

Influence of psychological flow on the management of cognitive secondary tasks while driving: an approach comparing subjective and objective mental effort measurement

C. Gabaude¹, V. Rolland^{1,2}, A. Carrotte^{1,2}, C. Jallais¹, A. Fort¹, B. Baracat³ and G.A. Michael²

¹Université de Lyon, F-69622, Lyon - IFSTTAR, LESCOT, F-69675, Bron, France

²Département de Psychologie Cognitive & Neuropsychologie, Institut de Psychologie, Laboratoire d'Étude des Mécanismes Cognitifs, Université Lyon 2, Lyon, France

³CUFR Jean-François-Champollion, Albi, France

Corresponding author: catherine.gabaude@ifsttar.fr, +33 (0)4 72 14 24 50

Abstract

Driving is a complex activity requiring a good management of attentional resources. Numerous studies try to understand dual task interference wondering whether driver has enough spare capacity to take on additional tasks or whether the amount of mental workload is responsible for driving errors. Thus, it is necessary to better understand how the driving activity is modified when drivers are performing demanding cognitive tasks in order to identify the best measurement tools to be used to evaluate the driver's mental effort.

Our previous preliminary results indicated that two workload regulation strategies exist. If required to resolve cognitive enigmas, some participants seemed more focused on driving. Some others were distracted, felt uncomfortable and were often stressed. In the present study, we hypothesize that their proneness for psychological flow can influence their choices regarding workload regulation strategies. Flow proneness is associated with personality; it may be a state of effortless attention relying on different mechanisms from those involved in attention during mental effort.

Taking into account the driver's psychological flow, this study aims to identify mental effort indicators from three different measurements recorded on a car simulator: cardiac activity, driving performance, and subjective data.

An experiment was conducted with 23 participants (mean age 26 years old) comparing simulator driving as the sole task with driving while performing two different cognitive tasks (either resolution of verbal or visuo-spatial enigmas). Flow proneness was evaluated with a French version of the Swedish Flow Proneness Questionnaire. Mental effort was measured with the Driving Activity Load Index and Heart rate variability.

A negative correlation between flow proneness and subjective mental effort was observed. However, flow proneness had no effect on heart rate variability. Moreover, regulation strategies used by the drivers on highway and secondary roads seems different.