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# A functional overlap between evidence accumulation, confidence, and changes of mind in the insula and pre-supplementary motor area

Dorian Goueytes<sup>\*1,2</sup>, François Stockart<sup>3</sup>, Lucien Gyger<sup>3</sup>, Martin Rouy<sup>3</sup>, Alexis Robin<sup>4,5</sup>, Dominique Hoffman<sup>5</sup>, Lorella Minotti<sup>4,5</sup>, Philippe Kahane<sup>4,5</sup>, Michael Pereira<sup>6</sup>, and Nathan Faivre<sup>3</sup>

<sup>1</sup>First Department of Neurology, Faculty of Medicine, Masaryk University – République tchèque

<sup>2</sup>Laboratoire de Psychologie et NeuroCognition – Centre National de la Recherche Scientifique, Université Grenoble Alpes – France

<sup>3</sup>Laboratoire de Psychologie et NeuroCognition – Université Savoie Mont Blanc, Centre National de la Recherche Scientifique, Université Grenoble Alpes – France

<sup>4</sup>Université Grenoble Alpes – Centre National de la Recherche Scientifique - CNRS – France

<sup>5</sup>Département de Neurochirurgie, CHU Grenoble Alpes – CHUGA – France

<sup>6</sup>[GIN] Grenoble Institut des Neurosciences – Institut National de la Santé et de la Recherche Médicale, Université Grenoble Alpes – France

## Résumé

In the present work, we used stereotactic electroencephalography to examine the functional role and implementation of evidence accumulation in human metacognition. More specifically, we studied the role of evidence accumulation concerning two metacognitive components of decision-making, confidence judgments and changes of mind. Indeed, although evidence accumulation has proven to be a powerful mechanism to understand the underpinnings of decision-making itself, the question of how and where in the brain it could give rise to metacognitive processes remains unclear. To address this issue, we recorded high-gamma activity in 24 participants with focal epilepsy while they performed a decision-making task followed by a confidence judgment. Participants had to report the motion direction of a random dot kinetogram using a computer mouse, which allowed us to use mouse-tracking to detect sudden changes in trajectory indicative of changes of mind. With this task, we were able to document the functional overlap between evidence accumulation, confidence, and changes of mind in a temporally resolved manner. First, we were able to reproduce the decision accuracy, decision times, and confidence observed at the behavioral level using a computational model allowing evidence accumulation to continue after the initial decision. At the neural level, we found that evidence accumulation is instantiated widely across the cortex, notably in the pre-supplementary motor area (pSMA), the inferior frontal cortex, and the insula. More importantly, in all these regions we found an overlap between the neural correlates of evidence accumulation, confidence, and changes of mind. Interestingly, our results indicate that the correlation between neural activity and confidence was maintained after the decision in the insula, but stopped at decision time in the pSMA. By modulating the duration for which evidence accumulation took place after the decision in our model, we

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\*Intervenant

could qualitatively reproduce these electrophysiological results. In conclusion, by combining intracranial electrophysiology, mouse-tracking, and computational modeling, we showed that confidence and changes of mind result from a mixture of pre and post-decisional evidence accumulation, as instantiated in the pre-supplementary motor area and the insula respectively.

**Mots-Clés:** Intracranial electrophysiology, Decision, making, Evidence accumulation, Metacognition