

## Transcript for poster video presentation

When listeners hear an adjective in a definite referring expression such as “the yellow banana”, they draw contrastive inferences. For example consider the contexts provided here in the introduction. While the utterance “Click on the yellow banana” unfolds, our critical point of interest is after hearing the adjective but before hearing the noun, namely “Click on the yellow...”. While a listener cannot infer whether the banana or the corn cob is the intended target in the left context, adding a contrasting orange banana (as in the context right next to it) results in a preference of the yellow banana. In the literature this preference has generally been evidenced as anticipatory eye movements to the target over the competitor in the display. While this contrastive inference seems to continuously show up with size adjectives, it has been observed to be more volatile with color adjectives. We propose the Rational Speech-Act framework to investigate this question from a highly speaker-centric perspective. The core idea of the model is that a listener determines the intended referent by reasoning about a speaker (and a prior over objects which we assume to be uniform and therefore neglect for now). Concretely, listeners’ target expectations are then proportional to the speaker’s probability of producing the adjective (such as yellow) for each item in the display.

So, the RSA model predicts that the preference of the target over the competitor when hearing “Click on the yellow...” depends on the speaker probability of mentioning “yellow” for the target and the competitor. Consequently, the target preference should change if the speaker’s modifier production probabilities for the items change. which is exactly what we test in this work.

We manipulate these production expectations in two ways: 1) by displaying targets with and without a color contrast; and 2) by displaying target and competitor in typical and atypical colors. This second manipulation is motivated by the observation that speakers rarely spontaneously mention an object’s color, when the color is typical for the object (such as „strawberry“ for “red strawberries”), but often do when the color is atypical (such as “yellow strawberry” for „yellow strawberries“). Therefore, contrast presence, target color typicality, and competitor color typicality all provide independent pragmatic reasons for a listener to expect a speaker to produce a color adjective. In the second context with the yellow banana, orange banana and yellow corn cob, the adjective is expected to refer to the yellow banana because competitor typicality, and contrast presence all support the explanation that the speaker intended to refer to the target. In the third context where the competitor is a yellow strawberry, the modifier production probability for the target is unchanged, however now the use of the color term can also be due to the atypicality of the competitor. It should therefore be more difficult to establish which of the two yellow objects is the intended target.

Those underlying modifier production probabilities were normed in a free production study with 112 participant pairs within an interactive reference game. The results from the reference game show that the modifier production probabilities increase when a contrast is present and crucially also if the object is of an atypical color, therefore supporting the main assumption of the highly speaker-centric account.

In our main experiment we tested whether listeners' target considerations are affected by those varying modifier production probabilities for the target and competitor. We recruited 211 participants for an incremental decision task on Mturk. They clicked on the object they believed the speaker intended at three different points in the utterance, which was gradually revealed on screen: in the prior window ("Click on the"), the adjective window of interest ("Click on the yellow"), and the disambiguating noun window ("Click on the yellow banana!"). All stimuli were normed in four separate studies to ensure that each object was color- diagnostic, nameable with only one possible label AND had a typical (e.g., red strawberry) and atypical (e.g., yellow strawberry) instantiation.

We find that in the prior window (that is after "Click on the"), the probability of object selection was uniform, which further justifies our uniform prior assumption in the RSA model. The results of the adjective window are displayed in this plot here in the lighter bars. Note that in each of these facets, we can talk about a target preference over the competitor, but the contrastive inference is the difference in target preference between the contrast absent and present conditions (so the lower and upper row). We can see that target preference changes across contrast conditions but the contrastive inference strength differs dependent on the typicality of the objects. For example the condition pair with the blue border shows a larger difference than the conditions marked in yellow. Note that the cases with the blue and green border refer back to the example contexts in the introduction.

Our RSA model qualitatively and quantitatively predicts these results from the previously elicited speaker production data.

In conclusion, our work provides empirical support for a highly speaker-centric model of comprehension, which correctly predicts a high variability of contrastive inference strength in the color adjective domain. Methodologically our results further show that contrastive inference with color adjectives can be elicited in offline clicking paradigms.