Effects of subconscious, nonlocal, and retroactive information on participants' choice/decision and neural activities

ABSTRACT:

Background
Metacognition is typically considered a cognitive process reliant on conscious awareness, yet its post-decision mechanisms remain inadequately understood, particularly regarding subconscious information.

Aims
This study utilizes EEG and data-driven methods to explore the post-decision metacognitive process under conscious, subconscious, and no-stimulus conditions, and examines how these differ between active and passive decision-making.

Method
Continuous-flash-suppression (CFS) was employed to induce conscious (Con), subconscious (SubCon), and neutral (None) conditions, while EEG data were recorded during active decision-making (Choice) and passive observation (View).

Results
Time-series decoding analysis revealed that metacognitive processing in SubCon and None conditions was distinct from Con, suggesting differential processing. Further decoding metrics validated that SubCon was also different from None, confirming unique metacognitive processing for subconscious information. Temporal generalization analysis further illustrated the varying neural dynamics across Con, SubCon, and None conditions, as well as between Choice and View modes. Additionally, the frontal-parietal lobe was identified as playing a pivotal role in differentiating metacognitive processes between active and passive decision-making. These findings highlight that post-decision metacognition is influenced by both the level of stimulus awareness and the extent of active participation.

Conclusions
This research offers novel insights into how neural dynamics underpin metacognition, particularly in terms of how conscious and subconscious information influence the metacognitive process, and how decision-making mode modulates neural activity.

Keywords
Metacognition, Subconscious, Conscious, Decision-making, Time-series decoding, Multivariate pattern analysis

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