Electrophysiological Correlates of Semantic Dissimilarity Reflect the Comprehension of Natural Narrative Speech

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1 Summarized Publication

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2 Summary

Speech comprehension involves rapid, online neural mechanisms that process words' meanings in an approximately time-locked fashion. However, electrophysiological evidence for such time-locked processing has been lacking for continuous speech. Although valuable insights into semantic processing have been provided by the ''N400 component'' of the event-related potential [1], this literature has been dominated by paradigms using incongruous words within specially constructed sentences, with less emphasis on natural, speech comprehension. Building on psycholinguistic work modelling how context impacts on word processing, we describe a new approach for deriving an electrophysiological correlate of natural speech comprehension. We use the well-known word2vec computational language model [2] to index words' semantically dissimilarity to their preceding context and then regressed this measure against electroencephalographic (EEG) data recorded from subjects as they listened to narrative speech. This produced a prominent negativity at a time lag of 200–600ms on centro-parietal EEG channels, characteristics common to the classic N400 response. Applying this approach to EEG datasets involving time reversed speech, cocktail party attention, and audiovisual speech-in-noise demonstrated that this response was very sensitive to whether or not subjects understood the speech they heard. These findings demonstrate that, when successfully comprehending natural speech, the human brain responds to the contextual semantic content of each word in a relatively time-locked fashion.

References

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