Grammatical Influences in a Bayesian Speech Production Framework

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Abstract: In a Bayesian speech production framework, the selection of forms to produce during speech planning is formalized as noisy-channel communication between different levels of mental processing. Each level of processing maintains a probabilistic distribution over possible forms to produce, and iteratively updates this distribution as evidence is received from other levels. The amount of evidence required to select a form for production corresponds to empirically observed latencies, and depends in part on prior biases encoded at a level of processing. As a novel contribution to the psycholinguistic modeling of speech production, we show that a speaker's grammatical knowledge can be easily incorporated into this prior bias if grammar takes the form a constraint-based maximum entropy model. Simulation results are provided indicating that a phonological level of processing with prior biases based on a phonotactic grammar of English is faster to produce phonotactically probable forms, in accordance with the empirical literature.