A quantitative exploration of adjective ordering preferences with an incremental Rational Speech Act model

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We present a quantitative analysis of experimental data on adjective ordering preferences (e.g. *big white bear* vs. *white big bear*) that is based on a computational model of incremental language processing Schlotterbeck and Wang (2023) in the Rational Speech Act framework (Frank & Goodman, 2012). The data were collected in a preference rating experiment that tested for conflicting effects of subjectivity (Scontras et al., 2017) and discriminatory strength (Fukumura, 2018) on adjective ordering preferences in referential visual context. The experimental results indicate that, if the communicative efficiency of an adjective is low in a given context, it is preferred later in a multi-adjective expression. What distinguishes our model from previous approaches is that it assumes fully incremental interpretation, without the need to anticipate possible sentence completions. Moreover, we incorporate a continuous semantics for color adjectives (e.g. *white*, cf. Degen, Hawkins, Graf, Kreiss, & Goodman, 2020) and a context-dependent semantics for size adjectives (e.g. *big*, cf. Schmidt, Goodman, Barner, & Tenenbaum, 2009), allowing for meanings that vary during the course of a sequential context update (Franke, Scontras, & Simonic, 2019). We implemented the model and conducted Bayesian Data Analysis utilizing NumPyro (Bingham et al., 2019), a Python-based probabilistic programming language. The modeling results demonstrate that the incremental model with context-dependent meanings outperforms a baseline model with a fixed 'global' semantics. A posterior predictive analysis shows that, in sum, our computational model accounts well for the experimental data.

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