What drives intersubject correlation of EEG during the processing of auditory narratives?

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When participants listen to narratives, neural and physiological signals show temporal correlations across individuals. The intersubject correlation (ISC) is increased when attention is directed to the stories suggesting that shared neural and bodily dynamics arise from a similar processing of the narratives. Determining whether ISC primarily reflects low-level acoustic processing or higher-level linguistic processing is important in the clinical context of disorders of consciousness (DoC). Although some DoC patients exhibit evoked responses to auditory narratives similar to healthy controls, ISC is typically reduced, prompting the question of whether this is primarily a difference in processing of the narrative or just low-level auditory processing. In this study, we investigate whether the ISC of the EEG in healthy participants is driven by low-level acoustic (envelope, spectrogram) and/or higher-level linguistic information (word onset, word unpredictability; WU). Combining temporal response functions (TRFs) and correlated component analysis, ISC was computed on the EEG data and on residuals obtained after removing TRF-predicted responses. Significant ISC emerged during both passive listening and attentive story engagement, largely driven by acoustic features. WU uniquely contributed to ISC during active engagement, with temporal and scalp distributions consistent with language processing. However, linear TRF-predicted responses accounted for only a small fraction of total ISC. These findings suggest that combining ISC with linear encoding models can provide meaningful markers of language processing in unresponsive patients. Future work should test whether nonlinear neural dynamics, higher-order narrative features, or arousal-related bodily processes explain the remaining shared variance.

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