
Sleep deprivation affects the sensitivity of reactive control: An ERP analysis

Céline Ramdani*^{†1}, Laurence Carbonnell², Thierry Hasbroucq¹, Boris Burle¹, and Franck Vidal¹

¹Laboratoire de neurobiologie de la cognition (LNC) – CNRS : UMR6155, Université de Provence - Aix-Marseille I – Pole 3 C Case C 3 Place Victor Hugo 13331 Marseille Cedex 3, France

²Laboratoire de psychologie cognitive (LPC) – CNRS : UMR6146, Université de Provence - Aix-Marseille I – Pôle 3 C, Case D 3 place Victor Hugo 13331 Marseille Cedex 3, France

Abstract

Failing to respond correctly in a timely fashion to a stimulus, is a hallmark of sleep deprived (SD) state. Response accuracy under speed-stress relies in particular on reactive control (ability to detect and correct errors). The "Error Negativity" (or "Error-Related Negativity") is an event-related potential starting just after electromyographic onset and peaking just after error in reaction time (RT) tasks. It is widely considered as an index of reactive control. Different research groups investigated the effect of SD on Ne and the impact of sleep deprivation on reactive control is inconclusive. After Laplacian transformation, this negativity can also be observed for partial errors and for correct responses. The amplitude of this negativity is maximal for errors, minimal for correct responses and intermediate for partial errors. This gradation which depends on response correctness reflects the sensitivity of reactive control. SD was expected to reduce the sensitivity of reactive control and the gradation of Ne as a function of response correctness was predicted to reduce. This was tested in a Simon task which is known to be particularly error- and partial error-prone. We recorded RT, error rate electromyographic and electroencephalographic activity of subjects completing the task either after sleep deprivation (26 hours of wakefulness) or after a normal night of sleep. Results showed that the gradation from correct responses to partial errors, and from partial errors to errors was decreased after SD. In conclusion, reactive control had a weaker sensitivity to performance after a night of sleep deprivation.

*Speaker

[†]Corresponding author: celineamdani@hotmail.fr