Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **4314** Type: **Poster not-in-competition (Graduate Student) / Affiche non-compétitive (Étudiant(e) du 2e ou 3e cycle)**

(G) (POS-33) Quantifying Consciousness and Inhibitory Control: An Integrated Information Theory Approach to Neural Dynamics in Go/NoGo Tasks

Tuesday 28 May 2024 17:45 (2 minutes)

This investigation delineates the application of Integrated Information Theory (IIT) for the elucidation of neurodynamics underpinning inhibitory control mechanisms, as operationalized within Go/NoGo paradigms, utilizing electroencephalographic (EEG) methodologies to quantify the integrated information (Φ) parameter across the brain's visual and frontoparietal networks. Inhibitory control, a pivotal component of executive functions, facilitates the suppression of prepotent responses to external stimuli, thereby enabling goal-oriented behavior. Contemporary advancements in the domain of cognitive neuroscience have accentuated the efficacy of EEG in mapping the neural substrates of executive functionalities, with a specific focus on the cognitive and attentional correlates discernible within distinct EEG frequency bands. Employing IIT—a theoretical construct positing the emergence of consciousness from the integrated information produced by a network of interrelated elements—this study analytically examines EEG data from a cohort of 14 healthy participants engaged in Go/NoGo tasks. The objective is to delineate the association between the magnitude of integrated information (Φ) within specific neural networks and the proficiency of inhibitory control as evidenced by task performance metrics.

Initial findings indicate a pronounced correlation between elevated Φ values within the visual network and superior task performance, suggesting that augmented information integration within this network may underlie more efficacious inhibitory control. This association was not mirrored within the frontoparietal network, intimating a potential functional specificity of integrated information in relation to cognitive control mechanisms. This research augments the cognitive neuroscience literature by illustrating the applicability of IIT in empirical investigations, furnishing novel insights into the neural architecture of inhibitory control and its interplay with consciousness. Future endeavors should aim to refine methodologies for Φ quantification and broaden the scope of these findings across diverse cognitive tasks and demographic cohorts.

Keyword-1

Integrated information Theory

Keyword-2

EEG

Keyword-3

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Session Classification: DPMB Poster Session & Student Poster Competition (28) | Session d'affiches DPMB et concours d'affiches étudiantes (28)

Track Classification: Technical Sessions / Sessions techniques: Physics in Medicine and Biology / Physique en médecine et en biologie (DPMB-DPMB)