Consciously perceived timing of "the first urge to move" does not relate to Bereitschaftspotential onset: further evidence

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Background

The role of Bereitschaftpotential (BP) in motor decision-making is a topic of ongoing discussion. Especially, it is important in the context of Libet's paradigm.

In the paradigm BP onsets are matched with introspective reports which the participants are required to give while monitoring the specific clock. It is either:
1) **M-time:** the time point which the clock showed when the participant had pressed the button; or
2) **W-time**: the time point the clock showed when the participant had felt "the first urge to move".

Importantly, Haggard & Eimer, 1999; as well as Schlegel et al., 2012 showed that BP onset and W-time are **unlikely** to be **causally connected.**

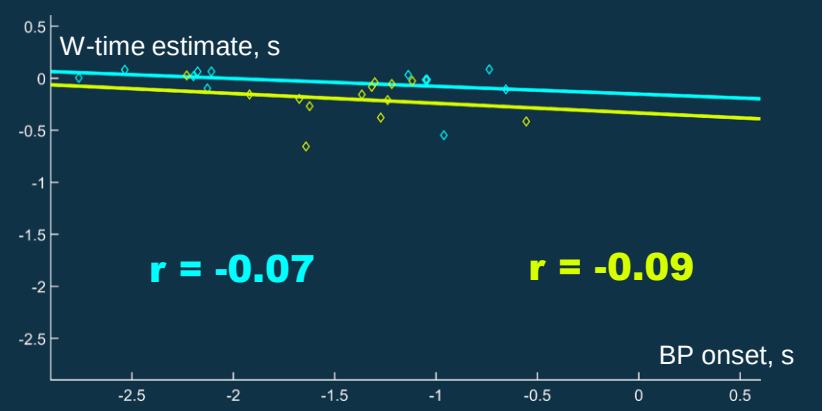
On the other hand, Dominik et al. (2017) questioned the validity of W-time estimation. Specifically, they showed that participants who start the experiment from W-time estimation do not differ in their W-time and M-time estimates.

Hypothesis

We suggest that if the correlation between BP onsets and W-time estimates exists, it would manifest itself only in the participants who start the experiment with M-time estimation (second group).

First Group
Start with W-task
Finish with M-task

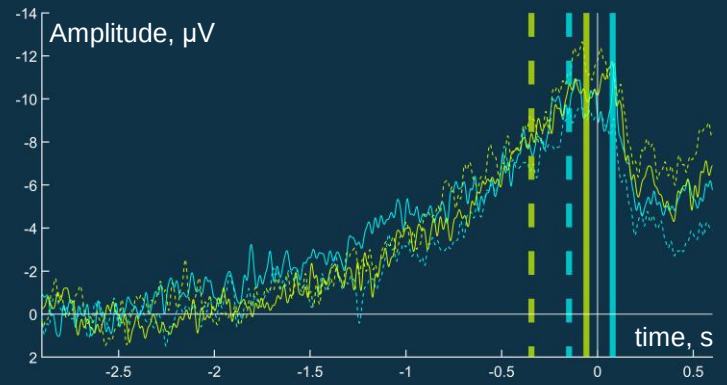
Second Group
Start with M-task
Finish with W-task



Averaged BP onsets in First and Second groups for trials with:

early awareness
*W-time estimates are **earlier** than subject's median report*

late awareness
*W-time estimates are **later** than subject's median report*



BP onset starts at the same time regardless **the order of the tasks** and **how early conscious awareness of the planning movement occurs.**
A new argument confirming the absence of causal relation between **BP** and **W-time estimate** is provided.

Methods

- EEG and EMG were recorded from 37 subjects (22 females, mean age 25.0)
- The experiment consisted of two task: M-task (40 trials of M-time estimation); and W-task (40 trials of W-time estimation)
- Subjects were randomly assigned to two experimental groups, which differed only in the order of the tasks.
- The W-task trials within each subject were split into early and late awareness trials BP onsets were calculated from the Cz electrode using multiple techniques, including automatic and manual detection.

Results

- Behavioral results of Dominik et al. (2017) are replicated (W-time estimates significantly precede M-time estimates only for the second group: within group t-tests)
- No correlation is found between BP onsets and W-time estimates in both groups
- 2x2 ANOVA within factors of group and awareness (early and late) revealed no significant difference in BP onset timing.

Discussion

Our results confirm that W-time reports depend on participant's prior experience with M-time estimation. Moreover, the results indicate that BP onsets are not causally connected with W-time estimates regardless the prior experience of the participant with movement reports. Thus, we conclude that W-time reports are unlikely to unambiguously capture motor intentions.