

Comprehenders Rationally Adapt Semantic Predictions to the Statistics of the Environment: a Bayesian Model of trial-level N400 amplitudes

Delaney-Busch N, Morgan E, Lau E & Kuperberg G

When semantic information is activated prior to bottom-up input (i.e. when a word is predicted or “primed”), semantic processing of an incoming word is typically facilitated, attenuating the amplitude of the N400 component. This N400 semantic priming effect is sensitive to the probability of seeing an associated prime-target pair within an experiment, suggesting that participants may be adapting the strength of their predictions to the predictive validity of the broader experimental environment. Using nonparametric local regression, we show that this adaptation takes place on a trial by trial basis. We formalize this adaptation using a Bayesian mixture model to show that the N400 amplitude evoked by words (whether associated or unassociated) in both low- and high-predictive contexts can be described as a function of word surprisal. These findings support the idea that comprehenders rationally adapt their semantic predictions to the statistical structure of their broader environment.