Are false alarms not as bad as supposed after all? A study investigating operators' responses to imperfect alarms

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Abstract

In the domain of binary alarm systems, current research has especially addressed the problem of false alarms which are assumed to lead to a so-called "cry-wolf effect", i.e. a disregard of alarms by operators or at least a delayed response to alarms. However, the question arises if these findings might be due to experimental settings that forced the operators to choose between reacting to the alarm immediately or to ignore it completely. A second issue of alarm systems regards the behavioural effects of misses which are assumed to lead to disuse of alarm systems in terms of a lack of reliance on its alerting function. The present laboratory experiment explored the relationship between false alarms, misses and operator behaviour. The experimental paradigm represented a dual-task environment where one of the two concurrent tasks involved responses to a binary alarm system. In contrast to earlier research, the paradigm offered participants the possibility to actively validate a given alarm by checking available raw data. Five different levels of alarm reliability, operationally defined as number of misses and false alarms were investigated. The results did not reveal any evidence for a cry-wolf effect. Even in case of a large number of false alarms, the participants continued to respond to the alarms by cross-checking the validity of alarms towards the raw data. In trials where the alarm stayed quiet, cross-checking behaviour was strongly influenced by even subtle changes of misses of the alarm system. These results provide another empirical evidence for the distinction between two behavioural tendencies in response to alarms that have been referred to as reliance and compliance.

Introduction

The increasing introduction of automation in operator workplaces in different domains like power plants, production, cockpits and air traffic control rooms has led to a shift in operators' tasks. Tasks have metamorphosed from active controlling and intervening to supervisory control tasks (Sheridan, 1992) which require the operator to monitor an automated system and to intervene whenever a system fault occurs. This operator task usually is supported by alarm systems which are used to alert an operator in the case of critical events. Most of these systems represent binary