

A systematic comparison between spatial similarity and evoked responses in EEG and MEG during language comprehension

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EEG and MEG index the time-course of neural activity associated with incoming stimuli. Traditional event-related potentials/fields (ERPs/ERFs) are generally taken to reflect differences in the engaged neurocognitive processes evoked by different stimuli (e.g. the reduced N400 ERP/ERF to plausible versus anomalous words reflects easier semantic retrieval/access). More recently, it has been argued that Representational Similarity Analysis (RSA) can capture differences in the underlying representations associated with different stimuli (e.g. animate versus inanimate). Representation and process are, however, tightly linked, and so, to take full advantage of RSA, it is critical to understand where it converges and diverges from evoked responses. We therefore directly compared ERPs/ERFs and spatial similarity patterns in an EEG (n=72) and MEG (n=32) dataset, collected using a paradigm that crossed the plausibility (plausible vs. anomalous) and the animacy (animate vs. inanimate) of nouns in discourse contexts. The two measures converged in (a) their overall time-course (similarity values mirrored the peaks of the classic N1/P2/N400/P600 evoked responses), and (b) their sensitivity to plausibility (mirroring the ERPs/ERFs, spatial similarity was larger to anomalous than plausible words between 300-500ms and 600-1000ms). These findings underline the importance of considering evoked responses when interpreting differences in spatial similarity between stimuli. RSA diverged from evoked responses by revealing greater similarity to animate than inanimate plausible nouns where overall ERPs/ERFs were small. This suggests that spatial similarity can capture differences in representation, even when overall evoked activity is minimal.