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Utilizing ACT-R to investigate interactions between working memory and visuospatial attention while driving

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Abstract

In an effort towards predicting mental workload while driving, previous research found interactions between working memory load and visuospatial demands, which complicates the accurate prediction of momentary mental workload. To investigate this interaction, the cognitive concepts working memory load and visuospatial attention were integrated into a cognitive driving model using the cognitive architecture ACT-R. The model was developed to safely drive on a multi-lane highway with ongoing traffic while performing a secondary n-back task using speed signs. To manipulate visuospatial demands, the model must drive through a construction site with reduced lane-width in certain blocks of the experiment. Furthermore, it is able to handle complex driving situations such as overtaking traffic while adjusting the speed according to the n-back task. The behavioral results show a negative effect on driving performance with increasing task difficulty of the secondary task. Additionally, the model indicates an interaction at a common, task-unspecific level.