# Using AcciMaps to describe the emergence of critical work situations - A systemic approach to analyse automation

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## Abstract

The use of automation is steadily increasing across domains. It has great advantages in terms of efficiency and accuracy, but is also known to cause unwanted effects during supervisory control. These effects originate from the interaction between human, organisational and technological aspects and are known to affect safety and increase the probability of operational problems. The aim of this paper is to clarify the relationship between factors contributing to the out-of-the-loop-problem during turbine operation in a nuclear power plant control room by using a holistic approach which is applied by an AcciMap representation to describe how factors from four organisational levels contribute to the formation of the out-of-the-loop problem during turbine operations. Further it is discussed how a holistic model improves the prerequisites for taking effective measures to avoid automation related problems.

## Introduction

The increased use of automation has changed industrial processes radically and improved production efficiency and control accuracy in a revolutionary way (Sheridan, 2002). The rationale for this development is mainly economical while modern automation technologies provide opportunities to optimise the production process and improve quality. In the seminal paper *"Ironies of Automation"* (Bainbridge, 1983), a number of paradoxes related to the introduction of automation were presented which still to this date are highly relevant, indicating that the use of automation can cause problems. An automation related problem that is frequently mentioned and also leads to other problems (Lee, 2006) is the "out-of-the-loop" (OOTL) performance problem (Endsley & Kiris, 1995), which refers to the problems of detecting failures in automatic systems and reverting to manual control. To describe the emergence of automation related problems such as OOTL holistically is difficult since the sharp-end/blunt-end relations quickly becomes complex. This motivates the use of a structured methodology for analysis.

The purpose of this paper is to suggest how the AcciMap method can be used to provide a holistic overview of automation related problems. The aim is (I) to