Modeling the Neural Responses to Speech

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Abstract: How the brain encodes speech is an important question in brain and cognitive sciences. However, classic EEG/MEG studies relying on the event-related response can only investigate the neural response to repetitively presented discrete speech units, such as isolated syllables or words. To investigate the neural encoding of continuous speech, such as sentences and passages, a number of studies in recent years have focused on the neural activity entrained/synchronized to the temporal envelope of speech. These studies employed different measures to characterize the neural entrainment to the speech envelope. Some of the measures are in the time domain, such as the temporal response function or the cross-correlation function, while other measures are in the frequency domain, such as the inter-trial phase coherence spectrum and the stimulus-response coherence function. Here, we explore the theoretic link between these measures and compare the robustness of these measures based on EEG/MEG responses recorded during story listening. Furthermore, we optimize the methods to reliably measure the neural entrainment to continuous speech.

Keywords: Systems modeling; MEG; EEG; Speech coding