Perception of short, but not long, time intervals is modality-specific: Converging electroencephalography evidence from vibrotactile and auditory modalities

*Nicola Thibault[1,2], Pier-Alexandre Rioux[1], Andréanne Sharp[1,2], Philippe Albouy[1,2,3], Simon Grondin[1]

1. Université Laval, 2. CERVO Brain Research Centre, 3. International Laboratory for Brain

A longstanding debate in cognitive neuroscience questions whether temporal processing is modality-specific or governed by a “central clock” mechanism. We propose that this debate stems from neglecting the duration of the intervals processed, as studies supporting modality-specific models of time perception often focus on below 1.2-s intervals. To address this, we studied the neuronal dynamics underlying the vibro-tactile perception of time intervals shorter and longer than 1.2-s. Twenty participants underwent electroencephalography recordings during a passive vibrotactile oddball paradigm. We compared brain responses to standard and deviant intervals, with deviants occurring either earlier or later than the standard in both below and above 1.2-s conditions. Event-related potentials revealed distinct deviance-related components: a P250 for deviance detection of below 1.2s and an N400 deviants for above 1.2s. Generators lied in a modality-specific network for below 1.2s intervals, while above 1.2s intervals activated a broader, higher-level network. We found no evidence of the contingent negative variation in the tactile modality, questioning its role as a universal marker of temporal accumulation. Our findings suggest that short intervals involve modality-specific circuits, while longer intervals engage distributed networks, shedding light on whether temporal processing is centralized or distributed. These findings are also in line with our previous results (Thibault al., 2023, 2024) using the auditory modality, where short auditory intervals recruited sensory regions while longer intervals elicited a more distributed network.

Keywords: EEG, Intervals, Oddball, Time perception, Vibrotactile