

A Rational Speech Act model of cross-linguistic differences in pronoun resolution preferences

Miriam Schulz

under the supervision of

Prof. Dr. Barbara Hemforth and Dr. Heather Burnett



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- I Introduction
- II Corpus study
- III Rational Speech Act model
- IV Experimental data
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Cross-linguistic differences in pronoun resolution preferences


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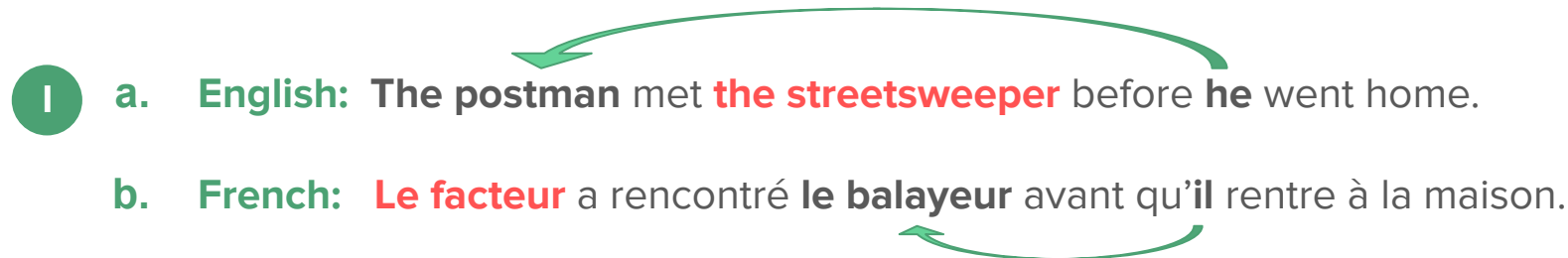
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Cross-linguistic differences in pronoun resolution preferences

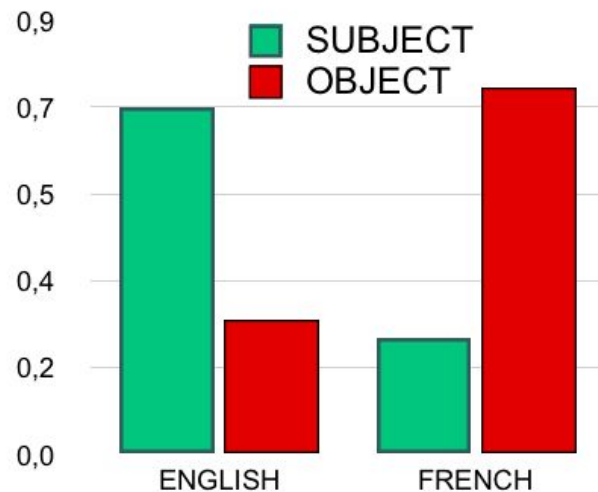
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- Superficially similar constructions can give rise to **different interpretation preferences across languages**
- **N1 (subject) preference in English** vs. **N2 (object) preference in French**

Cross-linguistic differences in pronoun resolution preferences



General mechanisms of anaphora resolution...

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- Preference for the **first-mentioned antecedent**
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... vs. alternative-based pragmatic reasoning

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... vs. alternative-based pragmatic reasoning

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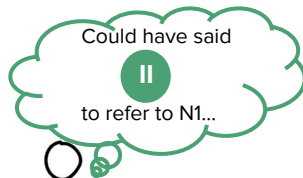
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French listener



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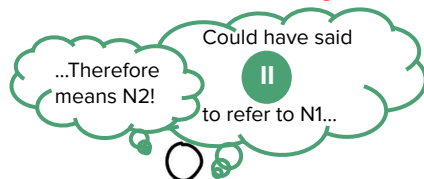
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... vs. alternative-based pragmatic reasoning

Can differences in the language-specific availability of an alternative construction account for the observed data?

Hypotheses of the present work

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- **Pronoun resolution preferences** can be derived from **alternative-based pragmatic reasoning**

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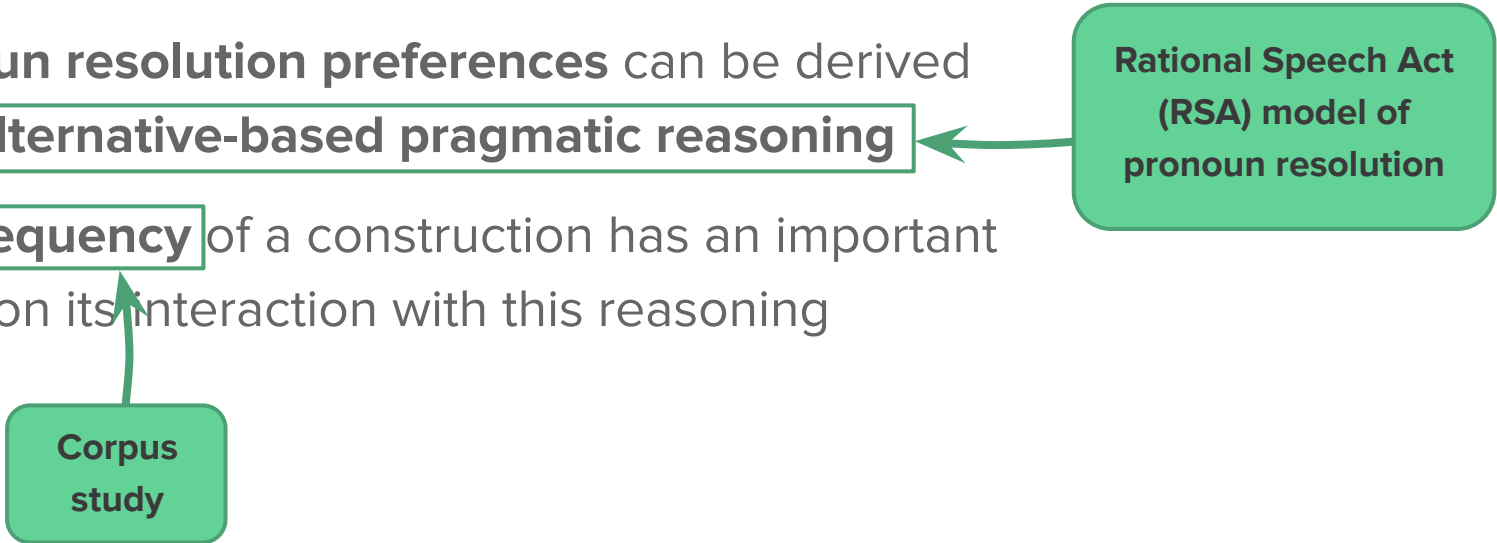


Corpus
study

Hypotheses of the present work

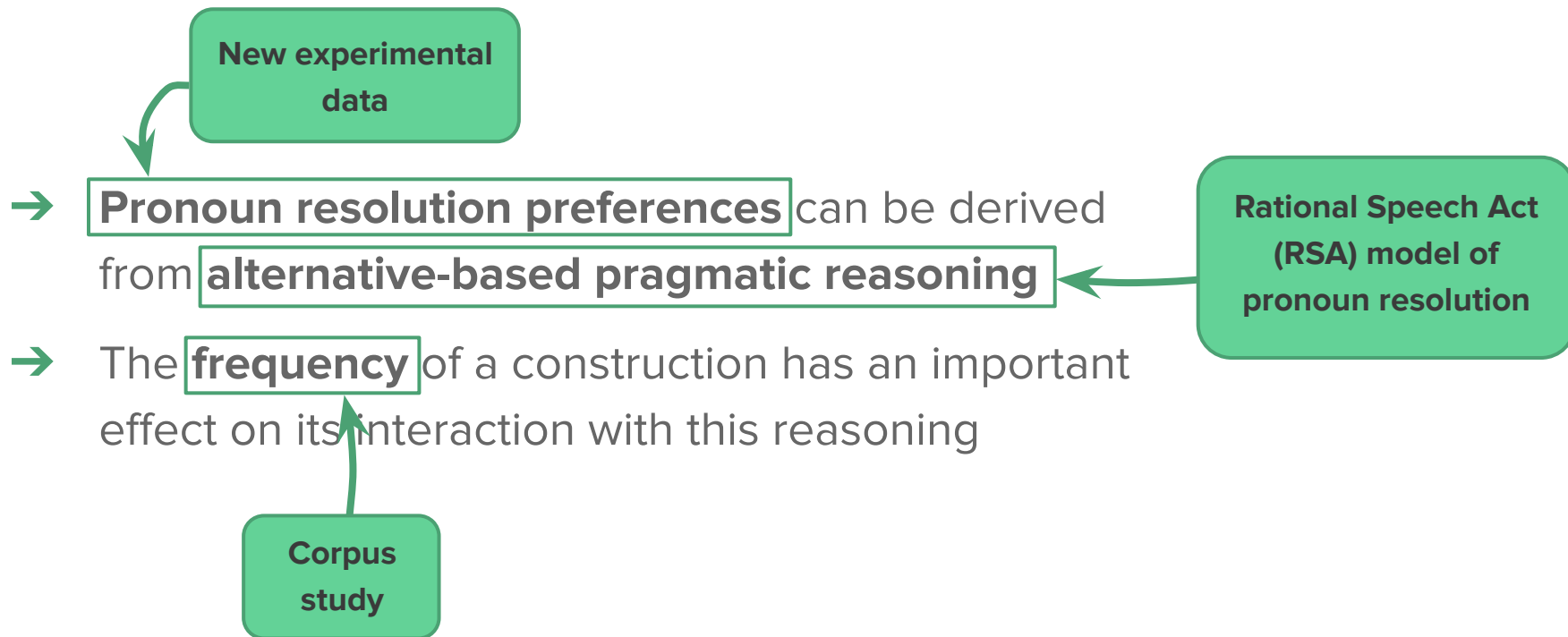
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**Rational Speech Act
(RSA) model of
pronoun resolution**



**Corpus
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Hypotheses of the present work



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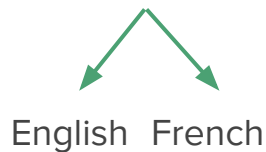
Objective of the corpus study

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Isolate different **language-specific**, **genre/modality-specific**, and **connector-specific** effects

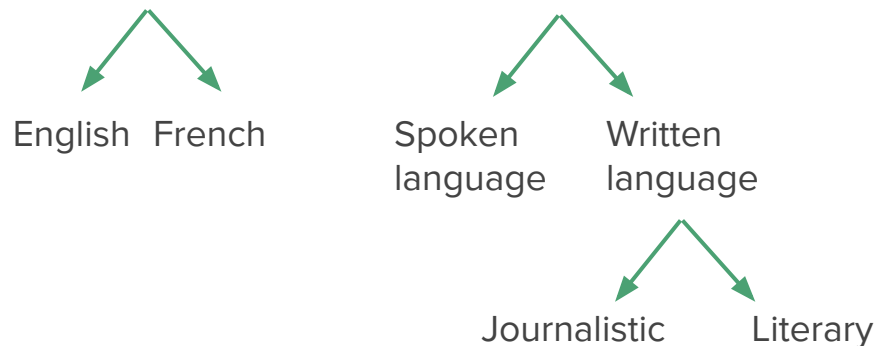
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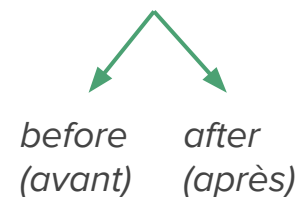
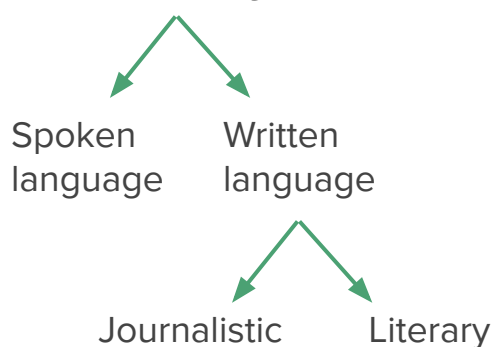
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Corpora

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English:

- Corpus of Contemporary American English (COCA)
 - Spoken section: 116 million words
 - Literary section: 111 million words
 - Newspaper section: 112 million words

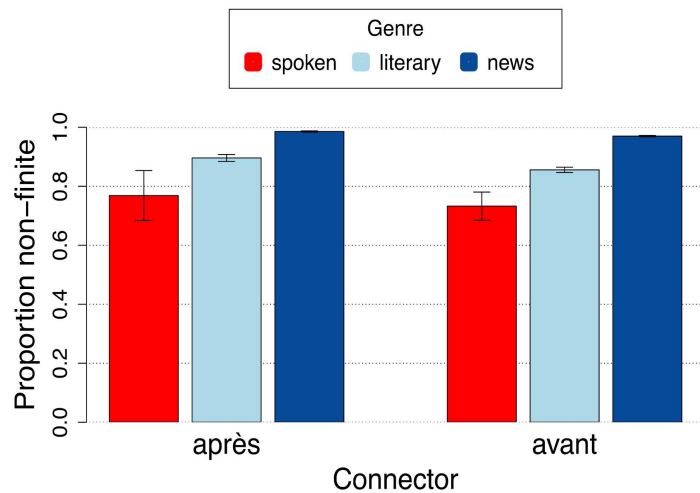
French:

- ESLO (spoken): 2.5 million words
- Frantext (literary; limited to 1990+): 22 million words
- Est Républicain (newspaper): 149 million words

Results

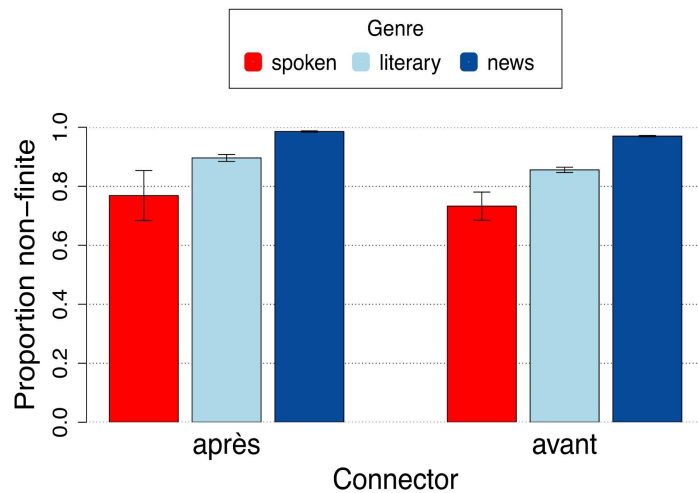
Results

French

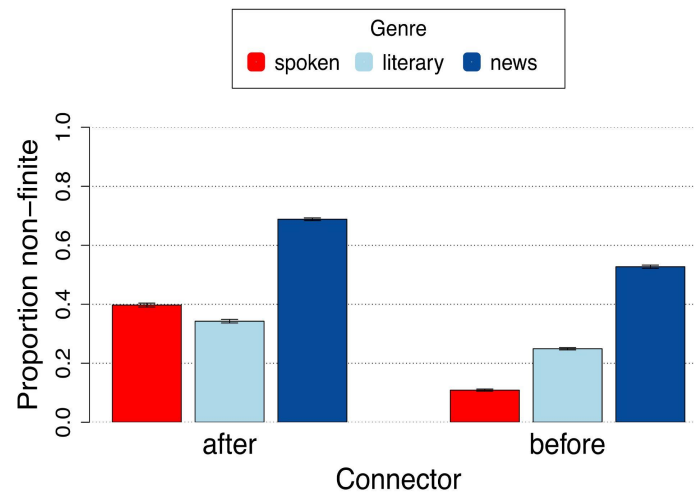


Results

French



English

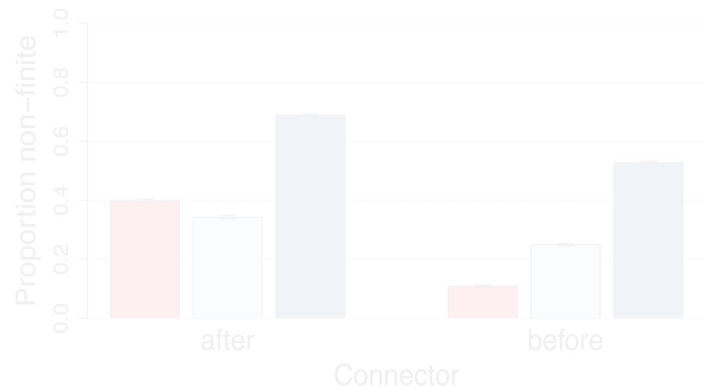
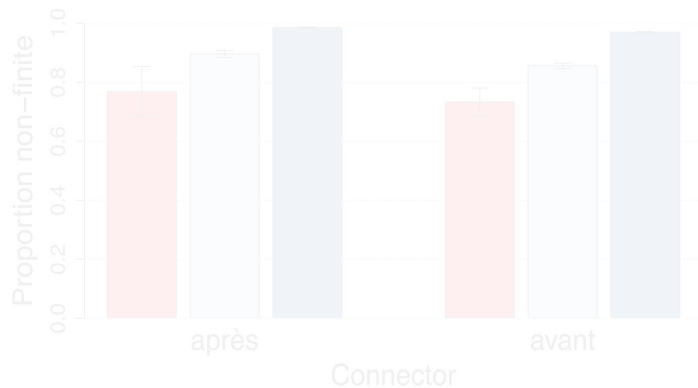


Results

French

English

- Alternative construction much more frequent in French!



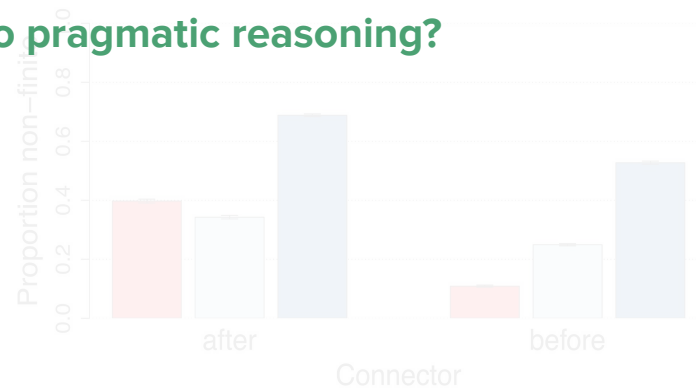
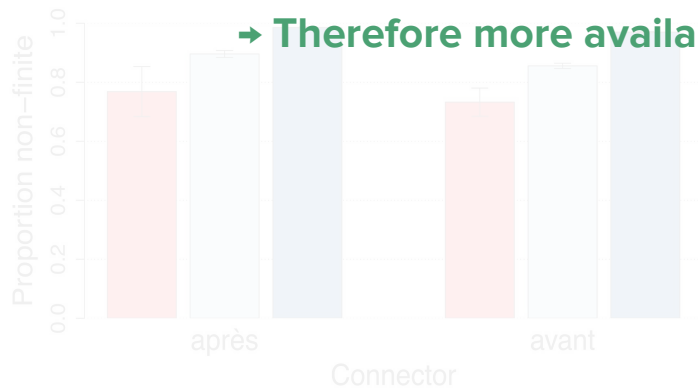
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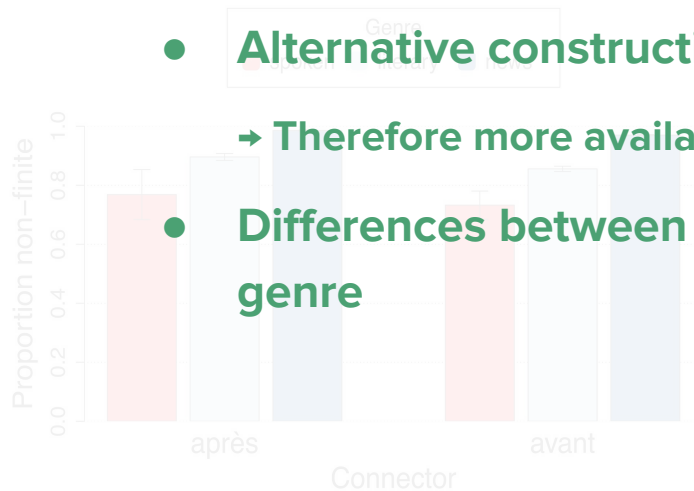
- Alternative construction much more frequent in French!

→ Therefore more available to pragmatic reasoning?



Results

French



English



- **Alternative construction much more frequent in French!**
 - Therefore more available to pragmatic reasoning?
- **Differences between languages most salient for spoken genre**

Results

French

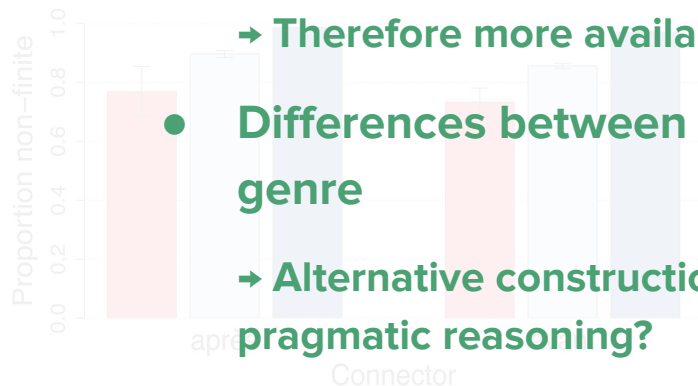
English

- Alternative construction much more frequent in French!

→ Therefore more available to pragmatic reasoning?

- Differences between languages most salient for spoken genre

→ Alternative construction not available to English speakers in pragmatic reasoning?



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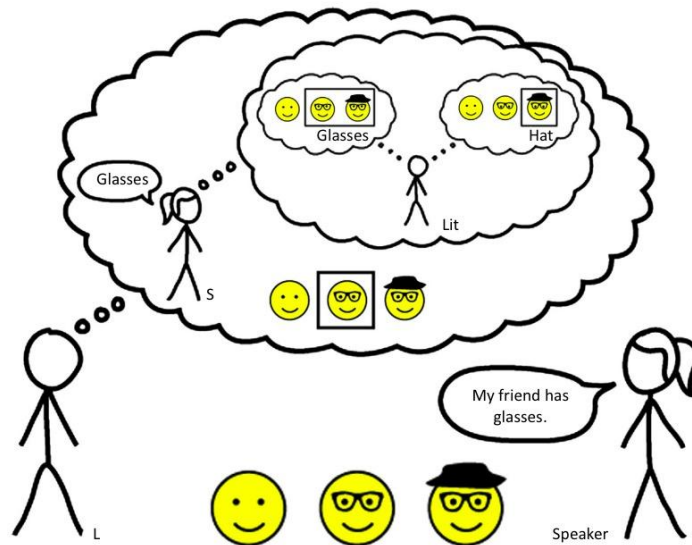
The Rational Speech Act (RSA) framework

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A precise mathematical framework **formalizing key aspects of Gricean reasoning**

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RSA model of cross-linguistic pronoun resolution

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→ High prior probability of next mention of subjects (see e.g. Arnold, 2001; Kehler & Rohde, 2019):

◆ $Pr(w1) = 0.8$

◆ $Pr(w2) = 0.2$

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◆ $U_s(m, w) = \log(Pr(w | [[m]])) + C(m)$

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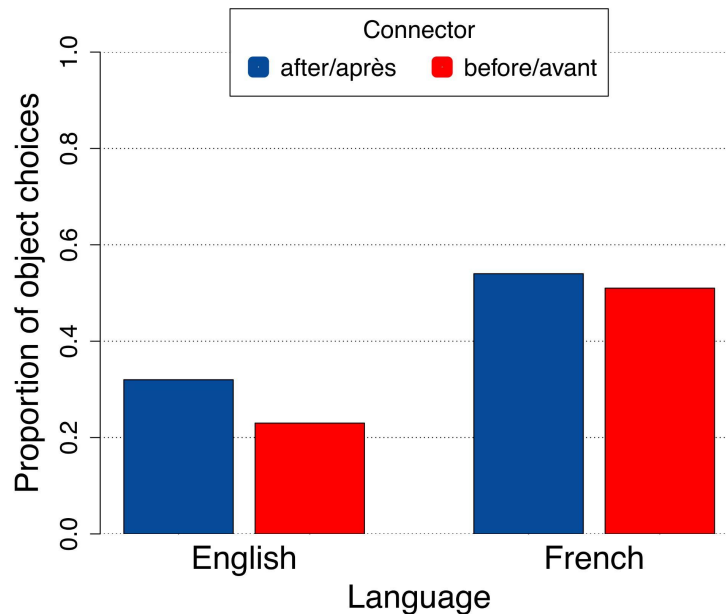
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Lower construction corpus frequencies

→ higher speaker utterance costs

Model predictions for pronoun resolution

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New experimental data

New experimental data

→ Cloze task:

- ◆ The policeman called the postman [before/after] he tied his shoelaces.
- ◆ _____ tied his shoelaces.

→ **Stimuli:** 16 experimental items, counterbalanced for order effects; 40 fillers

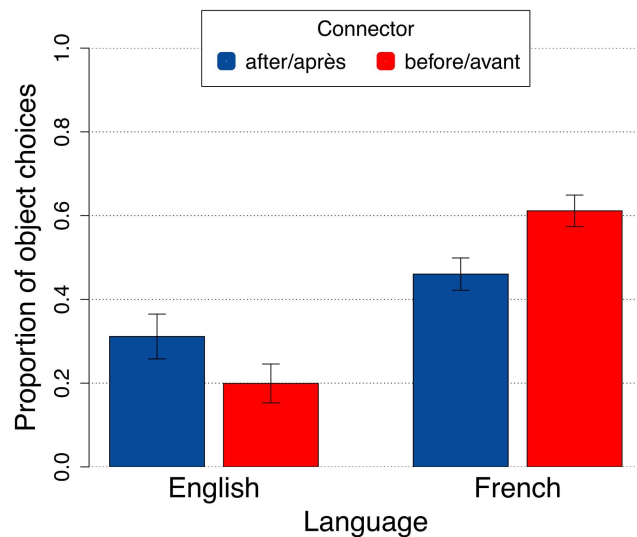
→ **Participants:**

- ◆ **English experiment:** 37 participants, mean age 36, recruited through Amazon Mechanical Turk
- ◆ **French experiment:** 83 participants, mean age 37, recruited through the RISC website

Results

Results

Experimental data

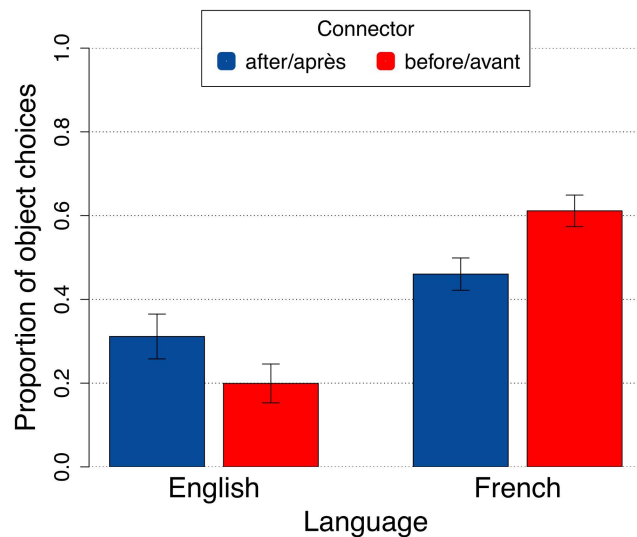


A logistic mixed-effects model shows significant effects of

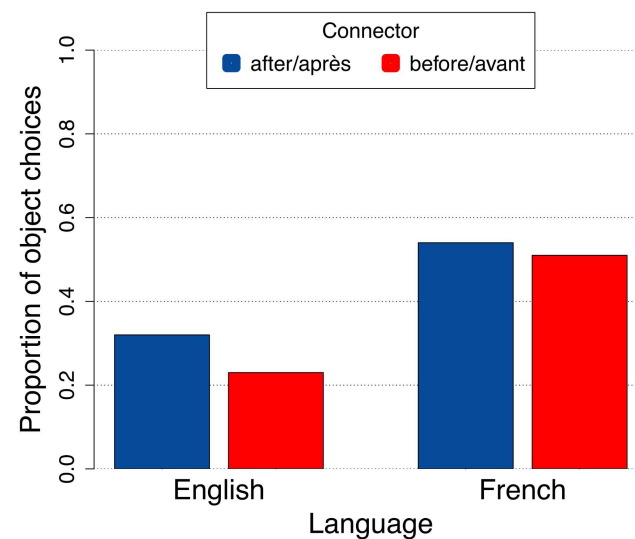
- **Language**
- **Interaction between language and connector** on antecedent choice (subject vs. object) ($p < 0.001$)

Results

Experimental data

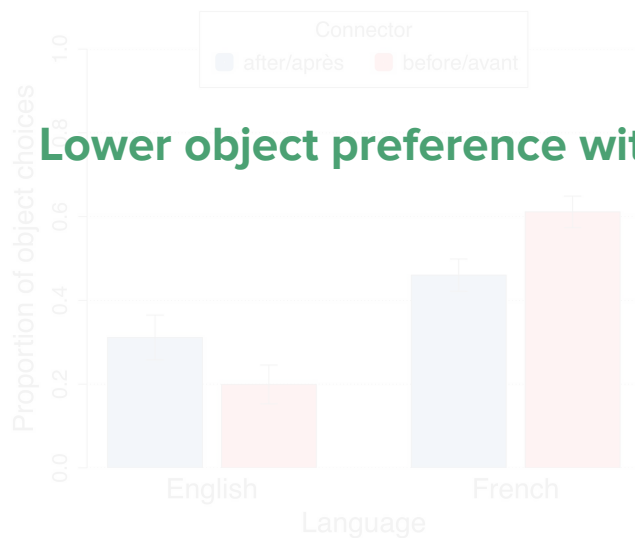


Model predictions

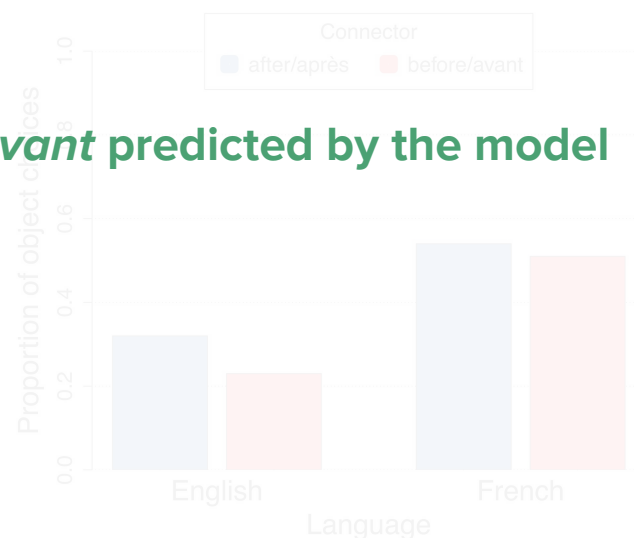


Results

Experimental data



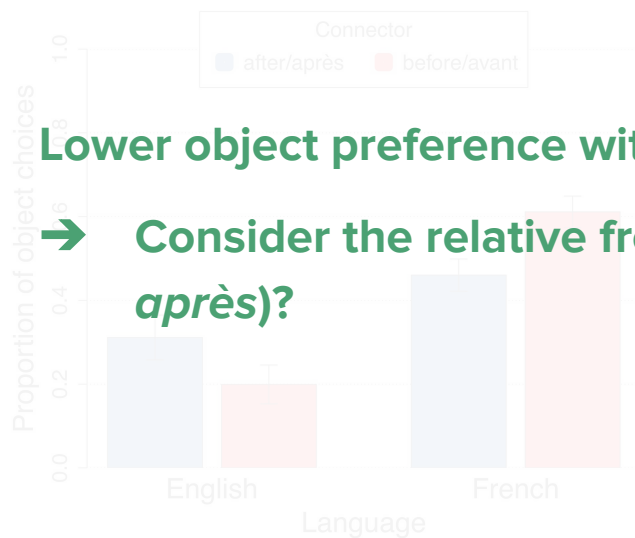
Model predictions



Lower object preference with French *avant* predicted by the model

Results

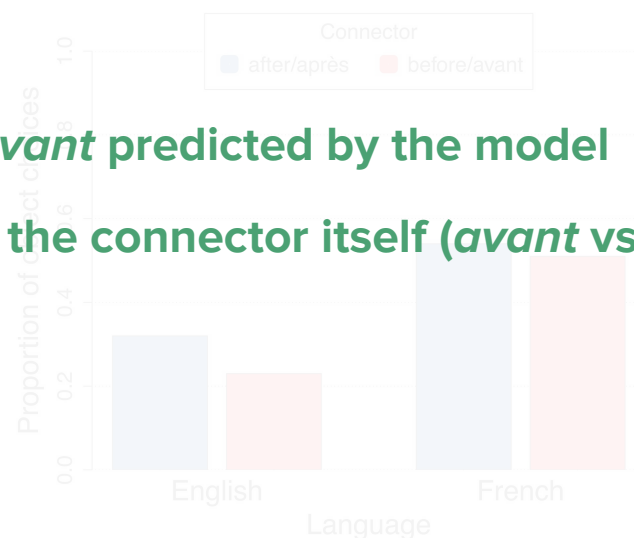
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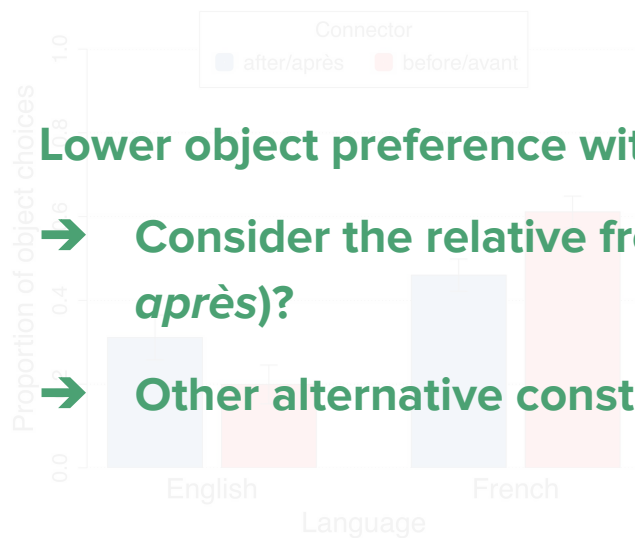
→ **Consider the relative frequency of the connector itself (*avant* vs. *après*)?**

Model predictions



Results

Experimental data

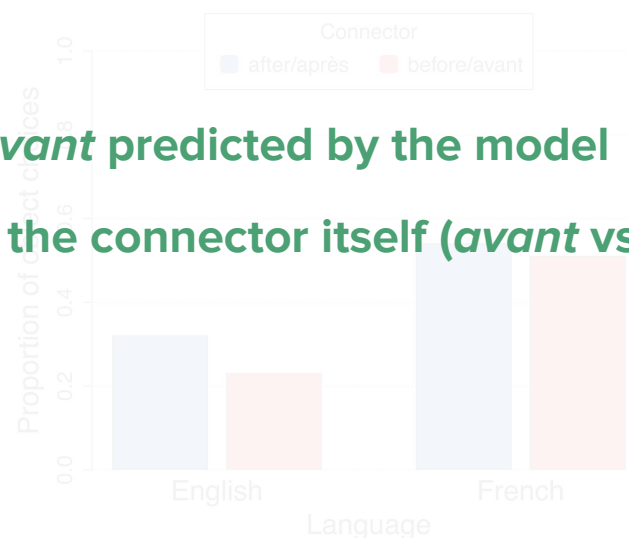


Lower object preference with French *avant* predicted by the model

→ **Consider the relative frequency of the connector itself (*avant* vs. *après*)?**

→ **Other alternative constructions?**

Model predictions



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→ **Cross-linguistic differences** in pronoun resolution preferences: English vs. French

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- A **Gricean reasoning + frequency-based** approach

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- Integrate **proportional construction frequencies** derived from corpus data into an **RSA model of pronoun resolution** as speaker **utterance costs**

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- Comparison of **model predictions** vs **experimental data**: close match for English, deviations for French

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- A **Gricean reasoning + frequency-based** approach
- Integrate **proportional construction frequencies** derived from corpus data into an **RSA model of pronoun resolution** as speaker **utterance costs**
- Comparison of **model predictions** vs **experimental data**: close match for English, deviations for French
- Frameworks like RSA allow to **test high-level theoretical predictions** and pinpoint key data for further investigation

Thank you

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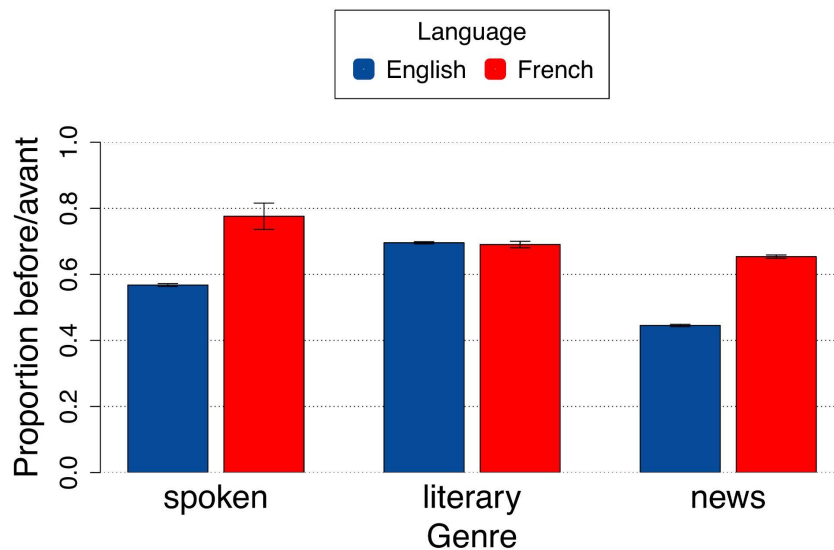
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Acknowledgements

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Results: frequency of *before* vs. *after*



RSA model of cross-linguistic pronoun resolution

- Implementation using **WebPPL** (Goodman & Stuhlmüller, 2015):
https://github.com/miriamschulz/RSA_pronoun_resolution
- **Bayesian parameter estimation** with Markov-chain Monte Carlo sampling for the rationality parameter *alpha* (based on Appendix IV in Scontras, Tessler & Franke, 2017)