Frank & Goodman (in press)
A probabilistic view of pragmatics

Mike Frank
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Modeling referent selection games

**Speaker:** Imagine you are talking to someone and want to refer to the middle object. Would you say “blue” or “circle”? 

![Objects](image)

**Listener:** Someone uses the word **blue** to refer to one of these objects. Which object are they talking about?
Being informative in context: model

**Listener posterior:** Probability of object given word

**Speaker likelihood:** Probability of word given object

**Contextual salience prior:** Probability of object

\[ P(R_S|w,C) \propto p(w|R_S,C)p(R_S) \]

define “be informative” as “transfer the largest number of bits of information, relative to what you want to say” (using KL divergence)

Frank, Goodman, Lai, & Tenenbaum (2009); Frank & Goodman (in press); see also Xu & Tenenbaum (2007), Tenenbaum & Griffiths (2001)
Experiment 1: Speaker

Imagine you are talking to someone and you want to refer to the object with the box around it. What do you say?

(square / blue)

Experiment 3: Ostensive Learner

Imagine someone is talking to you in a foreign language. "daxy," that he uses to refer to the object with the box around it. What does "daxy" mean?

(square / blue)

\[ P(w | R_s, C) \propto \frac{1}{|w|} \]
Listener condition

Contextual salience

Informative use of “blue”

Full model (with listener data)
Imagine someone is talking to you and uses the word “blue” to refer to one of these objects. Which object are they talking about?

\[ P(R_s | w, C) \propto \frac{1}{|w|} p(R_s) \]
Scalar implicature

Some of the apples are red.

Model

Data

Total number of objects with property

"Some", access 3

Goodman & Stuhlmüller (in press)
Ad-hoc (particularized) implicature

Furble’s friend has glasses. Can you show me Furble’s friend?

Same as “some of the apples,” without quantifiers
Ad-hoc pragmatic inference

N=24 per group

Stiller, Goodman, & Frank (2011)
Sensitivity to real-world base rates

Here are people in Furble’s world:

Furble’s friend has glasses.
Can you find Furble’s friend?
Base rates: data

If top hats are common, you wouldn’t necessarily mention one.
Base rates: models

\[ P(R_s | w, C) \propto \frac{1}{|w|} p(w)p(R_s) \]
Conclusions

• Rational goal inference can provide a formal framework for (Gricean) pragmatic reasoning

• Makes quantitative predictions about speakers, listeners, and learners in simple contexts

• Possibilities for extension to a range of more complex situations and phenomena