Interaction of physical and mental workload in cyclists differing in muscular strength and the implications for e-bike safety

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ABSTRACT

For safe road performance the management of mental work load is essential. For instance, mental workloads that are either too high or too low are associated with driver errors. In complex traffic situations *car drivers* keep mental workload within comfortable and safe boundaries, by lowering their driving speed. The question is whether and how *cyclists* manage mental workload, and how that is related to the factor on which car drivers and cyclists differ, namely physical work load. So far, little is known about the interaction of physical and mental workload in cycling in real traffic. The few studies available, were conducted in laboratory conditions, showing cognitive performance to improve at moderate levels of physical activities but to deteriorate at higher levels (Paas & Adam, 1991). A deeper understanding of such relationships may be beneficial for the understanding of risks associated with physical exertion and the potential benefits of bicycles that reduce physical exertion, such as e-bikes. To that end, the present study examined in a field experiment cyclists on e-bikes and conventional bicycles. It tested the hypothesis that high physical workload deteriorates the detection of relevant stimuli, specifically in complex traffic situations. The study further hypothesized that for cyclists with low muscular strength, the detection of relevant stimuli in physical demanding conditions would be better on an e-bike than on a conventional bicycle. The experiment was conducted in a real traffic. Participants rode a pre-set route twice, once on an instrumented e-bike and once on a conventional bicycle, under two levels of physical workload (medium and high) and two levels of task complexity (medium and high), while performing a visual detection task. The results of these studies will be presented and the implications for safety discussed. he one-page abstract begins with the title of the paper, the authors, affiliations, abstract and keywords as it is shown in this document. The title of the paper should be typed in 14 pt bold font and be centred. It should be separated from the symposium name by a 12 pt space and from authors' names by an 18 pt space. Authors' names should be typed in bold font. Affiliations should be typed in a general formatting style, centred within a corresponding bounding box. The abstract part of the final paper should not be longer than about 300 words, so it fits on one page. The abstract itself begins with the ``ABSTRACT'' header typed in bold 11 pt font. The abstract text should be separated from the header by an 11 pt space. The abstract should be followed by a list of keywords after the header ``Keywords:'' typed in bold 11 pt font. The keywords should be separated by commas. A dot should be place after the last keyword. Up to about five keywords are allowed. The abstract ends with references [1,2,3].

Keywords: guidelines for authors, template, final symposium paper, formatting instructions.

REFERENCES

[1] H. B. Pacejka, *Tyre and Vehicle Dynamics*, Butterworth and Heinemann, Oxford, 2002.

[2] E. Bertolazzi, F. Biral, M. Da Lio and V. Cossalter, “The influence of rider's upper body motions on motorcycle minimum time maneuvering”, in C. L. Bottasso, P. Masarati and L. Trainelli (eds), *Proceedings, Multibody Dynamics 2007, ECCOMAS Thematic Conference*, Milano, Italy, 25-28 June 2007, Politecnico di Milano, Milano, 2007, 15 pp.

[3] R. S. Sharp, “The stability and control of motorcycles”, *Proceedings of the IMechE, Part C, Journal of Mechanical Engineering Science* **13** (1971), pp. 316-329.