

# The effects of in-car information systems on mental workload: a driving simulator study

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*Fokje Cnossen<sup>1</sup>, Karel Brookhuis<sup>1</sup>, & Theo Meijman<sup>2</sup>*

*<sup>1</sup>Centre for Environmental and Traffic Psychology*

*<sup>2</sup>Department of Experimental and Occupational Psychology*

*University of Groningen*

*The Netherlands*

## **Abstract**

In a driving simulator experiment the effects of two information systems on workload were examined. We also examined whether speed and swaying can be used as measures of on-line workload. Subjects drove the simulator car in both heavy and quiet traffic. Within each drive, subjects were exposed to five conditions: map; route guidance; traffic information with map; traffic information with route guidance, presented either simultaneously or separately (scheduled).

Both subjective workload and heart rate were higher in map than route guidance conditions. Subjective workload showed significant differences for the factor 'information system', but the factor 'traffic density' was not significant. During map use, subjects' lateral position deviated more, and their speed was significantly lower than during route guidance conditions. Speed was also significantly lower in heavy traffic. This speed reduction was interpreted as subjects adapting to workload. It is suggested that this strategic speed reduction makes driving performance parameters difficult to use as measures of workload: drivers were observed to adapt their driving behaviour to task demands where possible.

## **Introduction**

In-car electronic information systems may provide drivers with information about congestion, route selection, or adverse road and weather conditions. Although such systems are designed to help the car driver, the extra information provided may increase driver workload to the extent that driving performance deteriorates. The presentation of information in the car may tempt drivers to focus on this information and consequently disregard events outside of the car. Alternatively, when drivers maintain attention focused on the road, the information presented by such systems may not be processed by the driver. For example, it is conceivable that drivers may miss information in complex traffic situations where workload is high. This effect may also occur when two or more systems present information at the same time, potentially obscuring each others' messages, especially when both systems use the same output modality.

Ideally, an information system should take the momentary workload of the driver into account before presenting information. This issue has been addressed in Brookhuis, De Waard & Weikert (Eds.) 1997. *Simulators and Traffic Psychology* HFES Europe Chapter