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Author

zeine, leonardo

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Relative time on the sentence timescale encoded in the brain during naturalistic sentence listening

Leonardo Zeine, Sonja Kotz, Peter Donhauser, David Poeppel

Abstract

Understanding how the brain constructs sentence-level meaning from continuous speech requires identifying neural responses that unfold on the timescale of entire sentences. Using MEG recordings from 71 Dutch participants listening to naturalistic sentences and matched wordlists, we combined temporal response function (TRF) modelling with a group-level canonical correlation analysis (CCA) to isolate neural components that track linguistic structure beyond lexical and acoustic information. We show that the CCA-derived canonical components reveal a shared, sentence-level neural trajectory across participants and across sentences of varying length, consistent with a ramping signal spanning the duration of each sentence. This sentence-long component is dissociable from word-level and envelope-based responses, and is significantly reduced in wordlists lacking syntactic structure. Model comparisons demonstrate that relative time within a sentence—rather than absolute time—best explains the ramping dynamics, suggesting that the brain tracks progress toward the end of the unfolding sentence.