**Including atypical information in referring expressions is communicatively efficient**

What governs how much information speakers include in referring expressions? One important pressure is for speakers to include just enough information for their interlocutor to uniquely select an intended referent from among a set of potential referents [3]. In Fig. 1, this corresponds to calling the target object a “banana” in 1a), where there is no competing banana; but a “yellow banana” in 1c), where there is a competing (brown) banana. However, speakers also have a well-documented preference to mention properties of objects – especially color – “overinformatively” [4]. For example, speakers are likely to call the banana in 1c) a “brown banana” some of the time. Speakers tend to mention atypical rather than typical properties of objects overinformatively [5] [6] [7]. For example, a banana is more likely to be called a “blue banana” if it is blue and more likely to be called a “banana” if it is yellow.

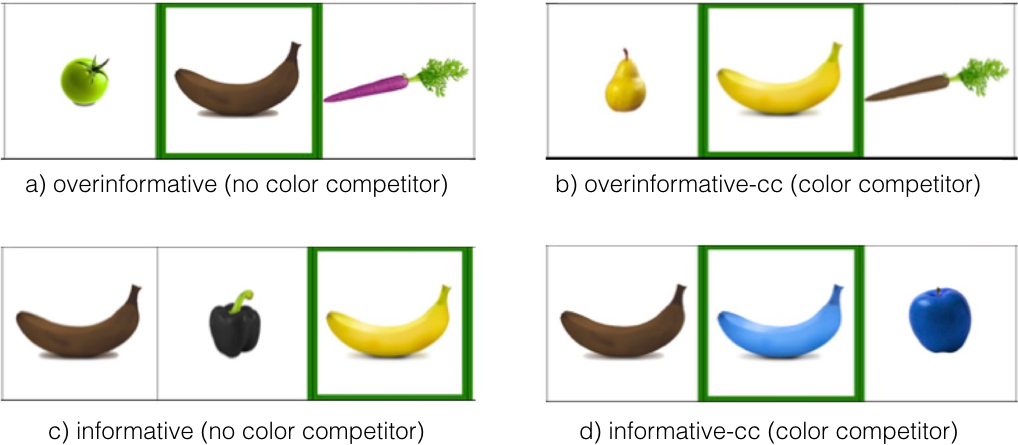
An account of why more typical properties are less likely to be mentioned is still lacking. Some have proposed that it is a speaker-internal pressure to mention salient properties; others have proposed that speakers mention properties when they are useful for their addressees, e.g., by facilitating visual search. Here, we abstract away from the question of whether properties are mentioned for speakers or for listeners and instead ask: when should a rational speaker with the goal to correctly communicate the intended referent be expected to mention an object’s color?

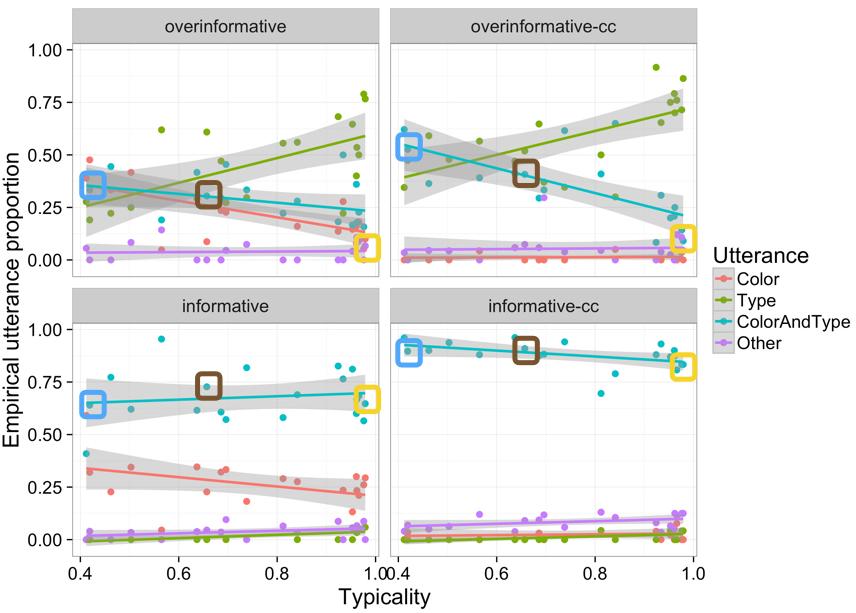
**Model.** We model reference production within the Rational Speech Act framework [1]. Taking inspiration from Graf et al. 2016, utterances (simple nouns like “banana”, simple color adjectives like “blue”, and modified noun phrases like “blue banana”) are taken to have a graded semantics: rather than assuming that the bananas shown in Fig. 1a)-1d) are equally good instances of “banana”, we empirically elicited object-utterance typicality values on Mechanical Turk for all possible utterances. For eliciting color typicality, we presented participants with a representative color patch from each object. FIXME SPELL OUT SPEAKER

**Production experiment.** In order to evaluate the RSA model quantitatively, we collected freely produced referring expressions in a multi-player online reference game experiment using contexts such as those depicted in Fig. 1. 60 pairs of participants were recruited through MTurk and randomly assigned to speaker and listener role. They communicated through a chat window. Speakers were instructed to produce a referring expression that would allow the listener to click on the target object. Once listeners made a choice by clicking on an object, feedback was provided to both participants about the listener’s choice. Stimuli were photo-realistic depictions of food items that occurred in three different colors, which differed in how typical they are for the item. Conditions differed in whether mentioning color was “informative” (necessary for uniquely establishing reference, 1c-d) or “overinformative” (1a-b); and whether there was a competitor from another food category of the same color (1b/1d) or not (1a/1c). Each participant completed 42 trials, on which all seven items were targets in their three colors twice. Informativeness and color competitor presence conditions were randomly sampled and trial order was randomized.

**Results** are visualized in Fig. 2**.** For ease of exposition (and following previous literature), we focus on whether or not color was mentioned at all (though the RSA model of course predicts the entire utterance distribution for each of the unique 1085 contexts). Color was mentioned more often in informative than in overinformative contexts (β=5.27,p<.0001) and more often when there was no color competitor than when there was (β=.67,p<.0001). Crucially, there was a main effect of typicality in the expected direction – the more typical an object was for the simple nominal expression, the less likely color was mentioned (β=-4.11,p<.0001). This was the case even when color was informative – in these cases, participants preferred to sometimes say “banana” for the very typical banana even though there was another banana present.

DISCUSSION FIXME RSA CAPTURES UTILITY OF REDUNDANT ADJECTIVE MENTION; LINK TO OPTIONAL INSTRUMENT MENTION

Fig. 1. Examples of relevant informativeness and color competitor presence conditions.

Fig. 2. Proportion of Color ("blue"), Type ("banana"), and ColorAndType ("blue banana") utterances as a function of mean object typicality for the Type utterance, across conditions. "COLOR banana" cases are circled in their respective color.

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