# Mentioning Atypical Properties of Objects is Communicatively Efficient

**Elisa Kreiss[1], Judith Degen, Robert X. D. Hawkins, Noah D. Goodman[2]**

University of Osnabrueck[1], Stanford University[2]

## Introduction

**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 (say "yellow banana" in Fig 3a and only "banana" in Fig 3c) [1]. However, speakers have a well-documented preference to mention properties "overinformatively", especially color [2]. E.g., speakers are likely to call the target in 3c a "blue banana". More precisely, speakers tend to mention atypical rather than typical properties of objects overinformatively [3][4][5]. For example, a banana is more likely to be called a "blue banana" if it is blue and more likely just to be called a "banana" if it is yellow.

A unified account of this phenomenon is still lacking. We ask: when *should* a rational speaker mention an object's color?

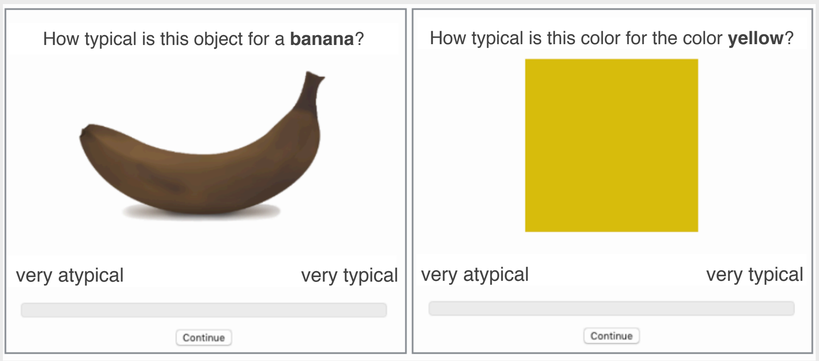
## Typicality norming studies

Purpose

- Collect empirical typicality values for each utterance-object pair

Design

- 3 separate studies
  1. adjective&noun-object pairs
  2. noun-object pairs
  3. adjective-color pairs

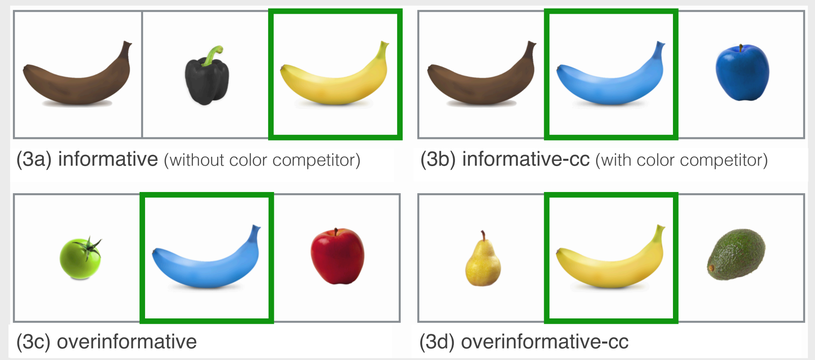



Examples for noun-object and adjective-color trials.

Result

| Utterance | Banana items: yellow | brown | blue | Other |
|---|---|---|---|---|
| *banana* | **.98** | **.66** | **.42** | .05 |
| *yellow banana* | **.98** | .33 | .17 | .05 |
| *brown banana* | .28 | **.90** | .18 | .04 |
| *blue banana* | .20 | .18 | **.91** | .06 |

Example typicality values for the banana case; numbers shown in bold are "correct" pairings.




The four context conditions as they occurred in the study.

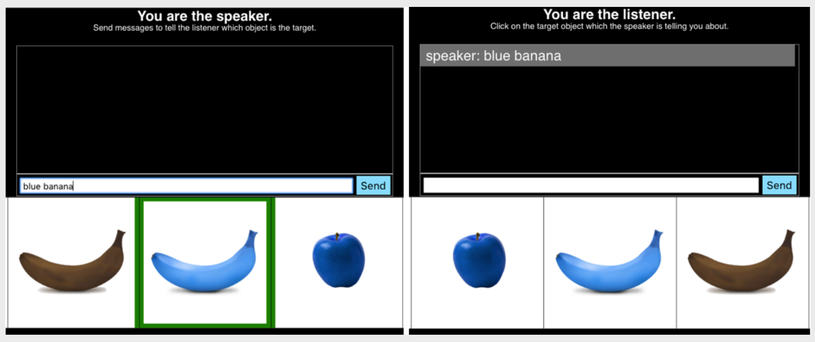
## Referential expression study

Purpose

- Collect freely produced referring expressions

Design

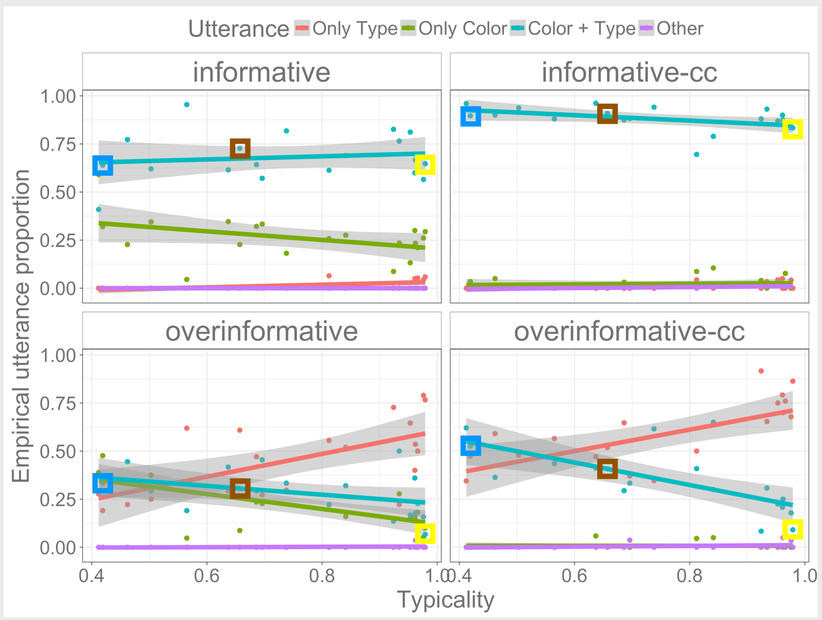
- Two-player reference game on MTurk
- 60 pairs
- Speaker aim: Communicate target
- Listener aim: Correctly identify it
- Free communication through chat box




Experimental design.

Results

- Replicated typicality effect in overinformative conditions
- Also found typicality effect in informative conditions




Empirical utterance proportions with respectively marked "COLOR banana" cases.

## Model

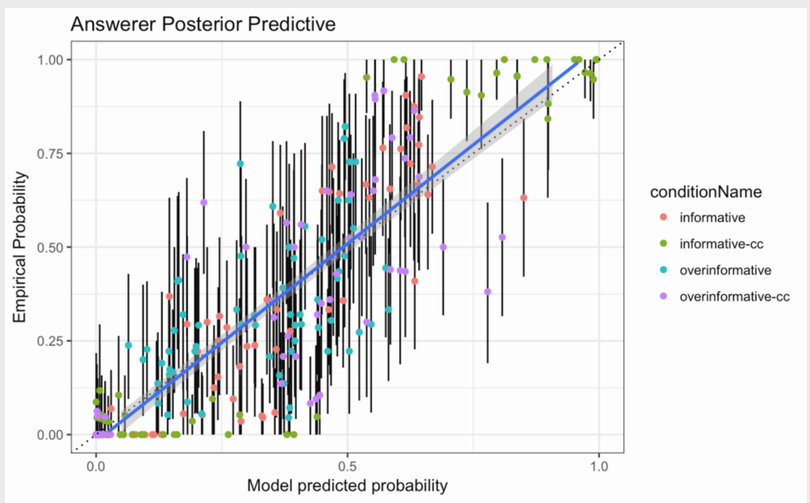
- Rational Speech Act (RSA) framework
- Literal listener $L_0$ that selects between contextual referents c ∈ C proportionally to the meanings given by a lexicon L:

$$L_0(c|u,C) \propto \mathcal{L}(u,c)P(c)$$

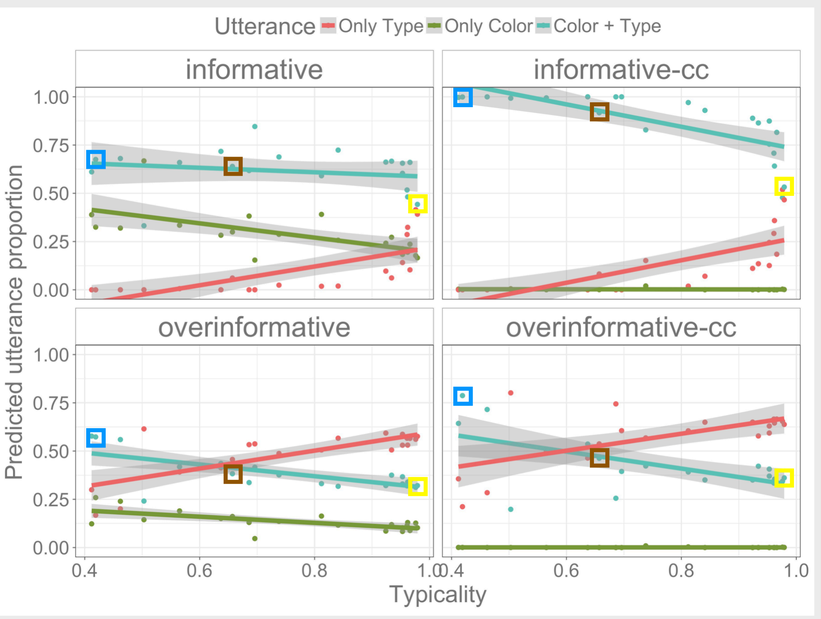
- Assume uniform prior beliefs P(c) over referents
- Pragmatic speaker $S_1$ which selects an utterance $u \in U$ to communicate an intended referent $c_i$ by trading off *informativity* with *cost*:

$$S_1(u|c_i) \propto \exp(\alpha \log(L_0(c_i|u,C)) - \text{cost}(u))$$

- Cost is defined as a function of an utterance's length and its corpus frequency + costs for mentioning color and type
- α is a parameter controlling the speaker's "optimality"
- Furthermore, we use soft semantics




Correlation between empirical and predicted utterance probability; $R^2$ = .75




Predicted utterance proportions with respectively marked "COLOR banana" cases.

## Conclusion

## Discussion & Problems

informative and overinformative condition work against each other: in the informative condition the color and color-and-type expressions need to show a bigger gap; in the overinformative condition the gap needs to be closed

alternative: noise-model (either replacing or adding objects of the same type or color to context to achieve uncertainty about objects in context)

## References

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## Acknowledgments