Testing the interface of a cab signalling system

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Abstract

The Signal Repetition System (SRS) used in Italian railways provides the driver with information about railway conditions ahead and automatically stops the train if the driver fails to acknowledge signal onsets. Performance of expert drivers using four versions of a SRS visual interface simulated on a CRT screen were compared. The first version of the SRS interface included a horizontal array of lights, similar to the one currently found in some locomotives. In two other versions an innovative design was introduced that maintained the horizontal array, to contrast rightward and leftward versions. The fourth version combined the innovative design and a vertical array of lights. The cognitive workload of actual driving was simulated in a dual task paradigm. Participants were required to perform tasks that involved the recognition of on-board signals as well as the planning and execution of appropriate actions. Performance improved in the fourth condition, in which lights were arranged along a vertical direction, fully compatible with the forward motion of the train.

On-board equipment and railway safety

Railway safety heavily depends on the human factor (Reason, 1990). The present study concerns the usability of the Signal Repetition System (SRS), a safety system used by the Italian railways, equivalent to the Automatic Warning System (AWS) used in the UK National Rail network and to the Automatic Train Stop (ATS) used in United States. A complete evaluation of the SRS interface would require an extensive study. The present experiment focused on one specific aspect, relevant for the ergonomics of safety instrumentation.

The SRS includes an interface for displaying visual and acoustic information on forthcoming events and an automatic device for activating the emergency brake if the drivers do not react to displayed information within a critical time limit (3 s). Input to the SRS is provided by the Automatic Block System (ABS). Normally, blocks are 1350-m long and correspond to track circuits that control wayside signals. When a train enters a block, the wayside signal at the beginning of the block changes from green or yellow (“free”) to red (“busy”). By allowing trains to