Ad Hoc Scalar Implicatures — Frank & Goodman 2012, Stiller, Goodman, & Frank 2014

Frank & Goodman 2012

- Experimental paradigm based on simple referential communication games. Players are asked to bet which object is being referred to by a particular word.
- Behavior is modeled by assuming listeners can use Bayesian inference to recover a speaker's intended referent r_s in context C, given that s uttered a word w:

(1) a. $P(r_s|w,C) = \frac{P(w|rs,C)P(r_s)}{\sum_{r' \epsilon C} P(w|r',C)P(r')}$

b. **The probability of the speaker's referent given the word uttered and the context** equals **the likelihood that the speaker would use this word to refer to the object** times **the prior probability that the object would be referred to**, divided by **the sum of these terms computed for all the referents in the context**.

- Definitions:
  - Likelihood term: speakers choose words to be informative in context. Informativeness of a word = its surprisal — how much it reduces uncertainty about the referent.

(2) $P(w|rs,C) = \frac{|w|^{-1}}{\sum_{w' \epsilon W} |w'|^{-1}}$

Why?

$I_{\tilde{w}c}(r_s)$ =surprisal of s's referent after a word is spoken in context = $-log\frac{1}{|w|}$

$I(w;r_s,C)$ = informativeness of word about s's referent in context= $-I_{\tilde{w}c}(r_s)$

thus:

$I(w;r_s,c) = log\frac{1}{|w|}$

S chooses words in proportion to their expected utility: $P(w|r_s,C) \propto e^{\alpha U(w;r_s,C)}$

Alpha is set to 1.

Utility: $U(w;r_s,C) = log\frac{1}{|w|} - D(w)$

$$P(w|r_s,c) = \frac{e^{log\frac{1}{|w|}-D(w)}}{\sum_{w' \epsilon W} e^{log\frac{1}{|w'|}-D(w)}} = \frac{e^{log\frac{1}{|w|}}e^{-D(w)}}{\sum_{w' \epsilon W} e^{log\frac{1}{|w'|}}e^{-D(w)}} = \frac{\frac{1}{|w|}}{\sum_{w' \epsilon W}\frac{1}{|w'|}} = \frac{|w|^{-1}}{\sum_{w' \epsilon W}|w'|^{-1}}$$

- Prior probability of referring to an object = contextual salience (perceptual, social, conversational salience): measured empirically (second group of participants, salience condition)

- Experiment:
  - Three groups of participants. Each saw communicative contexts with sets of objects varying on two dimensions:

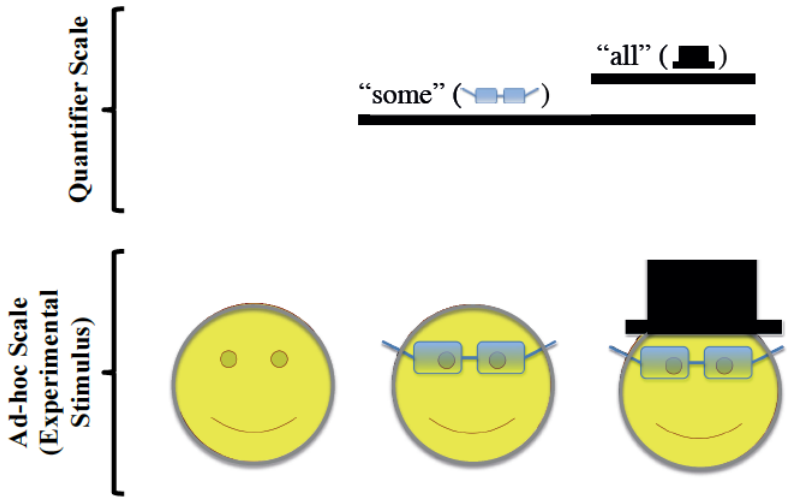
  - **First group (speaker condition):** tests the likelihood term of the model. Participants are asked to bet on which word a speaker would use to refer to a particular object. *"Imagine you are talking to someone and you want to refer to the middle object. Which word would you use, "blue" or "circle"?"*
  - **Second group (salience condition):** provides empirical measure of the prior in the model. Participants are told that a speaker used an unknown word to refer to one of the objects, and are asked to bet which object was being referred to. *"Imagine someone is talking to you and uses [a word you don't know] to refer to one of these objects. Which object are they talking about?"*
  - **Third group (listener condition):** tests the posterior predictions of the model. Participants are told that a speaker used a single word (ex., "blue") to refer to an object, and are asked to bet on which object is being referred to. *"Imagine someone is talking to you and uses the word "blue" to refer to one of these objects. Which object are they talking about?"*

- Results:
  - Mean bets in the speaker condition were highly correlated with the model's prediction for informative speakers.
  - Judgments in the salience and listener conditions were not correlated with each other, but when the salience and informativeness terms were combined via the model, the result was highly correlated with listener judgments.

- *Question: how does this compare to Jäger?*
  - Jäger uses a uniform distribution for the prior, while Frank and Goodman use experimentally measured salience.
  - Gradient vs. categorical.

Stiller, Goodman, & Frank 2014

- Examines the pragmatic abilities of children using a similar paradigm as in Frank and Goodman 2012.
- Problem: children have apparent difficulties computing scalar implicatures, although they show pragmatic competence and understanding of informativeness in other areas (word learning by relying on the goals and intentions of others, producing informative referring expressions when interlocutors are blind to a scene, etc.).
- Does this stem from broad pragmatic difficulties, or from issues with the relationships between specific lexical items?
- Possible factors which might contribute to children's apparent difficulties with SIs:
  - Difficulties accessing the relevant lexical alternatives ("all", when "some" is mentioned)
  - Knowing that one alternative negates others in a SI task
  - Methodologies of truth-value or felicity judgment — cannot differentiate between failure to compute SIs and general tolerance of pragmatic violations.
- To test this, contextually derived ad hoc implicatures were constructed, using sets of pictures with contrasting features. If children succeed at computing ad hoc scalar implicatures at a younger age than when they compute generalized scalar implicatures, this rules out underlying pragmatic incompetence.
- Ad hoc scales are constructed, where scalar alternatives are concrete nouns. One object from the set has neither feature ("distractor"), one has one feature ("one-feature"), and one has both features ("two-feature"):

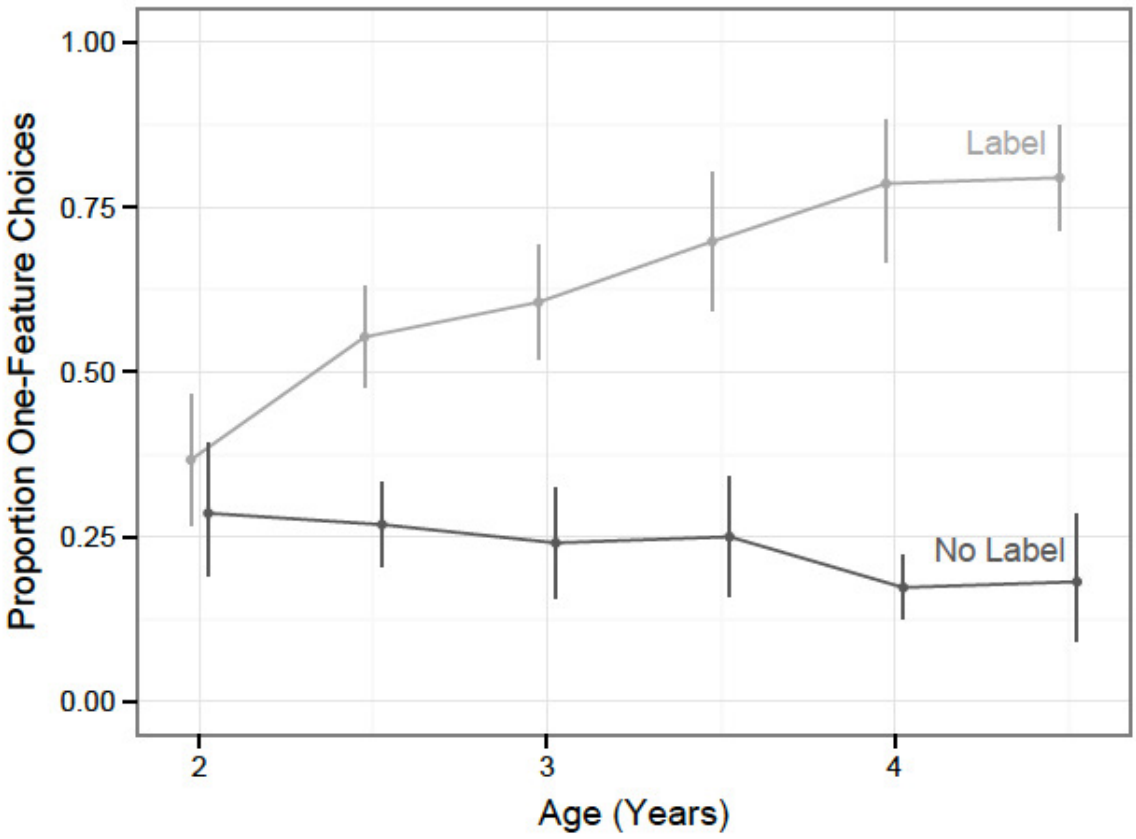


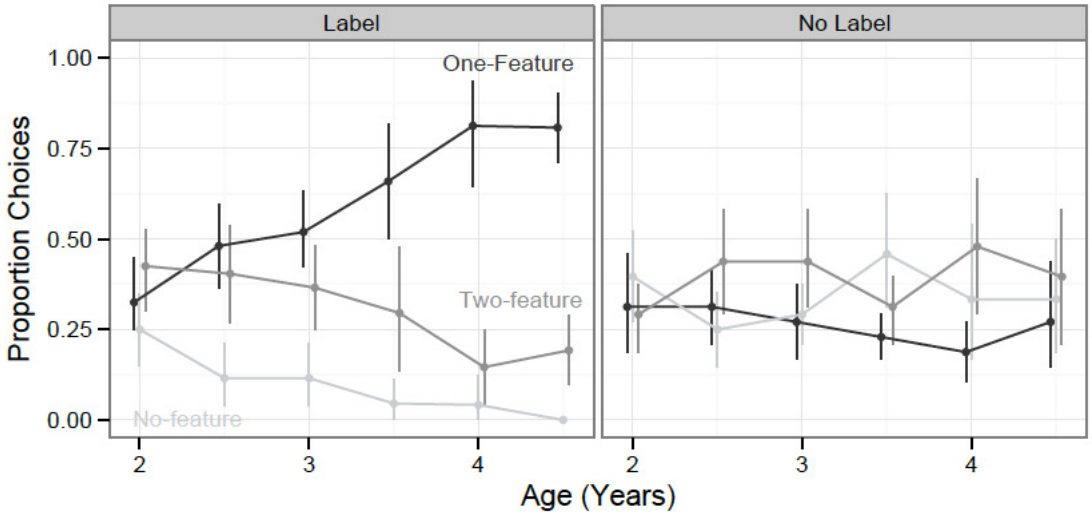
- Experimenter asks participants to help a stuffed animal identify people and objects.

- **Label condition:** stuffed animal uses a description, "My X is/has Y", which is ambiguous between the one-feature and two-feature objects. *"My friend has glasses".*
- **No label (control) condition:** identical procedure, but participants heard something unintelligible (mumbling or barking). Frank & Goodman 2012 — Salience condition.
- Adult controls completed an equivalent task online.

- Question of interest: do participants' choices indicate successful pragmatic inference? That is, do they choose the one-feature object instead of the two-feature object?

- Results:





- Evidence of pragmatic inference: children can make a pragmatic inference that the name of a feature (ex. "glasses") refers to the object with *only* that feature. See above figure.
  - Youngest age when there is a significant bias to choose the one-feature object is 3.5 year olds.
  - In the 3 year old age group, there is a trend towards overcoming the baseline bias of the No Label condition
  - There is evidence for pragmatic competence in these areas beginning around age 3-3.5. 2 year olds consistently fail at the task, but in the Label condition, there was a substantial amount of no-feature responses (25%), indicating that 2 year olds may not be able to succeed on the basic language interpretation component of the task.
- Adult controls performed at ceiling on the task.