Chapter 16
Accounting for Individual and Situation Characteristics to Understand the User Behaviour When Interacting With Systems During Critical Situations

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ABSTRACT

Human error studies tend to focus on identifying the relationship between human activity, errors and their consequences. Accidents and incidents report analysis has been the path followed by several authors in the human error studies field, as it will be discussed in this paper. However, error reports tend to detail technical aspects of the error occurrence but fail to explore the human-behaviour component that might have influenced it. In order to investigate the human behaviour and its relation with accidents and human errors the authors propose to observe individuals working during critical situations, while adopting a methodological approach supported by an experimental protocol, to ensure a rigorous systematization of the data gathering and analysis. This paper presents a cognitive model which accounts for the knowledge of the individual and situation characteristics when analysing the user behaviour during critical situations. It also presents the supporting experimental protocol, and discusses its application in the context of a decision making aid system, employed during maritime pollution crisis management.

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INTRODUCTION

It is widely accepted in the literature that human errors result from failures in the cognitive system. To prevent the error occurrence it is important to investigate the involved risk factors and understand the full context in which the error occurs, aiming to identify which combined factors can influence the human behaviour and performance, and consequently the task final status (outcome). According to Reason (2000) the human error must be viewed from the individual and system approaches. The first focuses on the individuals' errors, blaming these for forgetfulness, inattention, or moral weakness. With that approach it is possible to identify "Active failures", that is, unsafe acts committed by people who are in direct contact with the system (slips, lapses, ineptitude, mistakes, and procedural violations). In contrast, the system approach concentrates on the conditions under which individuals work and tries to build defences to avert errors or mitigate their effects. A system has "latent conditions" which also can lead to the human error. These result from decisions made by designers, developers, procedure writers, and top level management. Once being aware of the risk factors which can trigger human error and having identified the factors which may influence task performance; preventive measures can be put into place to: improve the processes adopted when performing the task, the tools employed in doing it, and the human operator skills.

In the domain of critical systems, accident and incident report analysis is at the basis of the human error study. Although this is cited in the literature as the main approach taken in the field, as mentioned in the works of Rasmussen and collaborators (1981); van Eekhout and Rouse (1981); and Johnson and Rouse (1982); analyzing the human behaviour when faced with adversities during task performance is also an important source of information on the cognitive mechanisms and strategies employed during activity. In the same direction, this research investigates the adoption of cognitive models to help understanding the cognitive process and anticipate risk-related behaviour in the work context. It focuses on analyzing the error context (when an operator of an industrial automated system is faced with unexpected work situations), combined with the analysis of typical time pressures, anxiety and altered emotional behaviour, in order to anticipate error occurrences.

It follows a brief literature review, which presents the human error as seen from different perspectives by different authors. These do not treat directly the proposed research problem, but give a foundation for the study.

Hollnagel (1993) defines the error as the consequence of a faulty action which leads into unexpected results. According to Rasmussen (1983), when a system presents an unsatisfactory response to a human action, which is different from the expected one, a human error has occurred. Yet, for Reason (1990; 1997), the human error occurs when the consequences of a fault cannot be assigned to external agents, exposing to risks: people, equipment and the surrounding environment. The authors adopt a combination of those views and assume that a cognitive model is at the basis of understanding the human interaction and the task outcome. The following cognitive models adopt complimentary approaches and share the notion that managing cognitive resources to perform a task and deciding which action to perform are influenced by multiple variables.

According to Norman and Draper (1986), the human cognitive process happens in seven stages: formulating objective; formulating intention; specifying action; performing action; perceiving the status of the environment and evaluating results. Therefore, an individual can assess whether an achieved result corresponds to the intended one, realizing when there was an error.