

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

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DOI:

[10.1002/ana.24827](https://doi.org/10.1002/ana.24827)

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Document Version

Peer reviewed version

Citation for published version (Harvard):

Gibson, RM, Chennu, S, Fernández-Espejo, D, Naci, L, Owen, AM & Cruse, D 2017, 'Reply to "Is command following unrelated to top-down attention in consciousness disorders?"', *Annals of Neurology*, vol. 81, no. 1, pp. 160-161. <https://doi.org/10.1002/ana.24827>

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Gibson, R. M., Chennu, S., Fernández-Espejo, D., Naci, L., Owen, A. M. and Cruse, D. (2016), Reply to "Is command following unrelated to top-down attention in consciousness disorders?". *Ann Neurol.* Accepted Author Manuscript. doi:10.1002/ana.24827

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Title: Reply to “Is command following unrelated to top-down attention in consciousness disorders?”

Running head: Reply to “Is command following unrelated...”

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Number of characters in the title: 91

Number of characters in the running head: 42

Number of figures, colour figures, and tables: 0

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process which may lead to differences between this version and the Version of Record. Please cite this article as an ‘Accepted Article’, doi: 10.1002/ana.24827

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

We recently reported a correspondence between event-related potential (ERP)-based evidence of bottom-up attention and command following among patients with severe brain injury¹. The P3a ERP reflects bottom-up attention and is often obtained by comparing responses to non-target deviant and standard stimuli². The P3b ERP reflects top-down attention and is often obtained by comparing responses to target deviant and standard stimuli². In our article¹, we quantified bottom-up attention by comparing responses to all deviant stimuli – target and non-target – and all standard stimuli. In their letter³, Bonfiglio and Carboncini highlight that our ERP definition comprises both P3a and P3b components and postulate that top-down attention may underlie our reported relationship between command following and ERP-based evidence of attention.

Our contrasts delineate a hierarchy of cognitive abilities. We quantified bottom-up attention by comparing all deviant and standard trials. This contrast has more statistical power than the conventional P3a contrast because more deviant trials are available. Furthermore, we quantified top-down attention by directly comparing target and non-target deviant trials. This approach was necessary because a deviant stimulus is only a target in our paradigm if the participant selectively attends to that deviant stimulus when instructed. If the participant does not comply with task instructions, however, the conventional P3b contrast (target versus standard) could return a significant effect driven by attentional orienting to deviant stimulation. This concern is particularly relevant for the patients in our investigation who could not overtly confirm that they understood and followed task instructions.

To examine any differences between the two approaches, we conducted the P3a and P3b comparisons described by Bonfiglio and Carboncini³. These comparisons yielded findings consistent with our original report¹: we detected P3a effects from all healthy volunteers and all patients who demonstrated command following; and we did not detect P3b effects from any of the patients. The conventional P3b contrast yielded a higher hit-rate in our healthy volunteers (100%) than our original approach (67%); this likely owes to the greater depth of processing elicited by targets relative to standards, as compared with targets relative to non-targets. However, as explained above, the conventional P3b contrast does not necessarily isolate top-down attention in our paradigm.

Bonfiglio and Carboncini³ also propose an explanatory role of cognitive attitudes in command following, which could be quantified using blink-related EEG^{4,5} or fMRI-based activation of particular cortical networks. We cannot directly investigate this proposal because our EEG and fMRI data were not collected simultaneously. However, the evidence linking intrinsic networks to external awareness adds weight to their hypothesis⁶.

Author Contributions

All authors contributed equally to this work.

Potential Conflicts of Interest

Nothing to report.

References

1. Gibson RM, Chennu S, Fernández-Espejo D, et al. Somatosensory attention identifies both overt and covert awareness in disorder of consciousness. *Ann Neurol* 2016;80(3):412-423.
2. Polich J. Updating P300: an integrative theory of P3a and P3b. *Clin Neurophysiol* 2007;118:2128-2148.
3. Bonfiglio, L, and Carboncini, MC. Is command following unrelated to top-down attention in consciousness disorders? *Ann Neurol*, in press.
4. Bonfiglio L, Olcese U, Rossi B et al. Cortical source of blink-related delta oscillations and their correlation with levels of consciousness. *Hum Brain Mapp* 2012;34:2178-2189.
5. Bonfiglio L, Piarulli A, Olcese U et al. Spectral parameters modulation and source localization of blink-related alpha and low-beta oscillations differentiate minimally conscious state from vegetative state/unresponsive wakefulness syndrome. *PLoS One* 2014;9:e95948
6. Demertzi, A, Antonopoulos, G, Heine, L, et al. Intrinsic functional connectivity differentiates minimally conscious from unresponsive patients. *Brain* 2015;138:2619-2631.