Bayesian Pronoun Interpretation in Mandarin Chinese

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Introduction

How do pronoun interpretation and production relate to each other?

- **Bayesian pronoun interpretation model** (Kehler & Rohde, 2013; Rohde & Kehler, 2014)
- $\boldsymbol{P(\text{referent}|\text{pronoun}) = \frac{P(\text{pronoun}|\text{referent})P(\text{referent})}{\sum_{\text{referent}\in\text{refs}} P(\text{pronoun}|\text{referent})P(\text{referent})}}$

Posterior: Pronoun interpretation biases ∝ **Likelihood**: Pronoun production biases x **Prior**: Next-mention biases

Information structure & grammatical roles

Semantic & pragmatic biases

- **Expectancy (prior-only) model** (Arnold, 2001)
- $P(\text{referent}|\text{pronoun}) \leftarrow P(\text{referent})$
- **Mirror (likelihood-only) model**
- $\text{P}(\text{referent}|\text{pronoun}) \leftarrow \frac{\text{P}(\text{pronoun}|\text{referent})}{\sum_{\text{referent}\in\text{refs}} \text{P}(\text{pronoun}|\text{referent})}$

Research questions

Does the Bayesian pronoun interpretation theory:

i. generalize crosslinguistically, specifically to Mandarin Chinese? -> Expt. 1

ii. generalize across different syntactic constructions, specifically active/passive alternations? -> Expt. 2

Methods and Materials

Active voice (Experiments 1 & 2)

IC-1, Free prompt	Meihui dadong-le Jieyi. _____ "[Meihui]$_{NP1}$ impressed [Jieyi]$_{NP2}$. _____"
IC-1, Pronoun prompt	Meihui dadong-le Jieyi. Ta _____ "[Meihui]$_{NP1}$ impressed [Jieyi]$_{NP2}$. She _____"
IC-2, Free prompt	Meihui jiegu-le Jieyi. _____ "[Meihui]$_{NP1}$ fired [Jieyi]$_{NP2}$. _____"
IC-2, Pronoun prompt	Meihui jiegu-le Jieyi. Ta _____ "[Meihui]$_{NP1}$ fired [Jieyi]$_{NP2}$. She _____"

Passive voice (Experiment 2)

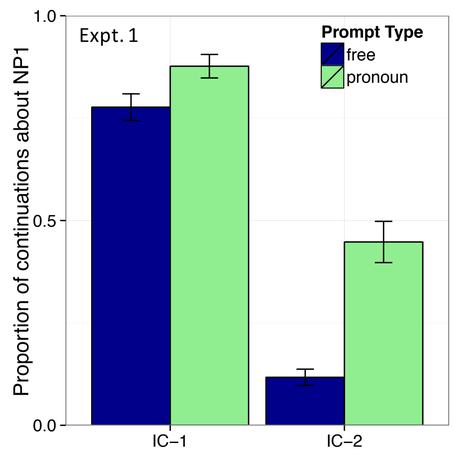
IC-1, Free prompt	Jieyi bei Meihui dadong-le. _____ "[Jieyi]$_{NP1}$ was_by [Meihui]$_{NP2}$ impressed. _____"
IC-1, Pronoun prompt	Jieyi bei Meihui dadong-le. Ta _____ "[Jieyi]$_{NP1}$ was_by [Meihui]$_{NP2}$ impressed. She _____"
IC-2, Free prompt	Jieyi bei Meihui jiegu-le. _____ "[Jieyi]$_{NP1}$ was_by [Meihui]$_{NP2}$ fired. _____"
IC-2, Pronoun prompt	Jieyi bei Meihui jiegu-le. Ta _____ "[Jieyi]$_{NP1}$ was_by [Meihui]$_{NP2}$ fired. She _____"

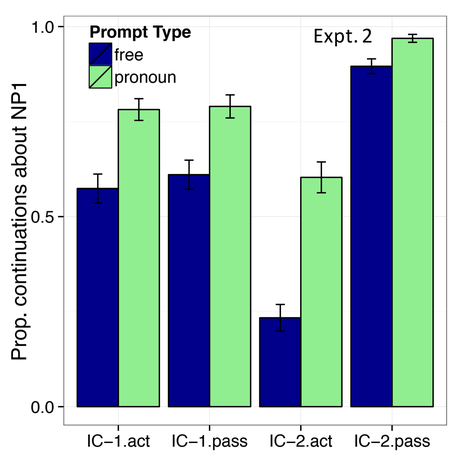
Implicit causality (IC) verbs: IC-1 and IC-2 favors NP1 and NP2 respectively.
16 IC-1 and 20 IC-2 verbs were used in each experiment.

Results

Prior P(NP1) vs. **Posterior** P(NP1| pronoun): Who was the intended referent?

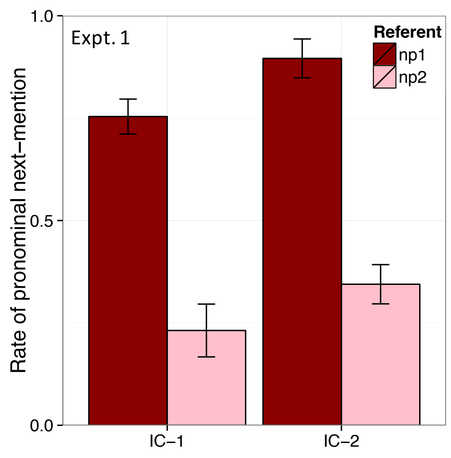
Significant difference between Free prompt and Pronoun prompt

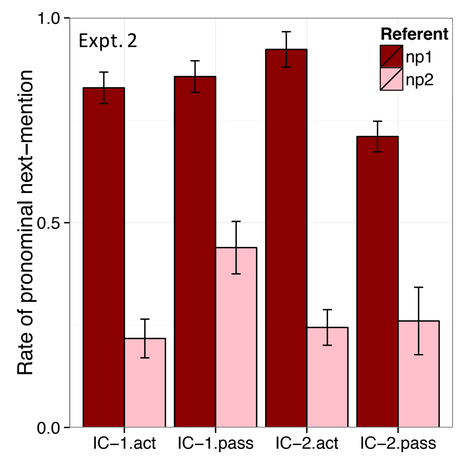




Likelihood P(pronoun| NP1) vs. P(pronoun | NP2): Pronoun used given a referent?

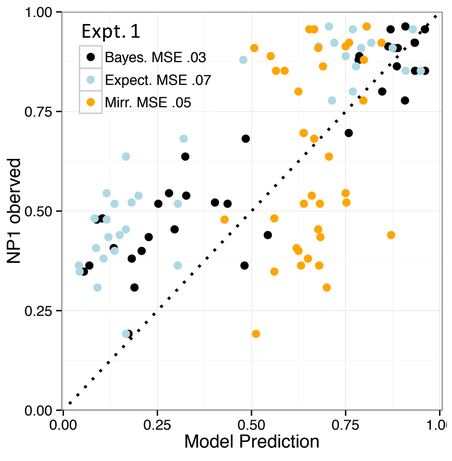
Significant difference between NP1 and NP2, not between passivized NP1 and active NP1

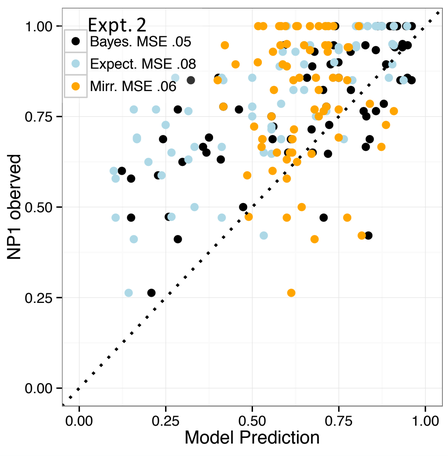




Quantitative model comparisons (Bayesian vs. Expectancy vs. Mirror):

Both prior and likelihood essential? Yes, Bayesian model is a better fit than either of the two competing models



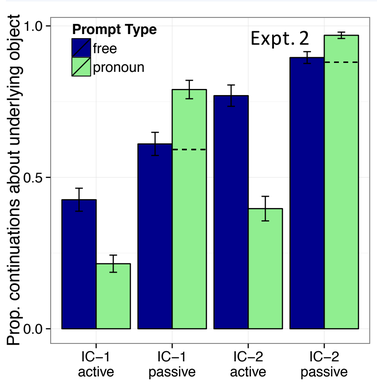


- Observed NP1 interpretation rate against item-specific prediction of three models
- x = y dotted line would be perfect model fit

- **Bayesian model**: least mean squared error
- **Mirror model**: underpredicts cross-item/condition variability in interpretation preference
- **Expectancy model**: underpredicts the rate of NP1 interpretation

We also found:

- Passivization increased the next-mentions of the logical object (P(Jieyi))



- This increase is reflected in pronoun interpretation
- Dashed lines indicate next-mention rates predicted using the active condition prior

General Discussion

- ➢ Verb semantics affect prior next mention biases
- ➢ Grammatical roles affect pronoun production biases
- ➢ Disassociation between next-mention biases and pronoun production biases
- ➢ No consistent evidence showing passivized subject is more likely to be pronominalized
- ➢ Full Bayesian model best predicted human data in pronoun interpretation
- ➢ Passivization increases next-mention biases of the logical object
- ➢ Results support a crosslinguistically general Bayesian theory of pronoun interpretation

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