Spontaneous action initiation with temporal constraints on the response time: an MEEG study

Bianca Trovó, Z Iscan, A. Schurger

To cite this version:

HAL Id: cea-02300823
https://hal-cea.archives-ouvertes.fr/cea-02300823
Submitted on 29 Sep 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Distributed under a Creative Commons Attribution - NonCommercial - ShareAlike 4.0 International License
Abstract

The Readiness Potential (RP) is a slowly increasing negative-going cortical potential that precedes spontaneous voluntary actions. Its eventual interpretation remains to be determined. Dosemeci (2019) suggests that this state resembles the process of mental preparation of actions where the external imperative is set but is not clear when the subject is allowed to move at his discretion over time.

In particular, the model predicts that movements are more likely to happen at a ‘threshold’ of these ongoing fluctuations, and less likely to do so if it is farther from the decision-threshold for movement. We developed a new experimental paradigm in order to investigate the effect of varying amounts of temporal freedom on the shape of the RP (Dosemeci, 2015b, 2015c). We performed a set of Libet (1983) tasks in which subjects are asked to make a finger lift within a given time window in which they feel that movement would most likely occur, but do not know the exact temporal limit of the RW.

Our main prediction is that the movement-preceding activity in pre-motor areas of the brain will appear at longer times as the time window increases, and will be shorter in the basic RW of the Libet paradigm. We explored these effects on ongoing sub-threshold cortical waves metaphorically as a drift towards the decision-threshold of movement.

Methods & Design

According to the classical view, the RP roughly reflects a continuous drift towards movement (Baker, 1969). However, it is currently not known whether this drift is continuous, or whether it is preceded by a slow buildup of activity that may be observed as a slow increase in ongoing sub-threshold fluctuations in a moving window of time.

A recent interpretation provided by the stochastic decision model suggests that this slow movement preceding the reactive event could be the outcome of a bounded-accumulation fashion where movements are reporting negative Wt (= the feel of ‘urgency’ after the movement instead of before). In classical RP studies, subjects are reporting negative Wt (= the feel of ‘urgency’ after the movement instead of before). In classical RP studies, subjects are instructed that they have an unlimited amount of time in which to perform the movement. The research question of the present study is to test whether the movement-preceding activity in pre-motor areas of the frontal cortex will be reported as less negative at shorter time, and less likely at a trough.

We also predicted the relationship between the RP between RT and the movement condition but we did not find any significant difference. For the time-locked analysis, we decided to examine what were recording negative Wt (= the feel of ‘urgency’ after the movement instead of before). In classical RP studies, subjects were reporting negative Wt (= the feel of ‘urgency’ after the movement instead of before). In classical RP studies, subjects were reporting negative Wt (= the feel of ‘urgency’ after the movement instead of before). In classical RP studies, subjects were reporting negative Wt (= the feel of ‘urgency’ after the movement instead of before).

Results (2): ERP

Results (3): ERP

We also predicted the relationship between the RP between RT and the movement condition but we did not find any significant difference. For the time-locked analysis, we decided to examine what were recording negative Wt (= the feel of ‘urgency’ after the movement instead of before). In classical RP studies, subjects were reporting negative Wt (= the feel of ‘urgency’ after the movement instead of before). In classical RP studies, subjects were reporting negative Wt (= the feel of ‘urgency’ after the movement instead of before). In classical RP studies, subjects were reporting negative Wt (= the feel of ‘urgency’ after the movement instead of before).

Discussion

The Readiness Potential (RP) is a slowly increasing negative-going cortical potential that precedes spontaneous voluntary actions. A recent interpretation provided by the Stochastic Decision Model (Schurger, 2012) suggests that this slow buildup could be the slow movement preceding the reactive event that may be observed as a slow increase in ongoing sub-threshold fluctuations in a moving window of time.

The Readiness Potential (RP) is a slowly increasing negative-going cortical potential that precedes spontaneous voluntary actions. The Readiness Potential (RP) is a slowly increasing negative-going cortical potential that precedes spontaneous voluntary actions. The Readiness Potential (RP) is a slowly increasing negative-going cortical potential that precedes spontaneous voluntary actions. The Readiness Potential (RP) is a slowly increasing negative-going cortical potential that precedes spontaneous voluntary actions. The Readiness Potential (RP) is a slowly increasing negative-going cortical potential that precedes spontaneous voluntary actions.