Rational Inference from Number Agreement Mismatch

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Abstract

Prior research suggests that humans rationally integrate semantic expectations and the likelihood of noise corruptions in robust language comprehension. For such inferences to be maximally useful in normal communication, people should be sensitive to the fine-grained statistical structure of likely errors that vary across contexts, but this has not yet been shown. Here we hypothesize that a rational language user should represent fine-grained patterns of potential mistakes. To test this hypothesis, we employ a novel free-form text editing task, where participants are asked to edit sentences with subject-verb agreement errors, among stimuli with various type of other errors. We build a Bayesian cognitive model to infer the parameters of the model of errors, based on the observed frequency of the type of edits and judgments of plausibility of sentences without agreement errors in an independent norming study. Results suggest that the full Bayesian model explains the editing choice data better than alternative models that attribute the variance in human behaviors to either prior or context-insensitive error likelihood. Furthermore, the estimated likelihood parameters show a pattern in the distribution of errors qualitatively similar to that reported in empirical research of language production, suggesting that humans' intuitive theory of errors may be rational as to represent language-wise statistical structure of errors in the environment. These results provide quantitative evidence that humans closely track prior statistics over linguistic forms and deploy a context-sensitive model of errors in reasoning about the cause of problem from erroneous input.

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