

SFN – San Diego 13-17 November 2010

Spatiotemporal dynamics of morphological processing: an MEG/EEG investigation

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Different aspects of spoken word processing are differentiated within the neural language system. Linguistic complexity engages primarily left lateralised processes, whereas general processing complexity - as indexed by lexical competition - engages a more bilateral network (Marslen-Wilson *et al.* 2007). To track the spatiotemporal dynamics of these systems we combined magneto-encephalography (MEG) and event-related brain potentials (ERPs) in an auditory study. Participants listened to lists of words that varied on two different dimensions and occasionally performed a 1-back memory task. Linguistic processing complexity was manipulated by the presence of a potential inflectional morpheme (*played, trade*). General processing complexity was engaged by the presence of onset-embedded lexical competitors (*claim, hump*).

First we analysed the data using standard univariate approach. Results indicate magnetic and electric field differences between the two types of processing complexity from 250 ms and extending until 510 ms post stimulus and maximally distributed on the anterior left part of the scalp. Source estimates computed with MNE (L2, minimum norm estimates) and analysed using regions-of-interest suggest that general processing complexity activates selectively right inferotemporal posterior areas from 350 ms, as the evidence builds up for the presence of an embedded stem. By contrast, linguistic processing elicited stronger activation in left middle temporal and posterior sources from 450 ms, linked to the timing with which the inflectional ending starts to be heard. Second, we analysed these data (sensor and source levels) using a Multivariate Pattern Analysis (MVPA) approach, in particular Representational Similarity Analysis (RSA; Kriegeskorte *et al.*, 2008). Both univariate and multivariate analyses converge to similar results supporting a spatiotemporal distinction between processes corresponding to different types of lexical processing complexity.

Kriegeskorte, N., Mur, M. and Bandettini, P.A. (2008). Representational similarity analysis: connecting the branches of systems neuroscience, *Front. Syst. Neurosci.*, 2:4.

Marslen-Wilson, W., & Tyler, L. K. (2007). Morphology, language and the brain: the decompositional substrate for language comprehension. *Philos Trans R Soc Lond B Biol Sci.* 363(1493), 917-921.