

Redefining the boundaries between cognition and action through the psychophysiological investigation of binary decisions

ABSTRACT:

Background

Prominent decision-making models assume a serial transition from cognition to action. Decisions are envisaged as evidence accumulating towards one of the alternatives, until reaching an action-triggering boundary: Motor responses are not part of the decision process.

Aims

The project questioned the notion of a functional segregation between cognition and action, and attempted to identify the neurocognitive underpinnings of a continuous processing stream mapping decisions to motor responses.

Method

The project focused on lexical decision experiments with manual button-press responses. The first study used electromyographic (EMG) traces to measure response durations. The second study co-registered EMG and electroencephalographic (EEG) signals to track the propagation of decisions across different stages of the motor hierarchy, including long-range interactions indexed by corticomuscular coherence (CMC).

Results

The first study revealed a selective propagation of decisional effects to response duration, which was possibly modulated by verification processes for items with no representation in memory. The second study highlighted a discontinuity in the percolation of decisional effects across the motor hierarchy, with the involvement of motor planning and response duration, but no modulations of motor programming and CMC.

Conclusions

These results question the assumption of a serial transition from decision to motor responses, and the notion of a single decisional variable propagating from decisional to motor stages. Differently, they foster the hypothesis of multiple decisional components reflected at different stages of motor control, pointing to verification process as a plausible decisional substrate of motor execution.

Keywords

Decision making, Motor control, EEG, Cortico-muscular coherence

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Published Work:

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