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Short-term statistics and lexical experience drive predictions and prediction errors along the auditory pathway

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ABSTRACT

Perception can be thought of as an act of inference, and the brain as a predictive machine continuously generating internal models of the causal dynamics of the world in an attempt to interpret its observations. According to the predictive coding theory, feed-forward prediction errors and feedback predictions flow across hierarchically organized brain areas in distributed neuronal assemblies that support neuronal representations. Despite the prevalence of this theory in the interpretation of brain function and the wealth of studies showing indices of prediction errors in neural responses, very few studies have actually found evidence for predictive brain activation, nor it is clear how far high-order predictions can travel upstream the hierarchy. Here we present two studies aiming to shed some light on these questions. In the first study, we show how the hemodynamic response of primary and secondary auditory areas is modulated by expectancy, increasing towards the predicted appearance of a sound according to local stimulation probabilities. In the second study, we show that lexically driven predictions about word endings generate early prediction error signals at different stages of the auditory system hierarchy, and that such predictions are even capable to modulate the early stages of acoustic encoding..

Keywords: Online statistics, predictive coding, auditory evoked potentials, frequency-following response

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