Applying human factors in the design of future rail systems

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Abstract

The UK rail network aspires to ever increasing levels of train reliability and punctuality whilst maintaining high levels of safety; one of the methods proposed to achieve this is the greater use of automation in managing train traffic. This introduction of more advanced automated systems has the potential to change the traditional roles of operational staff. The research discussed in this paper was undertaken to support the development of requirements for future traffic management systems and the job organisation for future operational roles. The initial work involved applying the cognitive work analysis technique to develop abstraction hierarchies to understand current railway operations and identify high level tasks. Job design of future roles was facilitated by the use of a scenario based approach. The scenarios were illustrated in a modified form of functional flow diagrams and a framework was developed to analyse each task using criteria to determine the allocation of function and propose future operational roles. The paper will present the methods used and discuss the benefits of applying these techniques in industry as well as the constraints and difficulties encountered.

Introduction

The UK rail network is operated by a wide range of technologies which have been developed and introduced over the 150 years of railway operations. These technologies vary from basic manually operated lever frame signal boxes where one operator controls only a few miles of track through to highly automated Integrated Electronic Control Centres (IECC), which comprise Visual Display Unit (VDU) based signalling control systems where one operator oversees an area which may previously have been controlled by up to 40 lever frame signal boxes. Between these extremes there also exist control panel technologies and VDU based systems without automated route setting agents. A more detailed overview of signalling system types can be found in Balfe, Wilson, Sharples, and Clarke (2007). The balance of technologies today remains towards the manually operated systems, with over 500 lever frame signal boxes still in use. In contrast, only 12 IECC signal boxes exist in the UK, although each controls considerably larger areas of the network than traditional signal boxes. This paper discusses the human factors input to a project aiming to increase the technological support in UK rail operations.