety performance. Furthermore, the concurrent task performance increased significantly because of a better allocation of time and attention when using the LAS.

Introduction

Today's work places of complex human-machine systems, such as control rooms of chemical plants or flight decks of advanced aircrafts, usually require human operators to monitor and control complex automated processes. This task has been referred to as "supervisory control" and involves, among other tasks, programming what the automation should do, monitoring its proper functioning, and intervening in case of problems (Sheridan, 1997). The monitoring part of this task is usually supported by alarm systems. These alert operators whenever a critical event occurs. Whereas the technical component (i.e. the alarm system) has become very sophisticated in terms of sensitivity to detect a critical event, the collaboration of operators and alarm systems still needs to be improved. Human performance issues regarding this collaboration mainly arise from the specific nature of alarm systems and the uncertainty of the situation.

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