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Reducing Monotony in Rail Signaling by Secondary Tasks with Various Levels of Difficulty – An Experimental Study	University of Applied Sciences Northwestern Switzerland FHNW

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☐ **Fatigue, monotony, mental workload**

Abstract

Monotony is a condition characterized by various symptoms. It shows itself through task-related boredom and passive task-related fatigue. In addition, monotony manifests itself in a reduction of attention and thus conveys, in reduced performance. In highly automatized train traffic control, monotony is a current problem.

The question addressed in the present study is, whether a cognitively demanding secondary task does reduce the experience of monotony and mitigate the loss of performance more than a cognitively less demanding secondary task.

The secondary tasks considered in the present study are job enrichments. Job enrichment means enriching a performed monitoring activity with additional tasks at a higher level of requirements. This results in a qualitative change in the activity. According to Kreikebaum and Herbert (1988), job enrichment measures extend the scope of activity of those carrying out the work by increasing the demands of the work on different skills (skill variety). In particular, they require additional anticipatory thinking (Ulich, 2005) and expand the scope of decision-making and control by increasing autonomy (Kreikebaum & Herbert, 1988).

We realized an experimental laboratory setting using a unifactorial between-subjects design with 3 factor levels of demand (none, low, high). 40 test persons took part in the study. The primary task used in the experiment was a monitoring task similar to the tasks of train traffic controllers at their workplaces.

For all test persons experienced monotony was recorded before and after the processing of the monitoring task (primary task), detection performance (d') and reaction times were recorded during the execution of the task.

Two experimental groups worked on secondary tasks with different levels of demands, one control group performed the monitoring task without a secondary task.

The secondary task included a simple visual search, a mental calculation (depending on the level of demand) and verbally naming the result of the calculation. An irregularly occurring acoustic signal triggered the necessity to process the secondary task.

The results show a reduction in the experience of monotony compared to the control group for both levels of demand in the secondary task. The secondary task at the higher level of demand reduced the experience of monotony stronger than the secondary task with the lower level of demand.

The secondary tasks led to no clear improvement in detection performance (d') or reaction times. No negative effects, such as a reduction in performance due to excessive demands, were shown.

Based on the results of this study, task enrichment through secondary tasks as a measure against monotony appears to be valid in the context of monitoring activities.

In practice, this should reduce various negative effects of monotony in train traffic control such as dissatisfaction, increased fluctuation, unacceptable sideline activities or falling asleep.