

Is command following unrelated to top-down attention in consciousness disorders?

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In a recent study¹, in order to evaluate the event-related potential (ERP) markers of bottom-up (P3a) and top-down (P3b) attention in disorders of consciousness (DoC), the Authors used a vibrotactile three-stimulus oddball paradigm. Standard (S), deviant target (T), and deviant non-target (NT) stimuli were administered to the upper back (80%), target wrist (10%), and contralateral wrist (10%) respectively, having participants count only target stimuli.

However, the component referred to by the Authors as P3a was identified by comparing overall deviant (T plus NT) to standard (S) responses, thus obtaining a hybrid ERP where P3a and P3b overlap, making involuntary/bottom-up responses (NT) indistinguishable from voluntary/top-down (T) ones. Nevertheless, these ERPs were associated with patients' ability to follow commands. This is an important finding from a clinical standpoint, but not surprising, since even voluntary/top-down responses have contributed to their elicitation.

On the contrary, the common practice is to average target and non-target responses separately^{2,3}, identifying them by comparison with standard responses (T vs S and NT vs S, respectively). Indeed, T vs NT comparison while allowing us to detect any difference between responses, would not exclude the presence or absence of one or both of them.

Beyond the correctness of comparison procedures, what is surprising is the lack of top-down/P3b responses in patients able to follow commands¹.

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The Authors speculate a failure of voluntary engagement in the three-stimulus oddball task, due to fatigue/alertness fluctuations or to the different suitability of task demands to patients' cognitive profiles.

In this regard, it's interesting to note how our cognitive attitude, at any given time, depends on the functional balance between two anticorrelated neural networks: the task positive network (TPN), active during perceptual and/or cognitive tasks, and the default mode network (DMN), active in resting conditions and involved in self-consciousness⁴. These two networks may be differently impaired in patients with DoC producing different functional imbalances and, thus, different cognitive attitudes⁵.

Therefore, we suggest also evaluating in DoC patients the DMN, by using fMRI and/or blink-related EEG^{6,7}, and the functional balance between the two networks. A prevalence of TPN, in fact, could reflect a patient's proneness towards the surrounding environment, while a prevalence of DMN towards the internal milieu^{6,7}. In the latter case, voluntary/top-down attention would be less engageable in external tasks even with the patient being able to present some kind of self-awareness and involuntary/bottom-up attention remaining capturable by relevant environmental stimuli^{6,7}.

Author Contributions

L.B. contributed to concept and drafting the manuscript. L.B. and M.C.C. contributed to critical revision of the final version.

Potential Conflicts of Interest

Nothing to report.

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