Distinct effects of semantic plausibility and semantic structure building in MEG

Liina Pylkkänen(1,2), Rodolfo Llinás(1,2), Brian McElree(1)
(1) Department of Psychology, New York University
(2) Department of Physiology and Neuroscience, New York University School of Medicine

To date, research on the neurobiology of sentential semantic processing has focused almost entirely on the processing of semantic anomaly, which arguably only modulates processing at the lexico-semantic level, rather than tapping onto the combinatoric process of semantic structure building. In this study we used MEG to disentangle the effects of plausibility and semantic composition. To modulate semantic composition we employed complement coercion, i.e. expressions where event-selecting verbs such as 'begin', are combined with entity denoting objects (the professor began the book before his evening tea), in such a way that interpretation of the sentence requires creation of semantic structure that is not explicitly present in the input (e.g., the professor began [to read] the book). Extensive behavioral evidence suggests that complement coercions elicit processing delay (e.g. McElree, et al. *Cognition*, 2001). Coerced sentences were contrasted with implausible sentences violating verbal animacy restrictions (the professor disgusted the book before his evening tea), as well as plausible non-coerced control sentences (the professor read the book before his evening tea). Visual stimuli were presented to 16 healthy young participants while magnetic fields were recorded with a whole-head 148-channel MEG system. Multidipole modeling of activity elicited by implausible target nouns showed a classic N400 effect in the left temporal M350/N400m source (e.g., Helenius et al., *Brain*, 1998; Pylkkänen & Marantz, *TiCS*, 2003). Coerced targets elicited no N400 effect, but were instead associated with larger amplitudes in an anterior midline source, which showed no sensitivity to semantic anomaly, and which peaked approximately 50ms after the M350/N400m. These results provide evidence against the hypothesis that the N400 effect is a reflex of semantic processing effort in any particularly linguistic sense. When semantic composition/integration is manipulated in well-formed plausible expressions, effects occur in the frontal lobe, not in the M350/N400m source.