An analysis of driving performance evolution under high workload conditions

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Abstract
More and more, cars are being equipped with In-Vehicle Information Systems or Advanced Driving Assistance Systems. The development of such equipment involves evaluating the actual impact of their use on the driver behavior. One interesting way to accomplish this evaluation is to complete an “on line” assessment of driver workload. However, at this point in time, no workload assessment methods exist that are able to satisfactorily assess the impact of driver assistance system use. This paper describes an experimental study whose ultimate goal is to develop a workload indicator based on objective measurements performed on the car itself. In this first step of the study, subjective workload assessment methods are used as a reference.

Keywords – driving simulation, driver behavior, secondary task, workload, subjective assessment, data analysis

1. Introduction
The development of in-vehicle systems, such as In-Vehicle Information Systems (IVIS) or Advanced Driving Assistance Systems (ADAS), often includes an evaluation step focusing on the actual impact of such equipment on driver behavior.

One indicator that can be used to characterize this impact is driver workload. As it is directly linked to the use of in-vehicle systems, workload can be used to measure the impact of use in terms of the real driving conditions [1,2]. High workload levels should be avoided not only to improve driver comfort, but also because high workload levels can lead to human errors and thus compromise road safety.

Many studies have examined workload assessment methods [3]. Physiological and subjective methods have been found to give good results, but both are invasive and subjective methods are not well suited for “on line” use. Many studies have also examined performance measurements, based either on the primary task (i.e., the driving task) or a secondary task (e.g., the use of an on-board system, in this study). The most often stated hypothesis is that when “human operators” become overloaded, their performance drops suddenly [3].

However, such performance analyses raise the question of the relationship between performance and workload.