(Bound) Pronouns in Competition: Ambiguity Avoidance in Romanian Anaphora Production

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Today's Talk

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We provide psycholinguistic evidence from production which supports the hypothesis that **ambiguity avoidance** strategies steer pronominal usage in cases of **local coreference**, and, surprisingly to the BT literature, also for **bound variable dependencies**.

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Romanian is one such language.

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The pronoun *el* is compatible with either interpretation.

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c. **Lockhart** a vorbit despre **el** **însuşi**. EMPHATIC
Lockhart has talked about him himself
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Background

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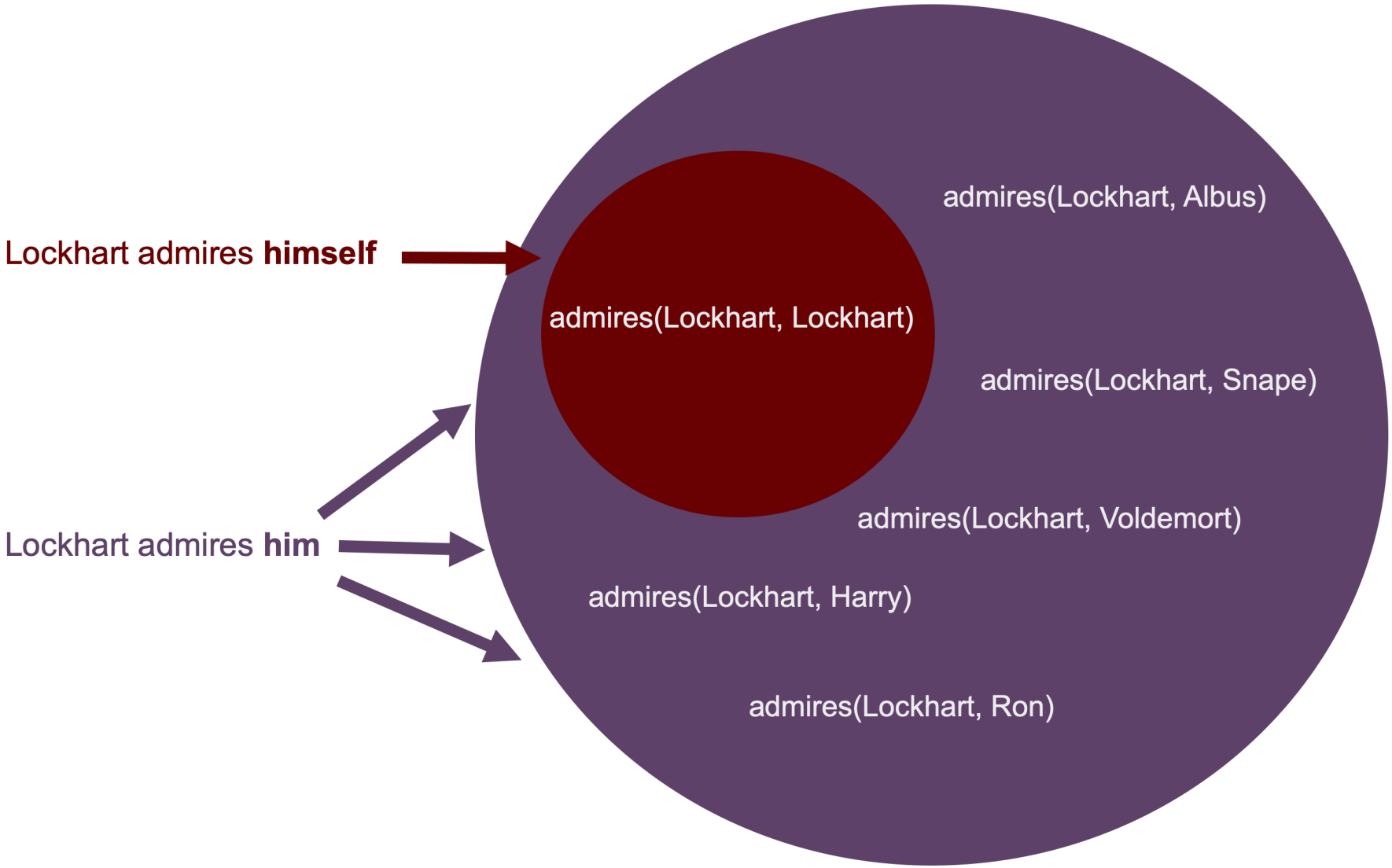
Lockhart admires **himself**
Lockhart admires **him**
admires(Lockhart, Albus)
admires(Lockhart, Lockhart)
admires(Lockhart, Snape)
admires(Lockhart, Voldemort)
admires(Lockhart, Harry)
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This reasoning also led to a number of accounts which constrain the competition between pronouns and reflexives in terms of ECONOMY considerations. (Safir 2004, 2014; Rooryck & vanden Wyngaerd, 2011; a.o.)

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And, in fact, the competition between pronouns and reflexives is couched in an important larger question ...

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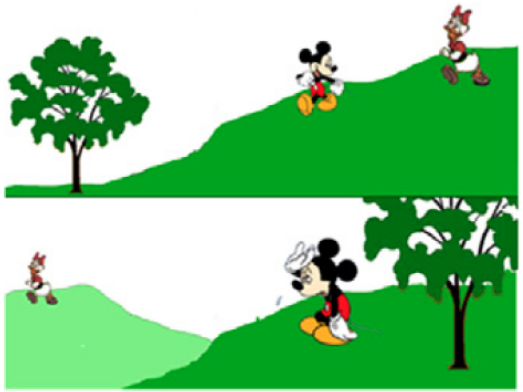

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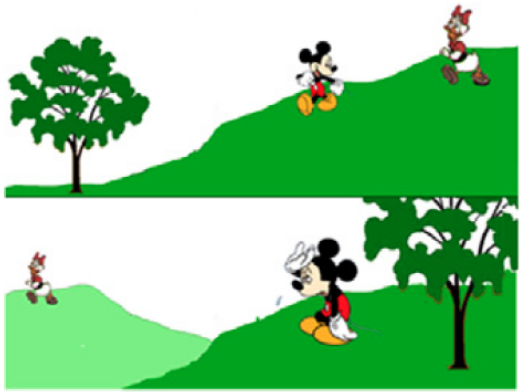

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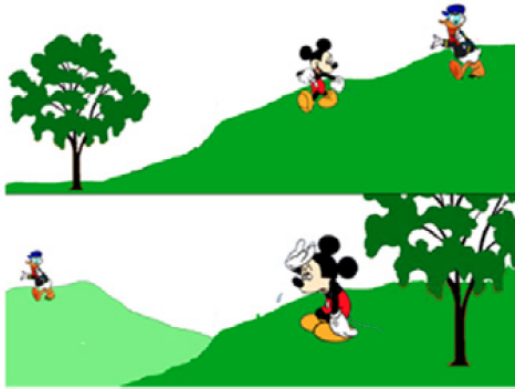

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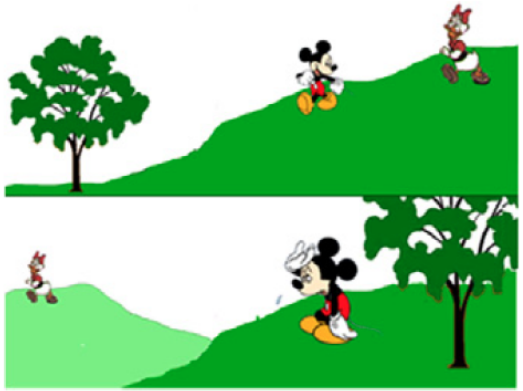

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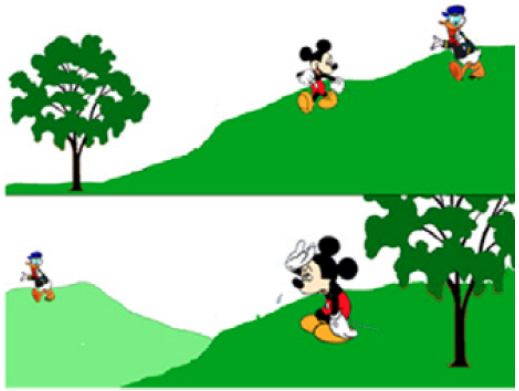

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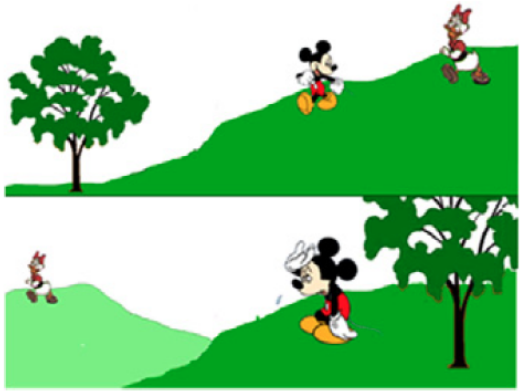

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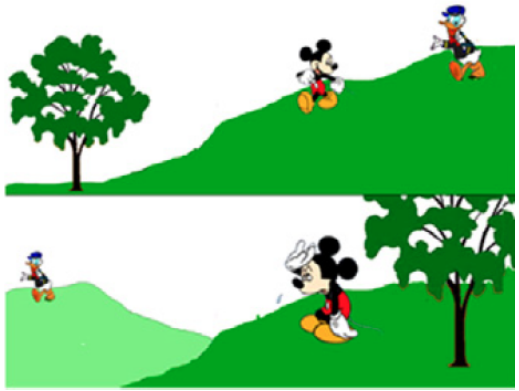

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Sample possible continuations:
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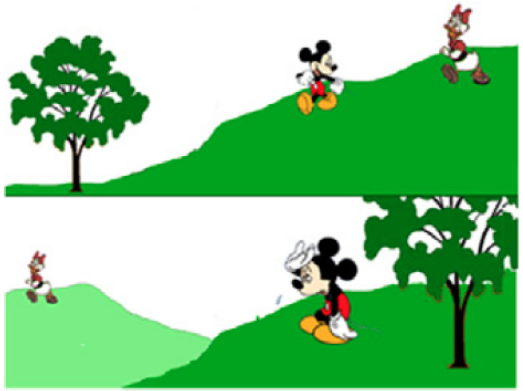

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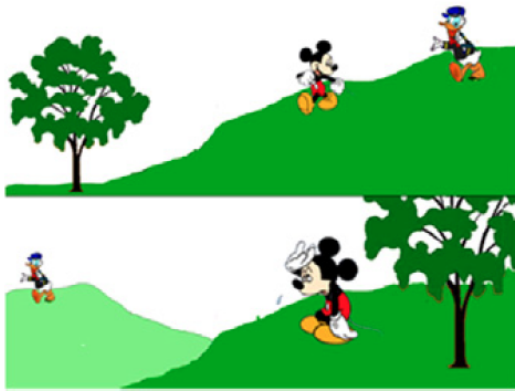

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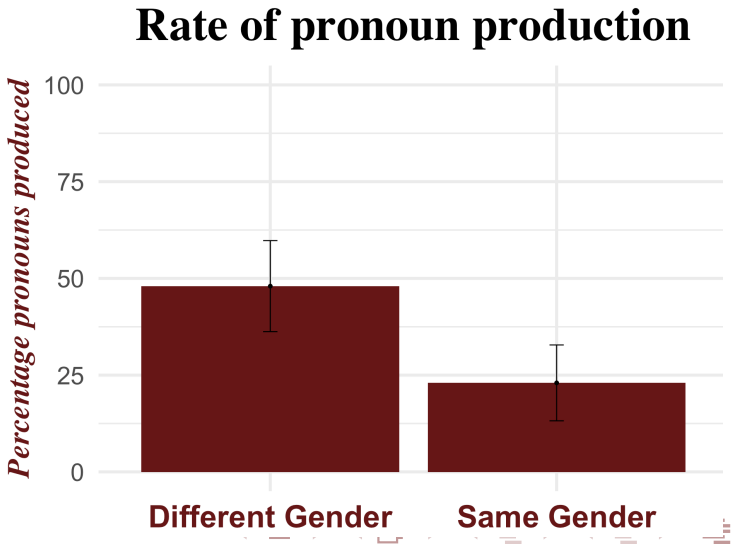

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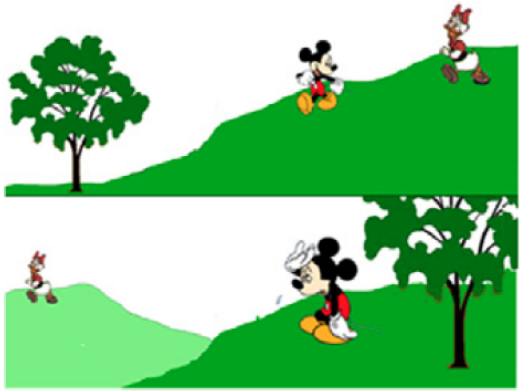

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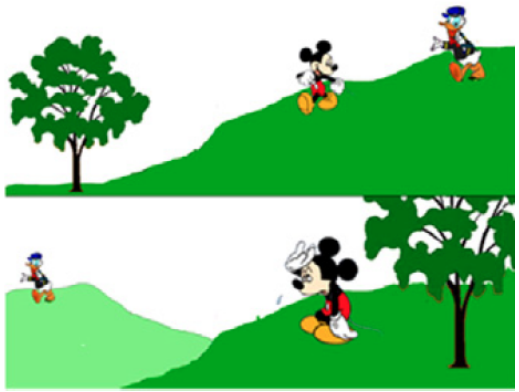

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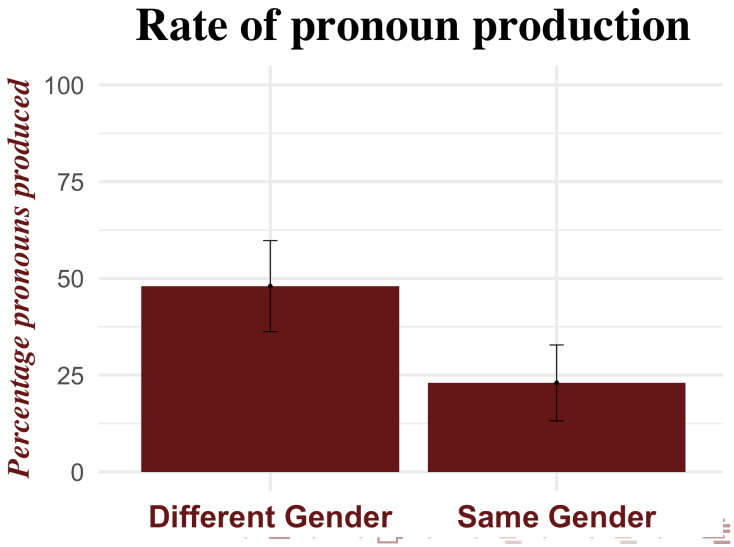

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While there is evidence in favor of ambiguity avoidance cross-sententially, it is not obvious that the same pressures should hold for intrasentential contexts.

Hypothesis

Gricean Reasoning

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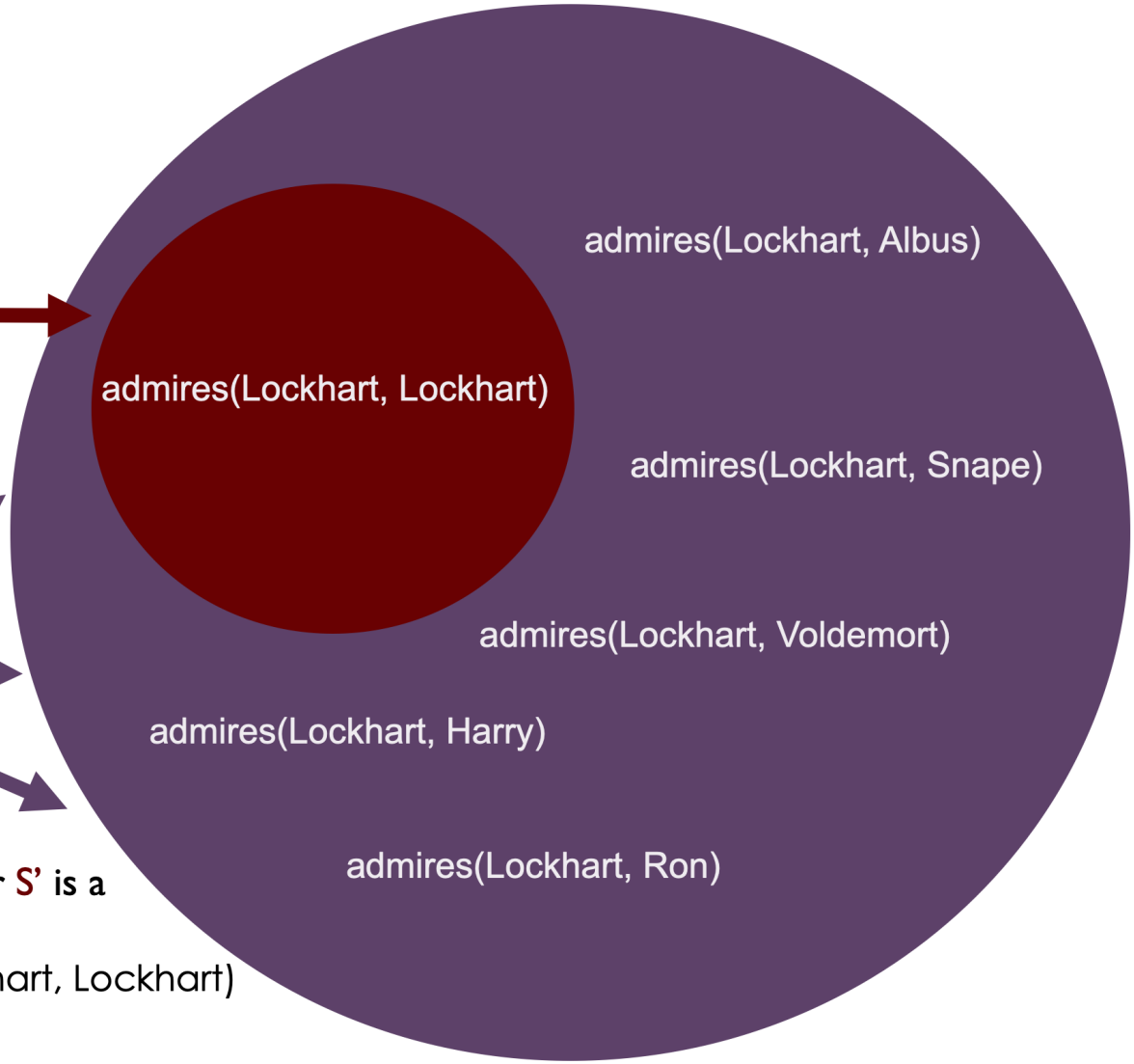
Be Clear!

S': Lockhart **se** admiră

Lockhart admires **himself**

S: Lockhart **îl** admiră

Lockhart admires **him**



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These constraints stipulate preference for bound variables over coreference. A similar consequence is obtained by syntactic-based competition accounts (Safir 2004, 2014; Rooryck & vanden Wyngaerd 2011; a.o.).

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Referential vs. Quantified Subjects

By design, constraints like *Rule I* and the *Coreference Rule* do **NOT** predict that the form of a **bound variable** should be affected by contextual ambiguity.

According to **BE CLEAR!**, regular pronouns should be disfavored in ambiguous contexts, irrespective of the type of antecedent: referential or quantificational.

The experiments target this difference.

Experimental Question:

Is the rate of production of pronouns affected by context ambiguity in disjoint reference, local coreference and bound variable contexts?

Referential Subjects & Quantified Subjects

Main Questions:

1. Is the rate of pronoun production affected by ambiguity in the case of **coreference** / **variables bound** by the local subject?

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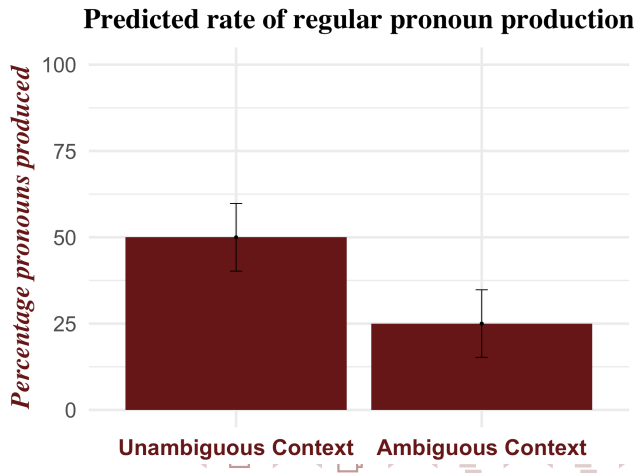

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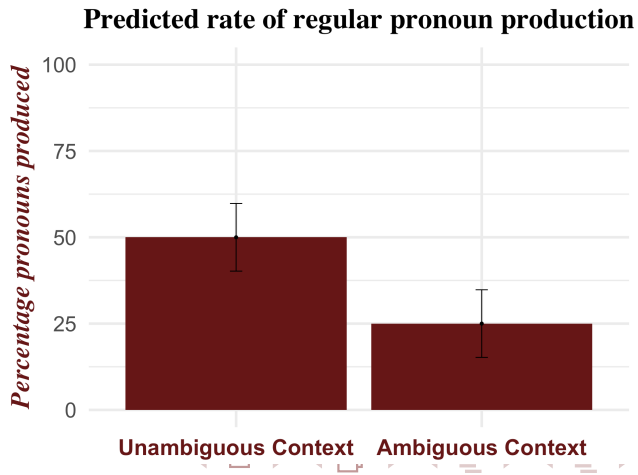

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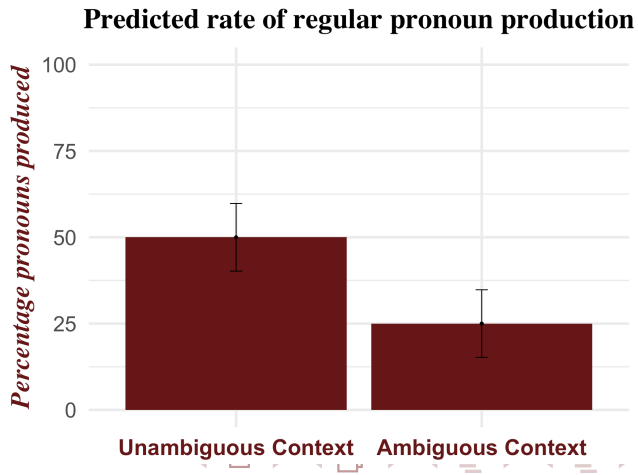

Experiment 1: Referential Subjects

Design

- picture description task
- 2 x 2 design: Picture Type x Ambiguity
  Local Coreferent/Local Disjoint x *Character Gender Match/Mismatch*

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- 16 items (distributed in 4 Latin Squared lists)
- only 2 referents in the context per item
- 20 fillers

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- 20 fillers

Participants

- 68 participants (62 female), University of Bucharest students
- The age range was between 18 and 30, with an average age of 20.4
- reimbursed 30 RON ($\approx$ 8 USD) for participation

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At Monica's picnic,

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  - → No transitive verbs were used to avoid clitic doubling.

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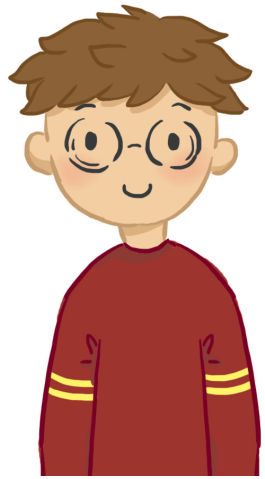
Sample Item

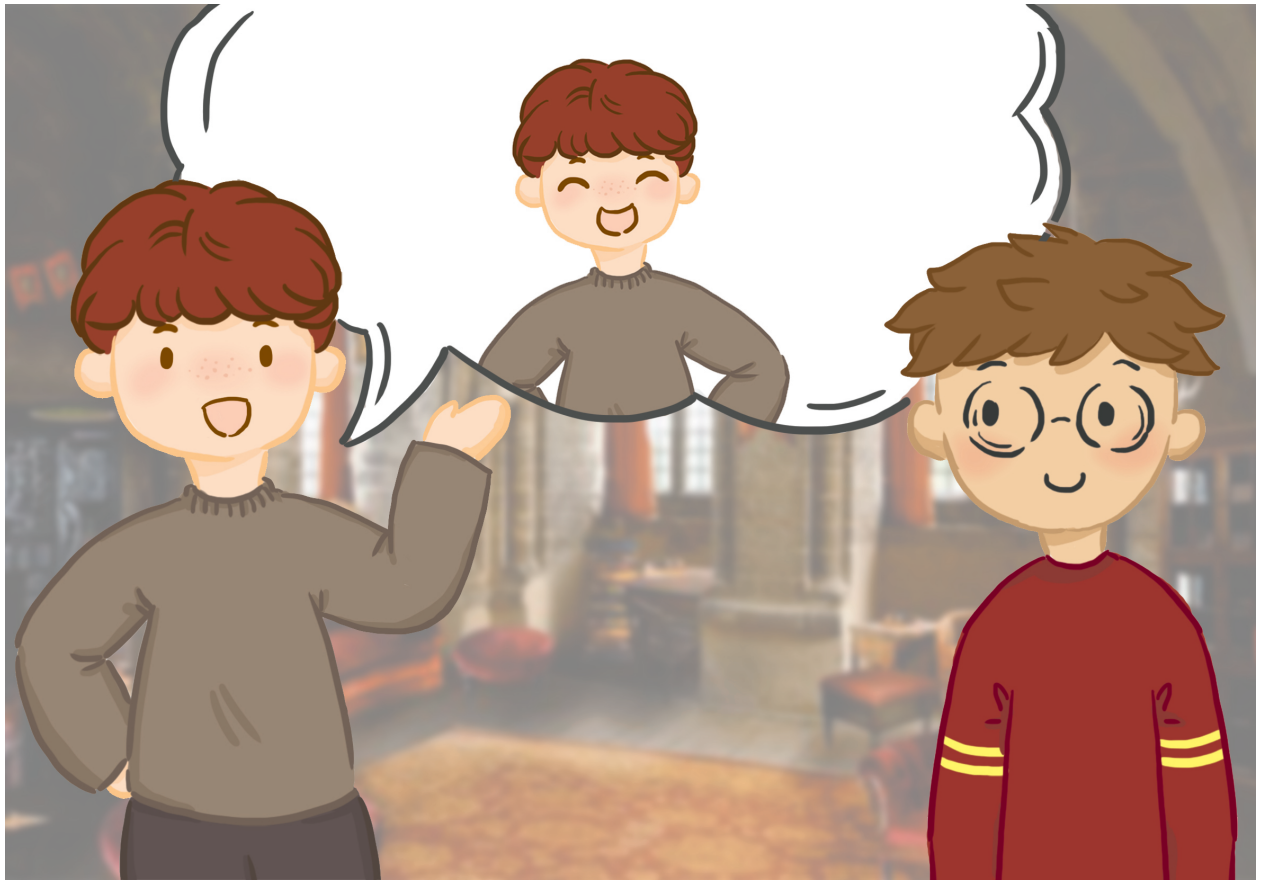
Sample Item

This is Andrei.



This is Mihai.

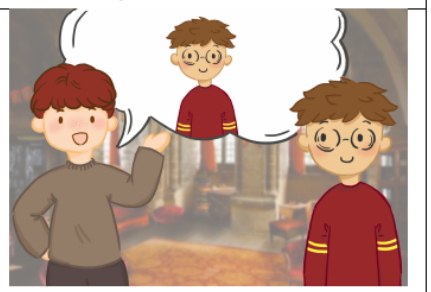
Local Coreferent, Character Gender Match



At Mihai's house, Andrei talked about ...

Sample Item Pictures & Target Sentences by Condition

	COREFERENT MISMATCH	DISJOINT MISMATCH
		
MISMATCH SENTENCE	*Acasă la Irina,* ***Andrei*** *a vorbit despre …* home at Irina, Andrei has talked about … 'At Irina's house, Andrei talked about …'	

	COREFERENT MATCH	DISJOINT MATCH
		
MATCH SENTENCE	*Acasă la* ***Mihai****,* ***Andrei*** *a vorbit despre …* home at Mihai, Andrei has talked about … 'At Mihai's house, Andrei talked about … ´	

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	COREFERENT MISMATCH	DISJOINT MISMATCH
		
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Be Clear! Prediction

lower rate of regular pronouns than in MISMATCH

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		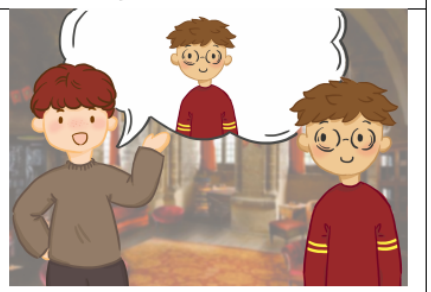
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Non Target Responses

- pronouns/names targeting wrong referent
- possessive constructions: *her emotional states, his friend, his glasses*, etc.
- random NPs: *love, magical powers, girls*
- full sentences: *how he feels, what happened last night, how they met at a restaurant 10 years ago, etc.*

Data Exclusion

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- excluded non-target responses
- excluded data from 2 participants due to a low rate of target responses (<30%)
- lost 15 responses due to a PsychoPy error
- in total, 10.81% of responses were removed
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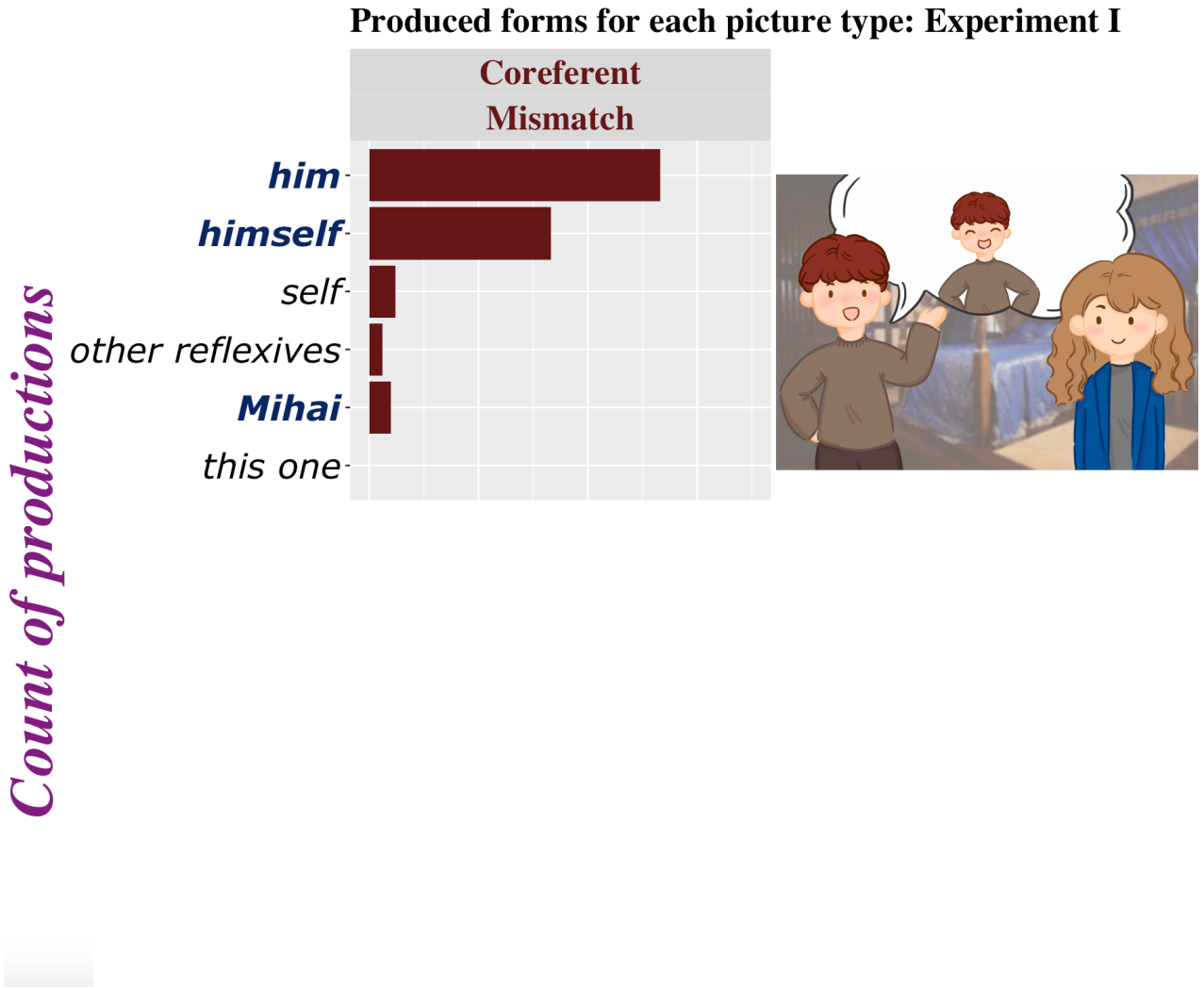
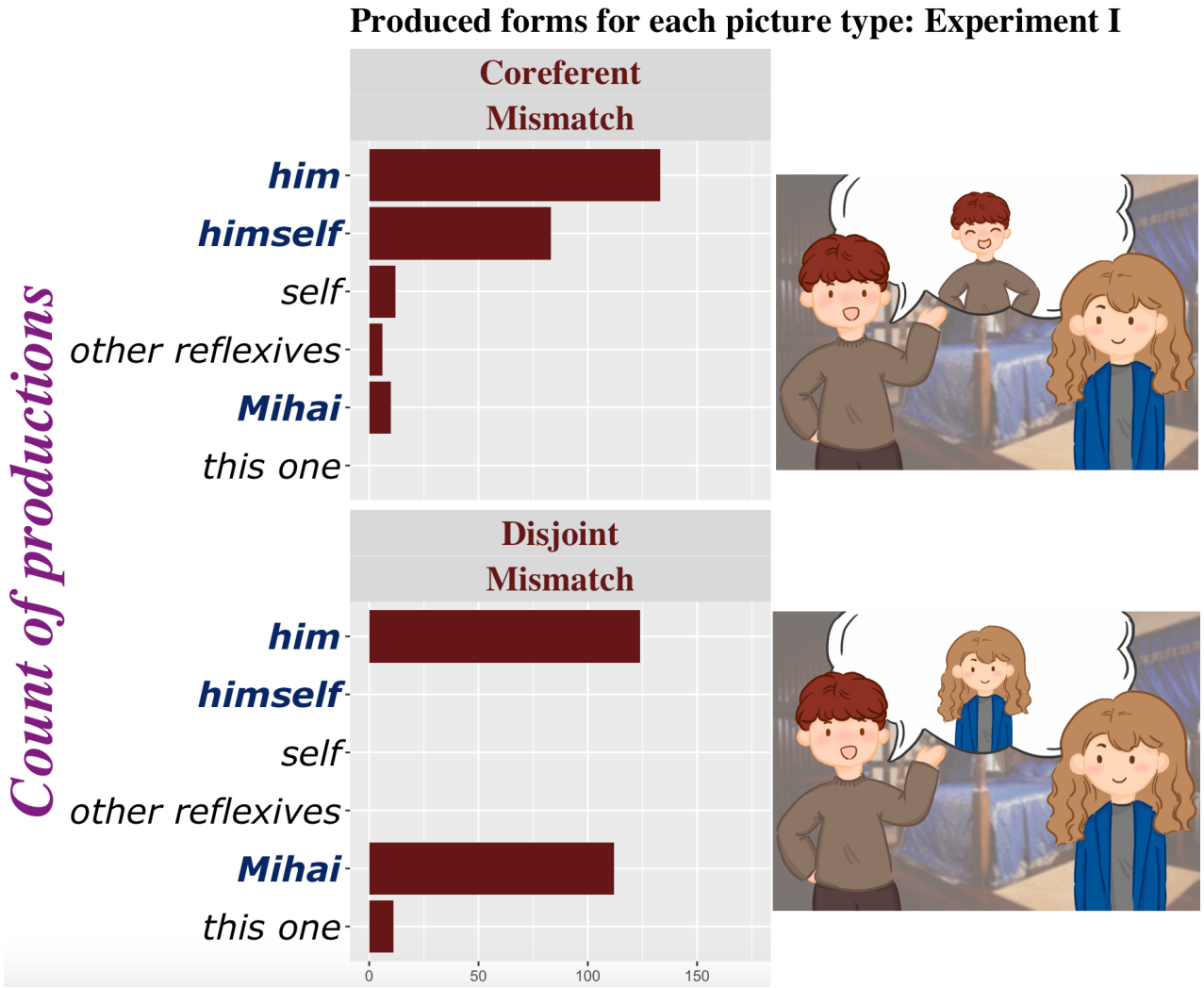
A second nested model was fitted to estimate size of **AMBIGUITY** within each picture type.

Raw Results


Produced forms for each picture type: Experiment I
Coreferent
Mismatch
him
himself
self
other reflexives
Mihai
this one
Count of productions

Raw Results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Disjoint
Mismatch
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himself
self
other reflexives
Mihai
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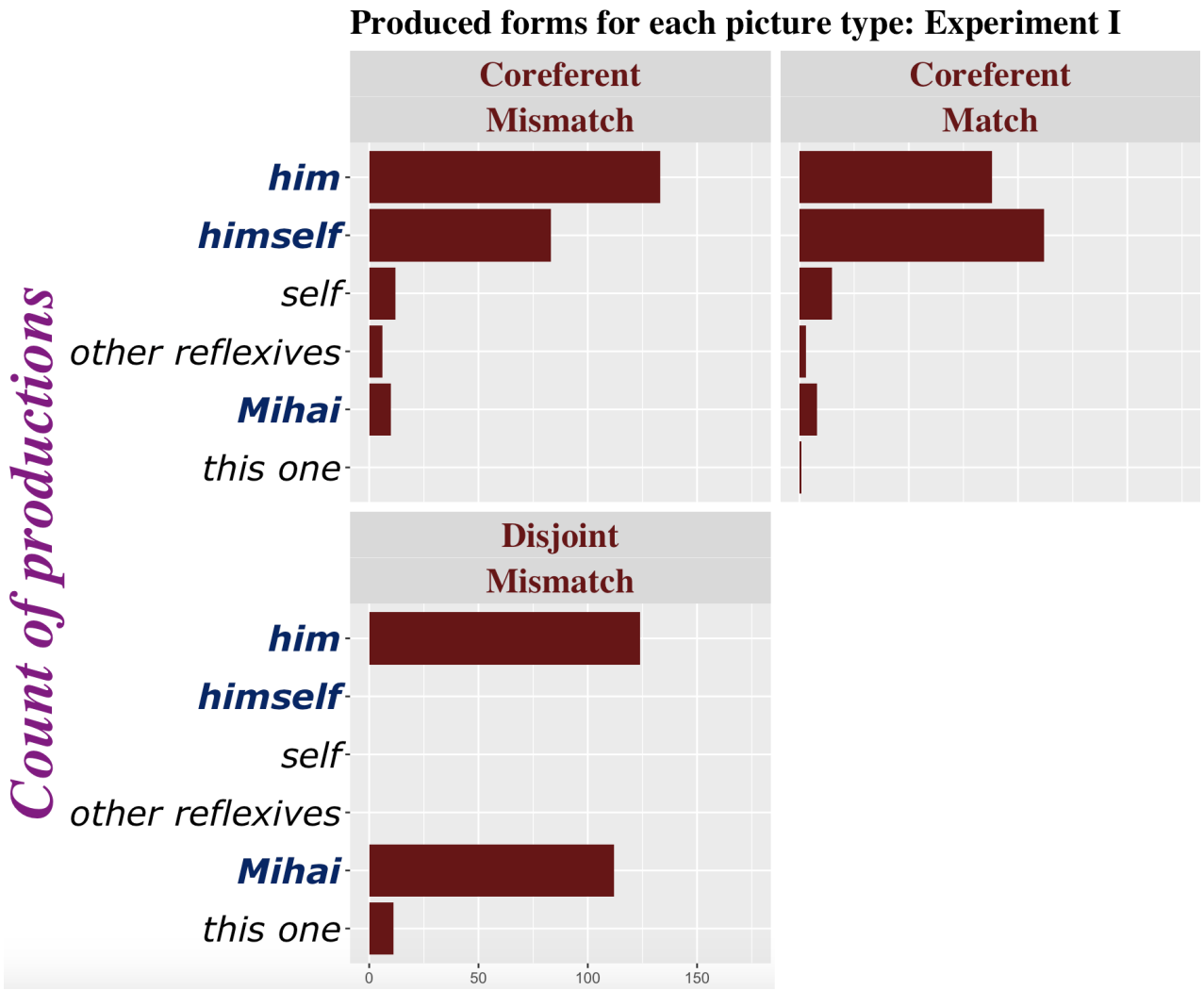
Count of productions
0
50
100
150

Raw Results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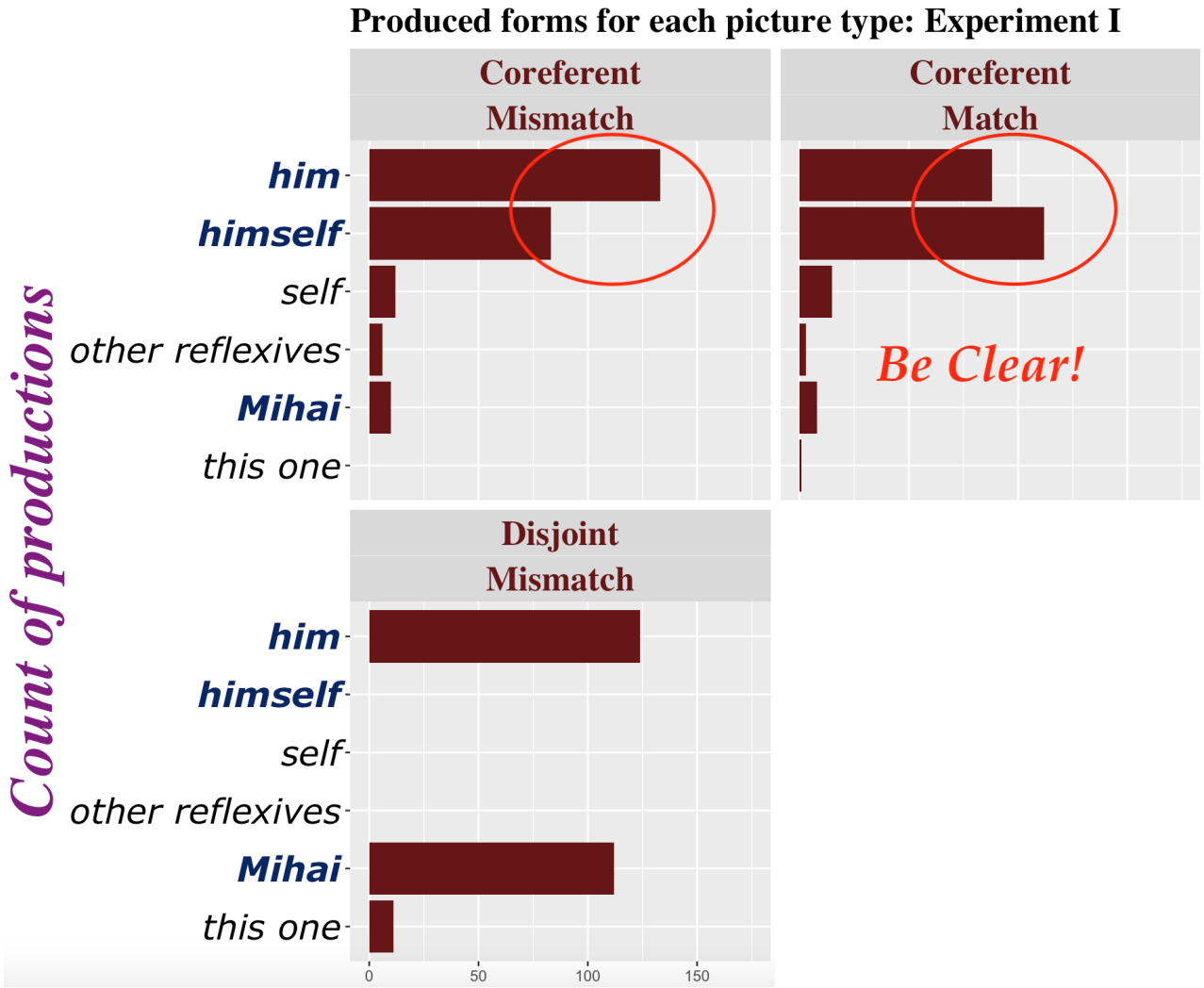
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Coreferent Mismatch
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Be Clear!
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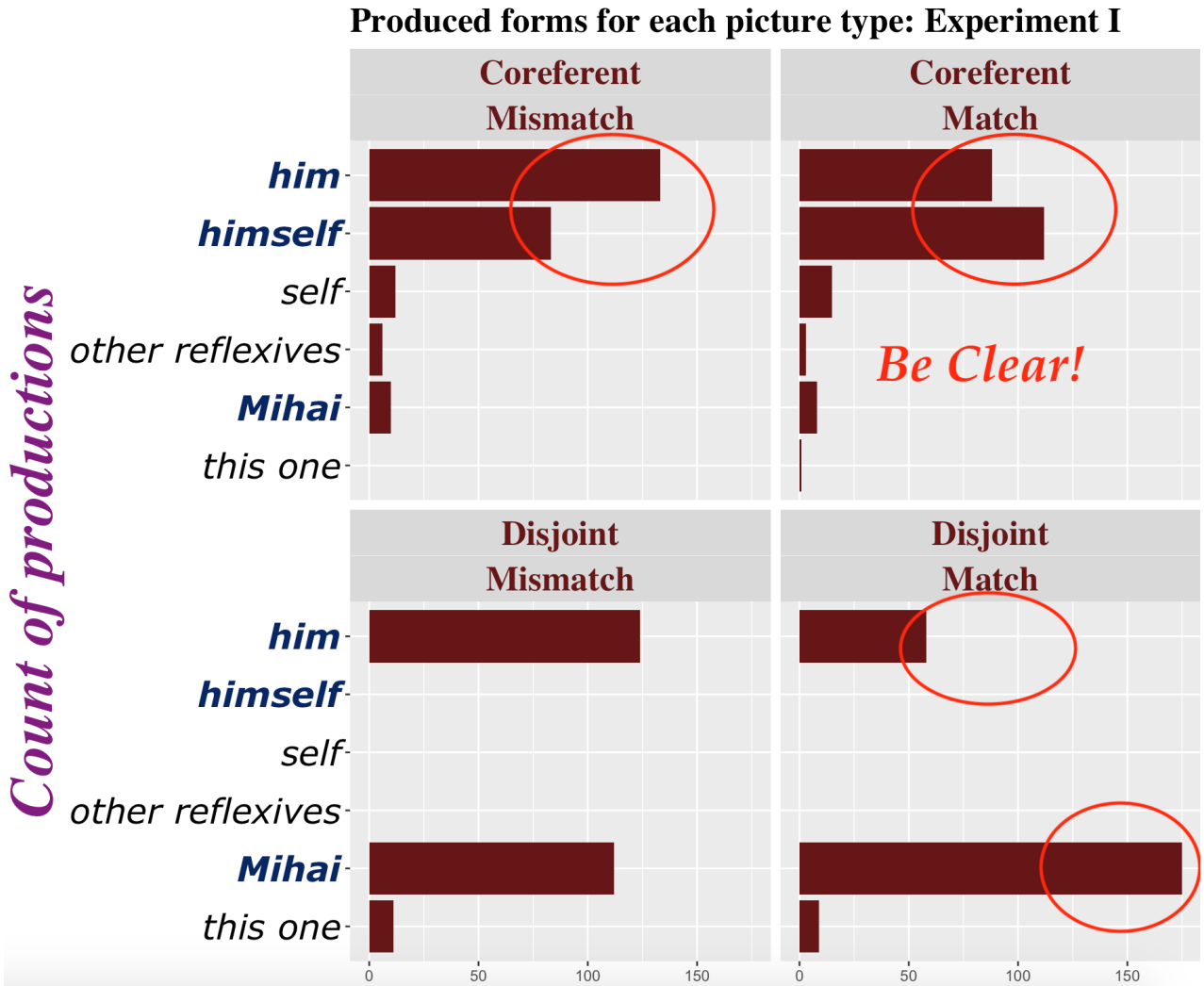
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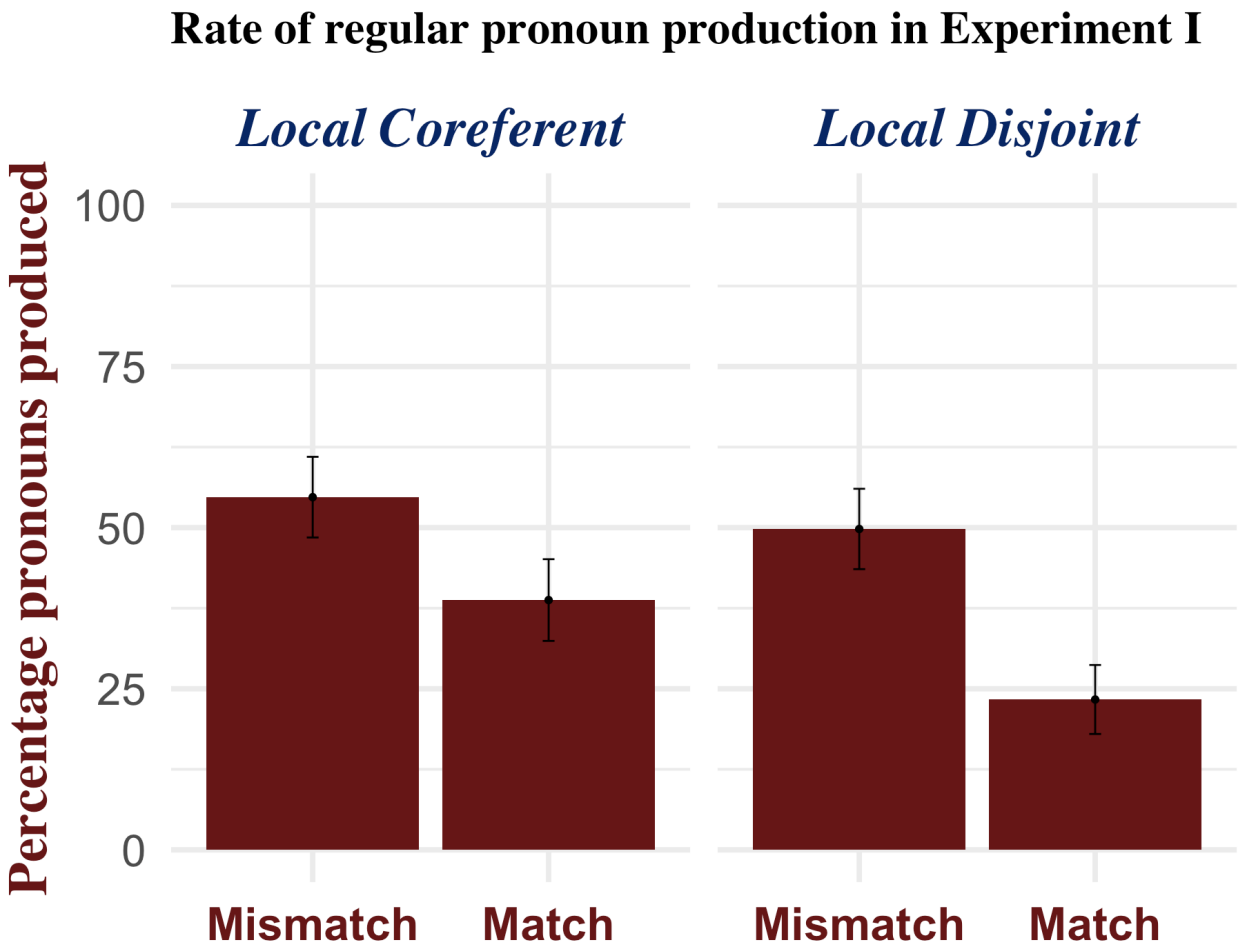
Rate of regular pronoun production in Experiment I
Local Coreferent
Local Disjoint
Percentage pronouns produced
100
75
50
25
0
Mismatch
Match
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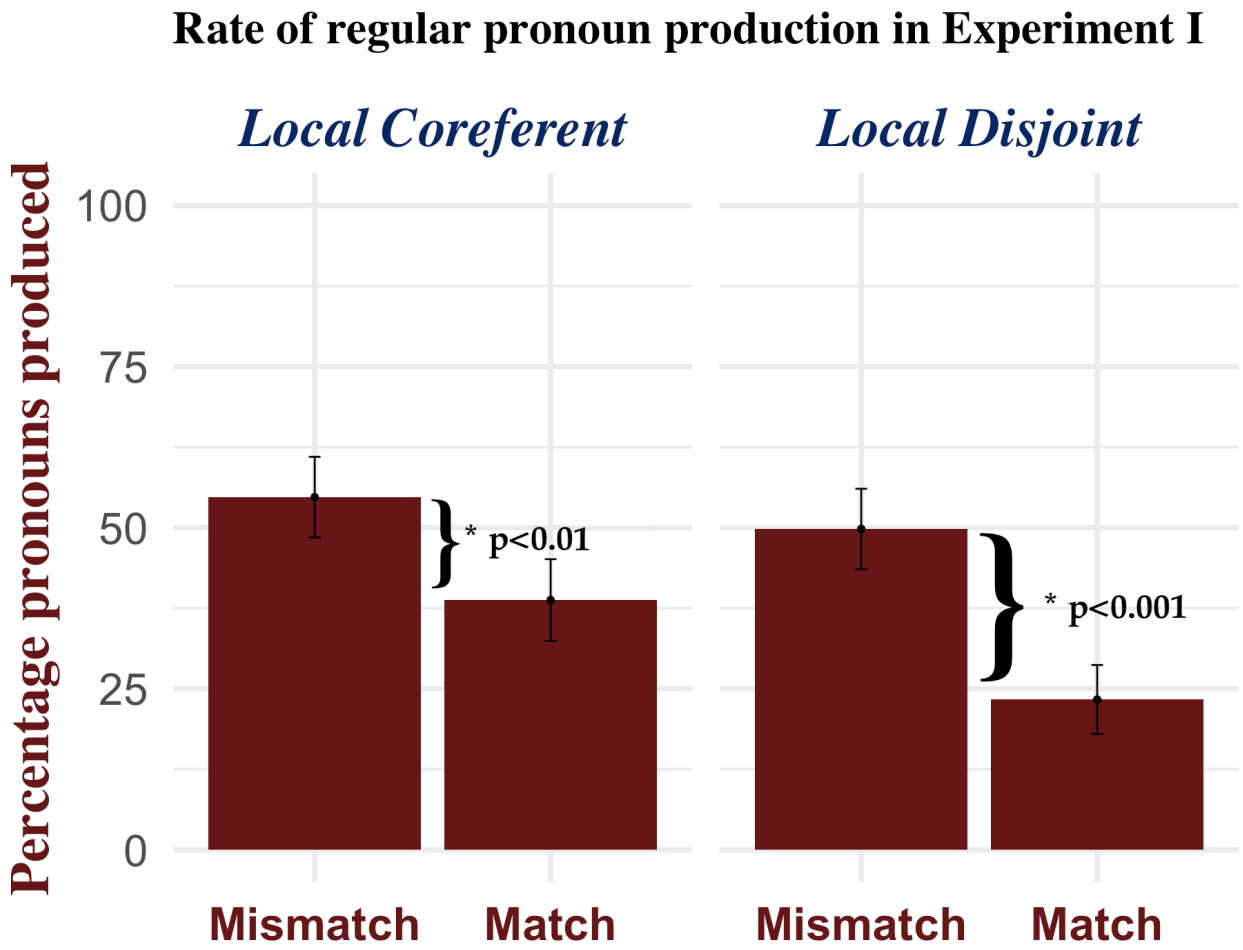
Match

Results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75
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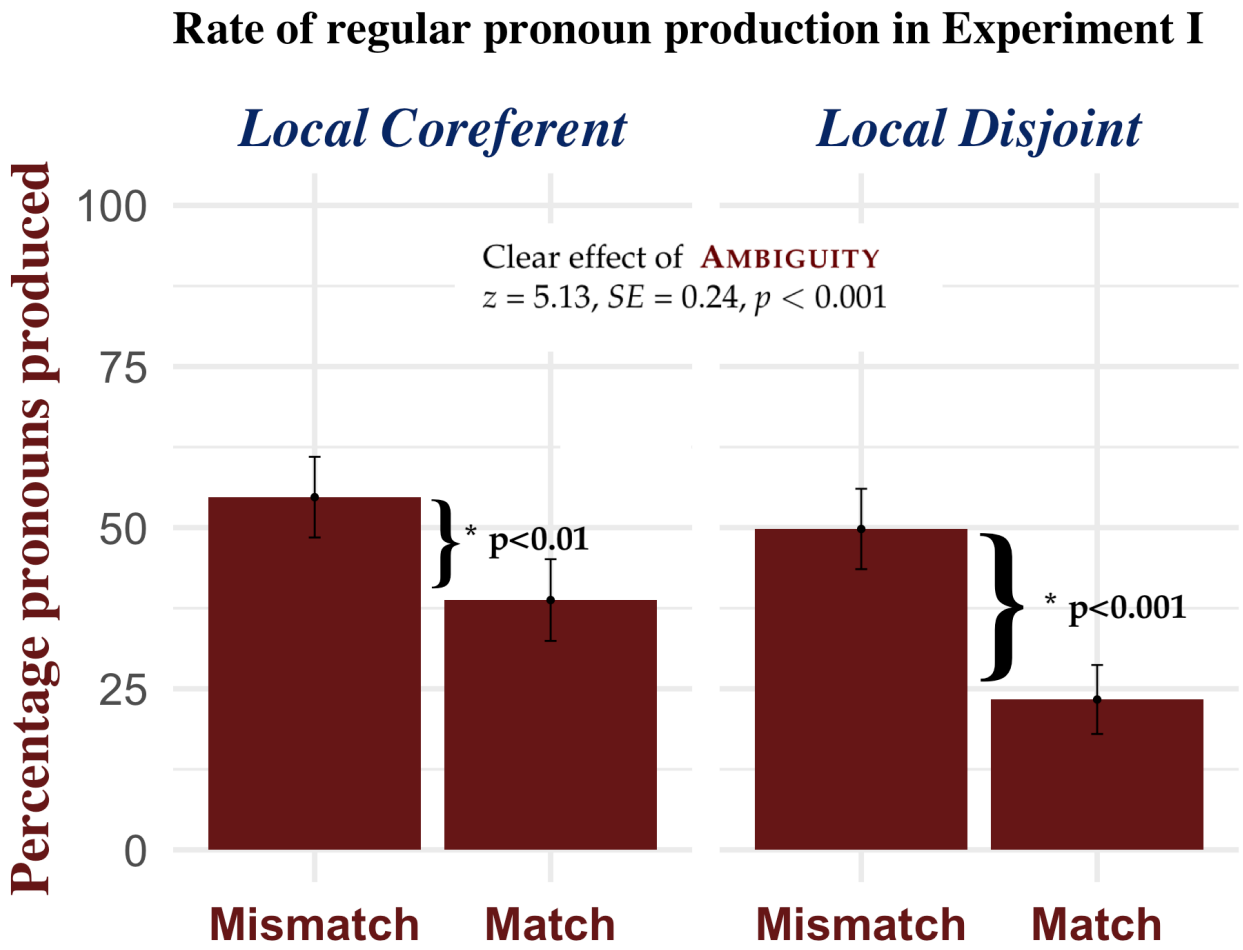
25
0
* p<0.01
* p<0.001
Mismatch
Match
Mismatch
Match

Results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Clear effect of AMBIGUITY
z = 5.13, SE = 0.24, p < 0.001
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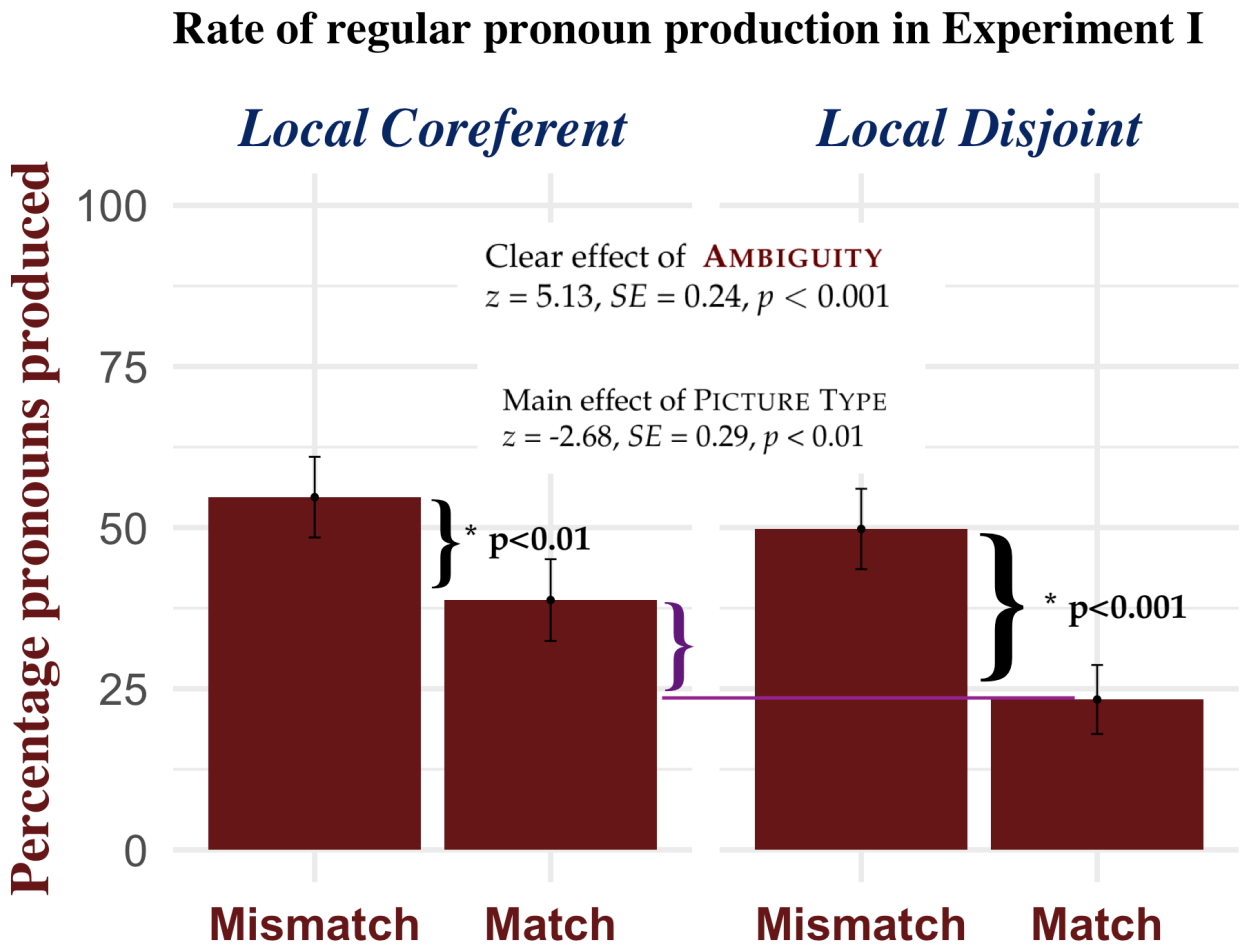
* p<0.001
Mismatch
Match
Mismatch
Match

Results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z = 5.13, SE = 0.24, p < 0.001
Main effect of PICTURE TYPE
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* p<0.001
Mismatch
Match
Mismatch
Match

Discussion

Hypothesis:

BE CLEAR! affects both coreference and disjoint reference contexts.

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Predictions:

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  - ✓ a 26.9% increase from LOCAL DISJOINT MISMATCH to LOCAL DISJOINT MATCH ($p<0.001$)

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  - ✓ a 16.9% increase from LOCAL COREFERENT MISMATCH to LOCAL COREFERENT MATCH ($p<0.01$)

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Does **BE CLEAR!** impact the choice of pronominal form for **locally bound variables** as well?

Experiment 2: Quantified Subjects

Design, Materials, Analysis

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Experiment 2 is a **replication** of *Experiment 1*: the same design, procedure, data annotation and analysis were used.

The relevant differences:

- item subjects are quantified expressions - like *every boy*
- there are 4 referents per context per item

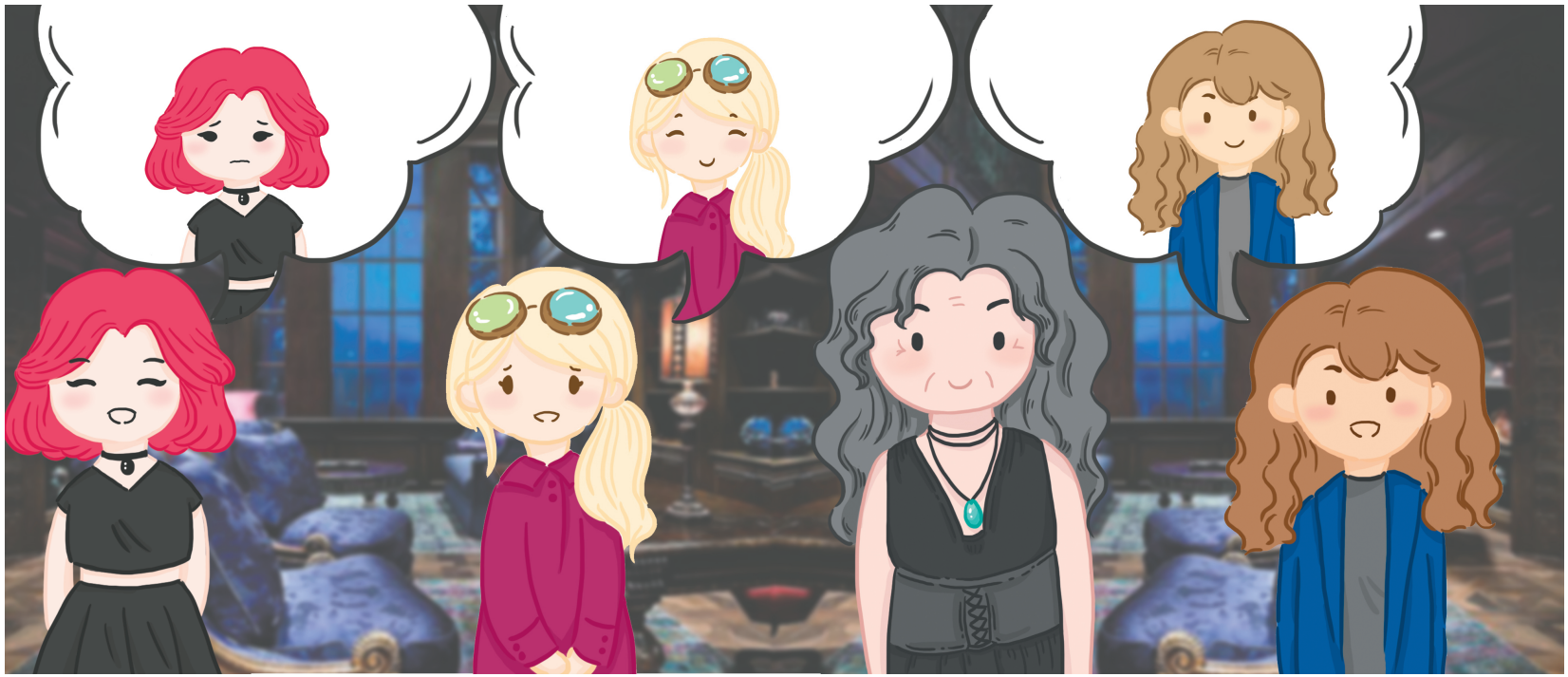
Sample Item

Sample Item

(11) **Context Screen**:

Grandma Laura was recently visited by her family.
Monica, Elena and Irina were there too.

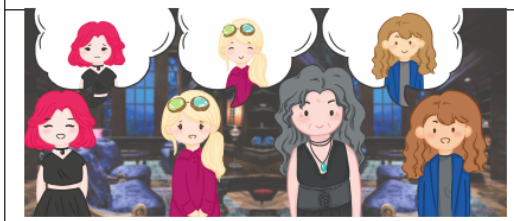
Local Bound, Character Gender Match



At Grandma Laura's house, every girl talked about ...

Sample Item Pictures & Target Sentences by Condition

	Bound Mismatch	Disjont Mismatch
		
Mismatch Sentence	*Acasă la <u>bunicul Paul</u>, **fiecare fată** a vorbit despre …* home at grandpa Paul, every girl has talked about … 'At Grandpa Paul's house, every girl talked about …'	

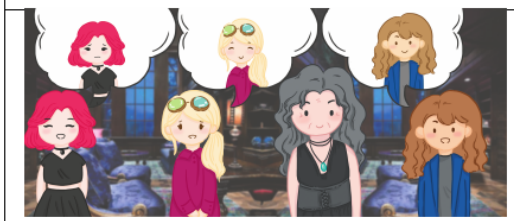
	Bound Match	Disjoint Match
		
Match Sentence	*Acasă la **bunica Laura**, **fiecare fată** a vorbit despre …* home at grandma Laura, every girl has talked about … 'At Grandma Laura's house, every girl talked about … ´	

Sample Item Pictures & Target Sentences by Condition

	BOUND MISMATCH	DISJONT MISMATCH
		
MISMATCH SENTENCE	*Acasă la bunicul Paul, **fiecare fată** a vorbit despre …* home at grandpa Paul, every girl has talked about … 'At Grandpa Paul's house, every girl talked about …'	

Be Clear! Prediction

lower rate of pronouns than in MISMATCH

	BOUND MATCH	DISJOINT MATCH
		
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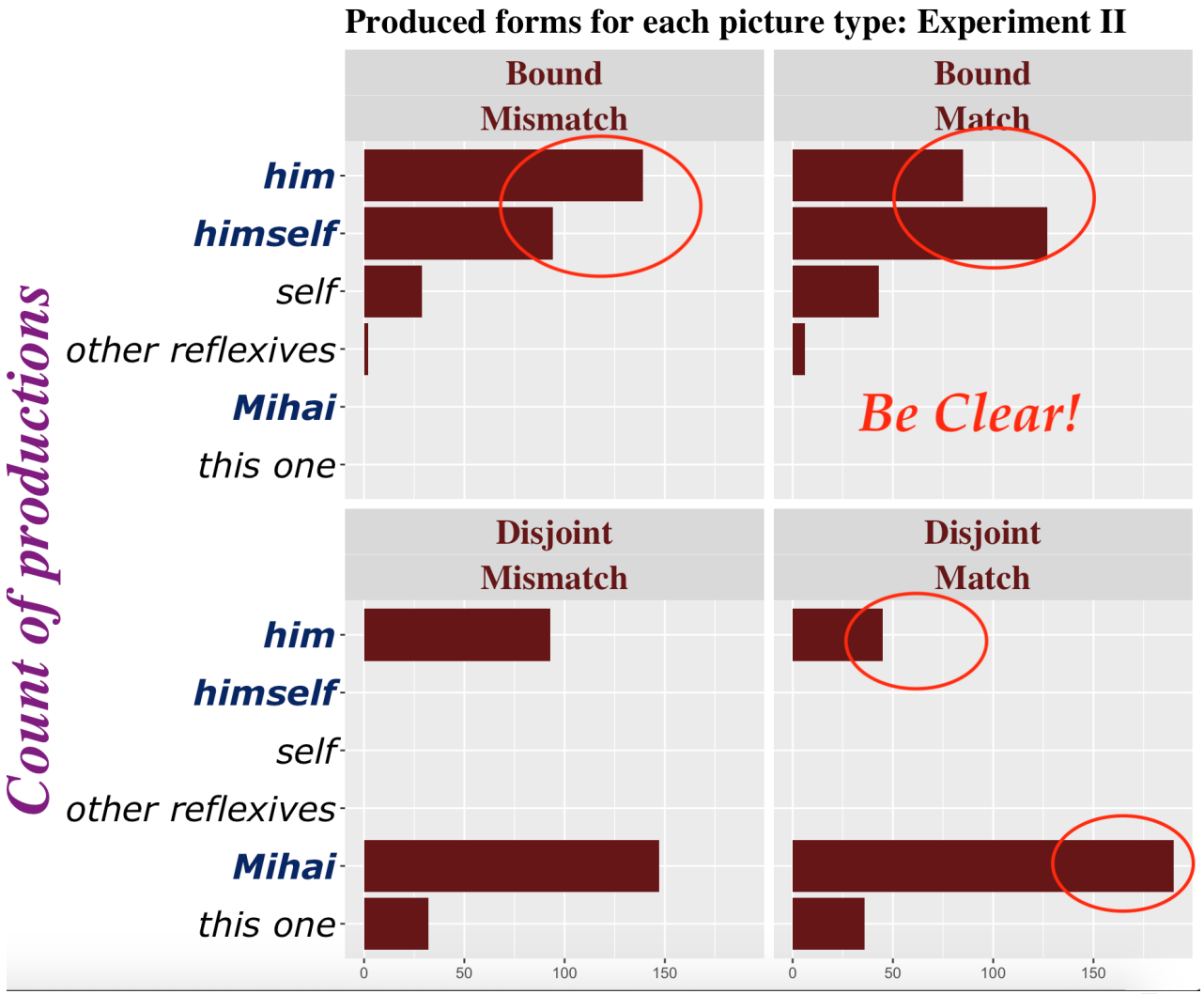
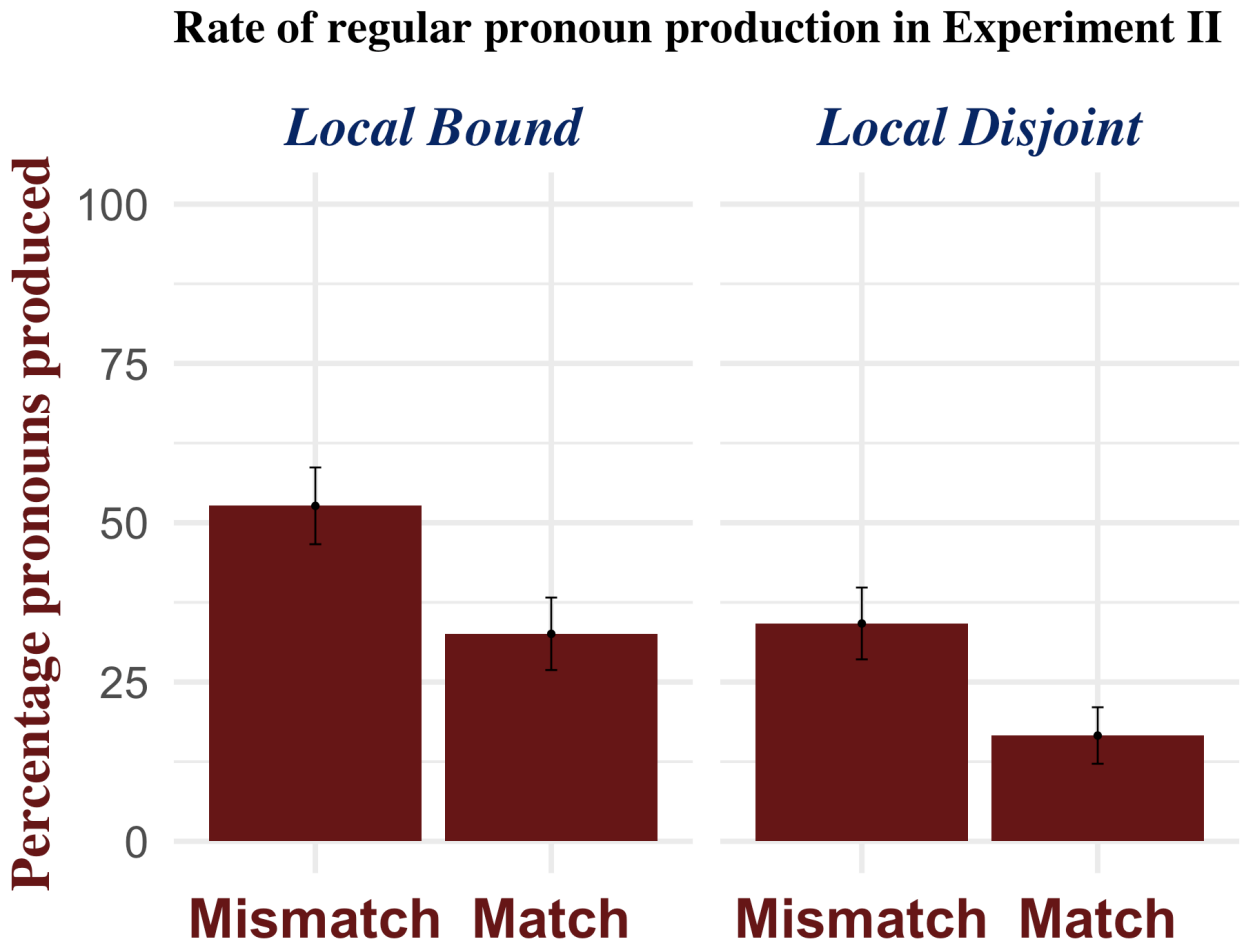
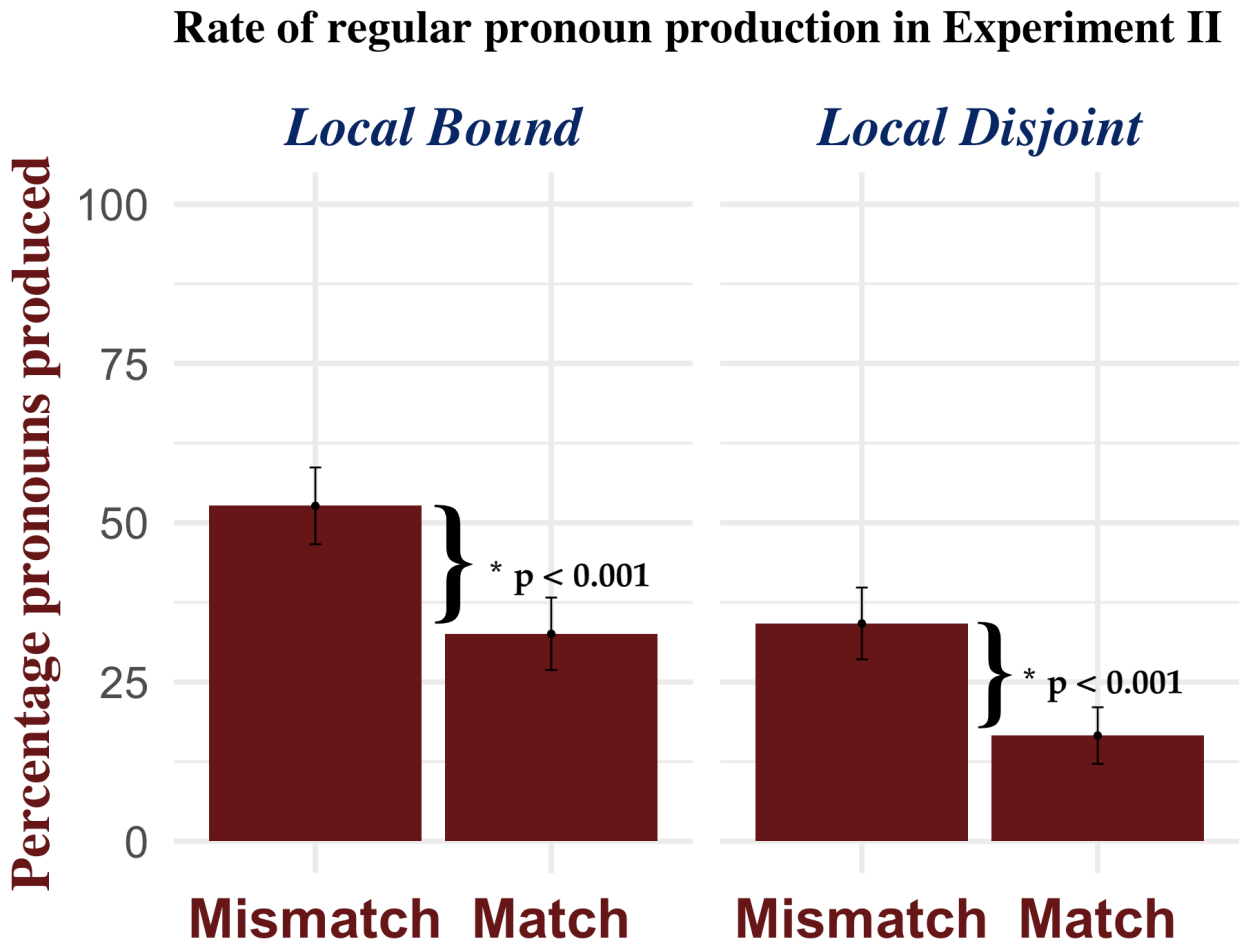
Raw Results


Produced forms for each picture type: Experiment II
Bound Mismatch
Bound Match
Disjoint Mismatch
Disjoint Match
him
himself
self
other reflexives
Mihai
this one
Count of productions
Be Clear!
0
50
100
150

Results


Rate of regular pronoun production in Experiment II
Local Bound
Local Disjoint
Percentage pronouns produced
100
75
50
25
0
Mismatch
Match
Mismatch
Match

Results


Rate of regular pronoun production in Experiment II
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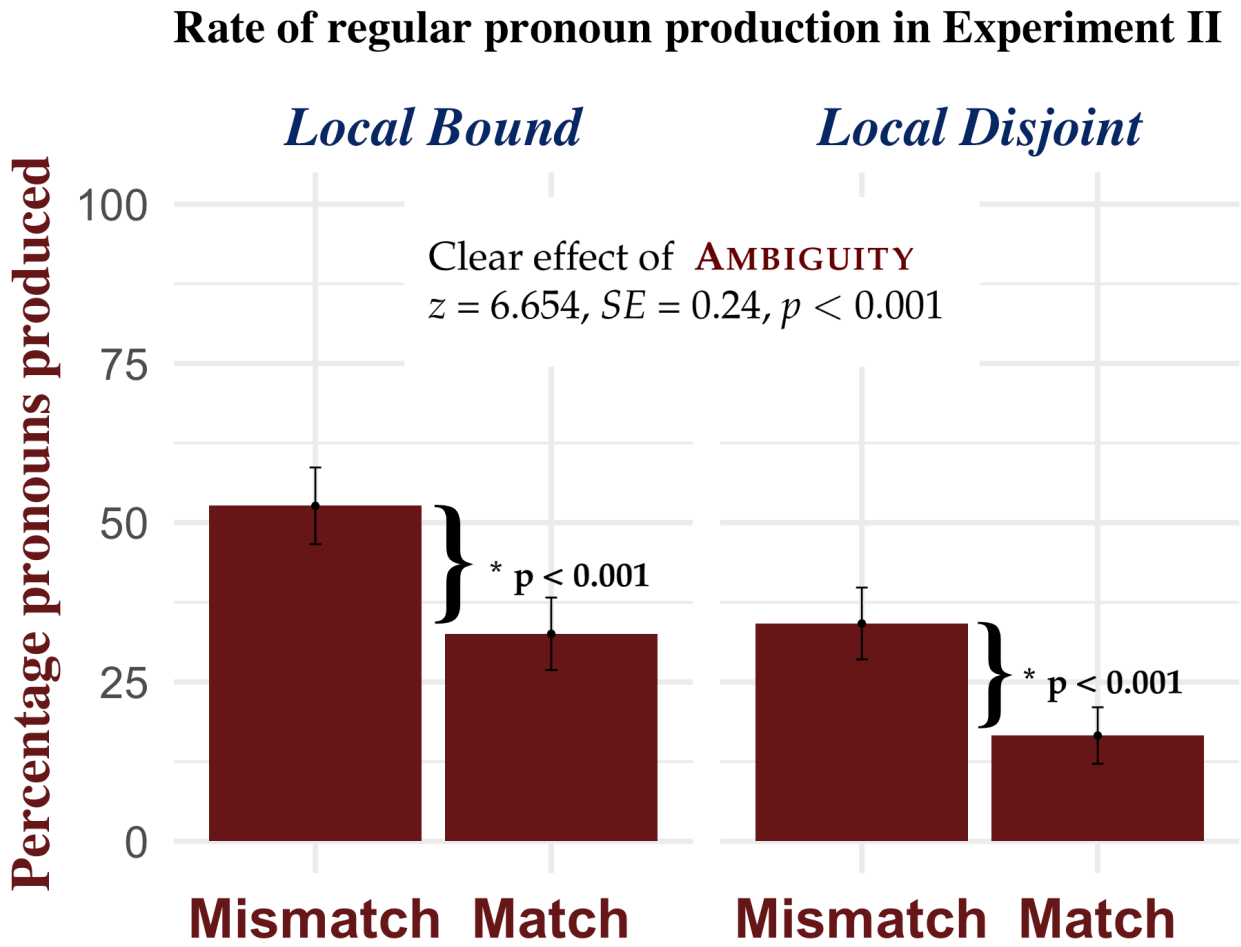
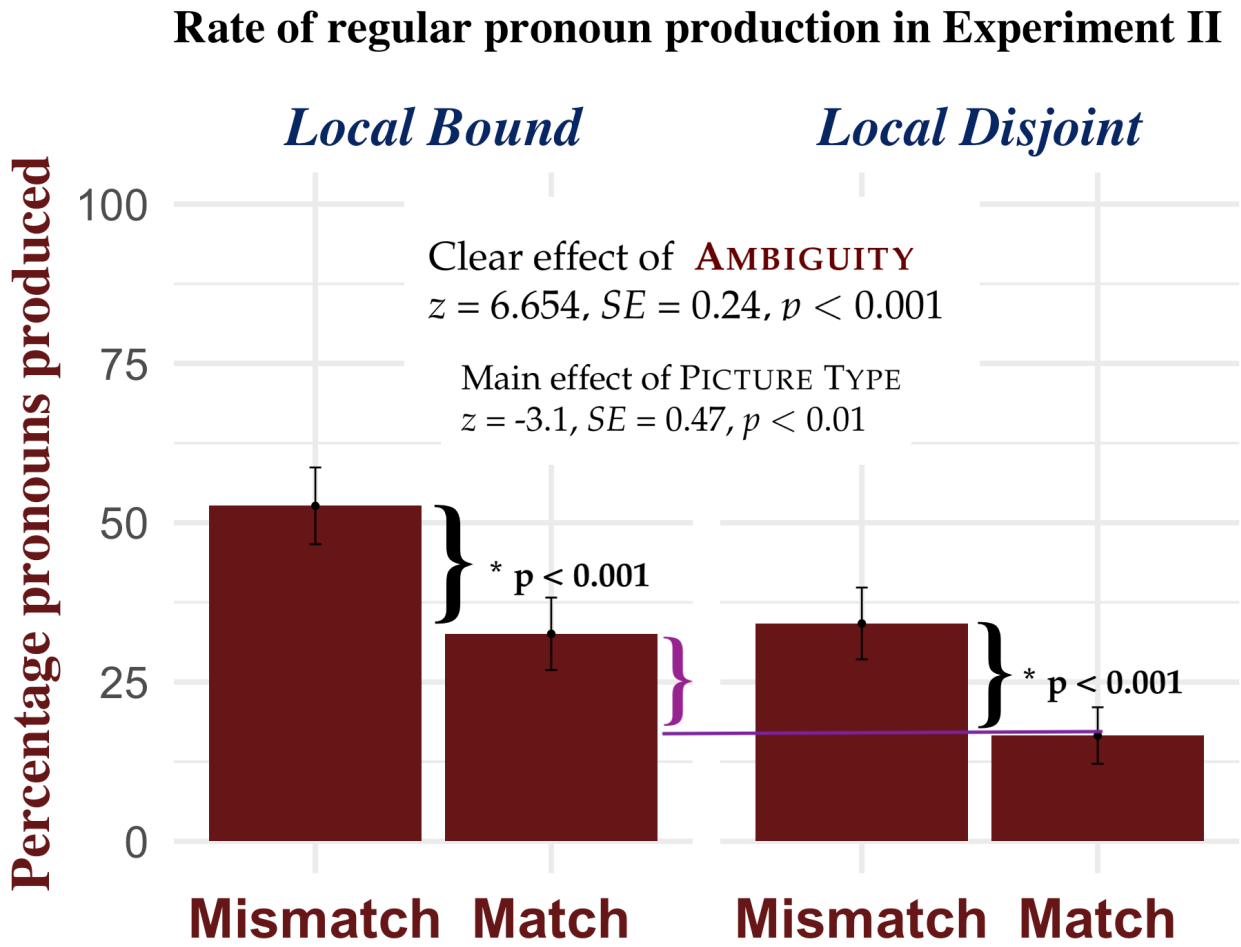
* p < 0.001
* p < 0.001
Mismatch
Match
Mismatch
Match

Results


Rate of regular pronoun production in Experiment II
Local Bound
Local Disjoint
Percentage pronouns produced
100
75
50
25
0
Clear effect of AMBIGUITY
z = 6.654, SE = 0.24, p < 0.001
* p < 0.001
* p < 0.001
Mismatch
Match
Mismatch
Match

Results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100
75
50
25
0
Clear effect of AMBIGUITY
z = 6.654, SE = 0.24, p < 0.001
Main effect of PICTURE TYPE
z = -3.1, SE = 0.47, p < 0.01
* p < 0.001
* p < 0.001
Mismatch
Match
Mismatch
Match

Discussion

Hypothesis:

BE CLEAR! affects coreferent, disjoint and locally bound variables.

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Predictions:

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An ambiguity avoidance (**BE CLEAR!**) constraint impacts the choice of pronominal form in all three contexts: local disjoint reference, local coreference and locally bound variables.

General Discussion

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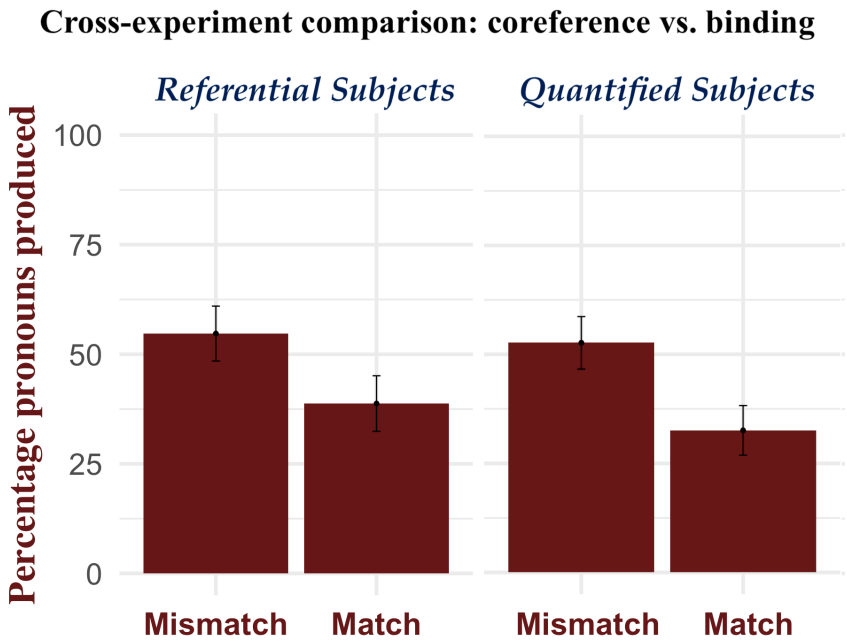

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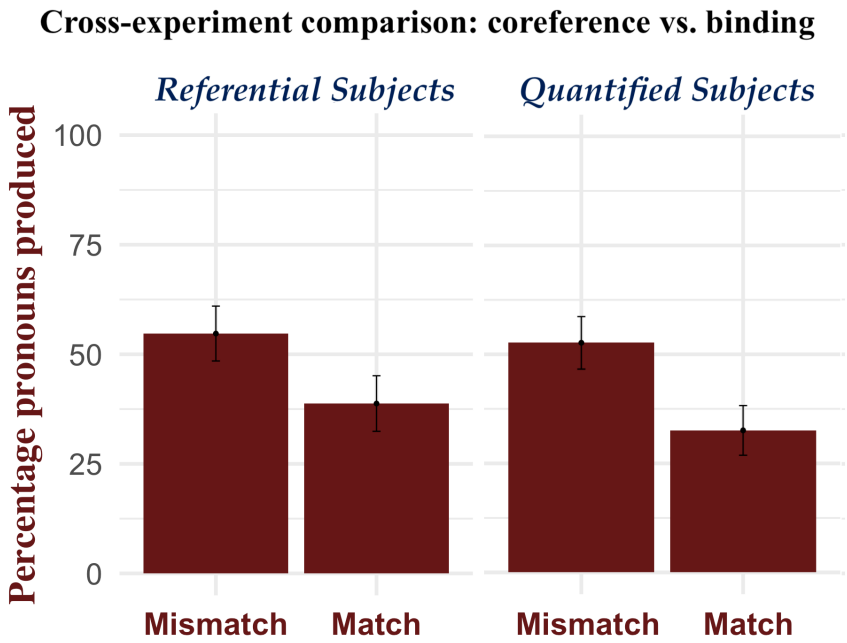

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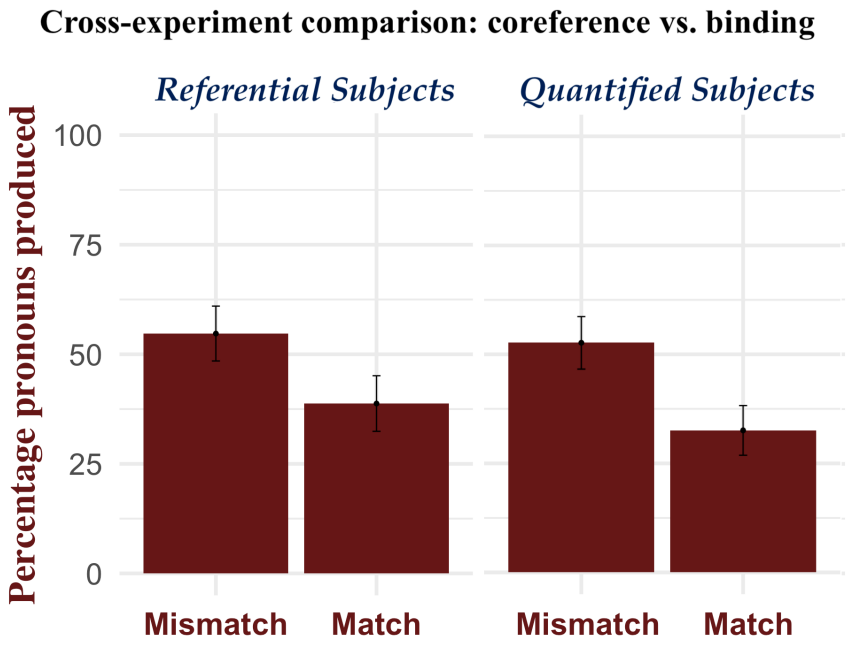
- In ambiguous coreferent and bound variable contexts, the emphatic reflexive is the preferred pronominal form.



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- The results from *Experiment 1* and *Experiment 2* show that **ambiguity avoidance** strategies affect the production rate of regular pronouns for both **coreference** and **bound variables** in **intrasentential** contexts.

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Question: Why is the regular pronoun *el/ea* the preferred form in unambiguous contexts?

Ask me about it!

Further Questions

- Is there pyscholinguistic evidence in favor of competition between forms? (Yes!!)
- Should we expect BE CLEAR! to affect pronoun production in other languages? (Of course!)
- Is the data from comprehension consistent with the data from the production experiments? (Yes!)
- so many other questions...

Thank You!

Acknowledgements: We are grateful for all of the feedback, support and encouragement of Kyle Johnson, Seth Cable, Isabelle Charnavel, Alexandra Cornilescu, Marcel den Dikken, Lyn Frazier, Ken Safir, Dominique Sportiche, Adrian Staub, the audiences of *WCCFL 36* @ UCLA (April 2018), *Pronouns in Competition* @ Santa Cruz (April 2018), and many others we're bound to forget. We are also very thankful to the NSF, the University of Bucharest, and the UMass Amherst Predissertation Grant for their support.

Rule I

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Unlike its predecessors, **BE CLEAR!** is a **general ambiguity avoidance strategy**: it does not favor bound variables over unbound variables.

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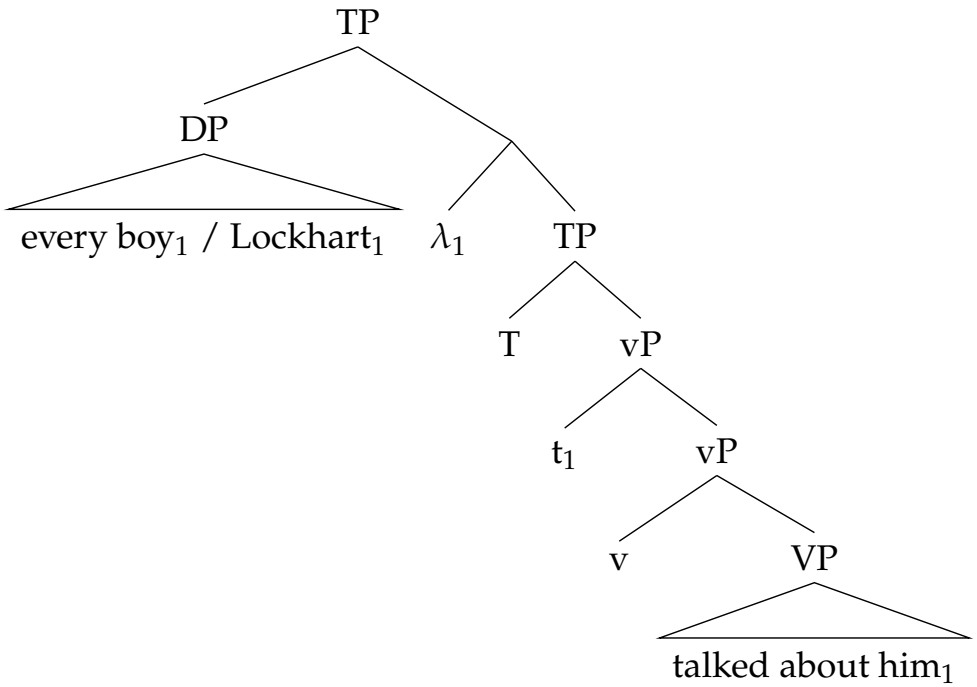
c. RULED OUT BY CONDITION B



Be Small!

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We suggest a generic economy constraint (inspired by *Minimize Restrictors*, Schlenker, 2005) BE SMALL and the generic pragmatic constraint BE CLEAR!! *jointly* determine the distribution of pronouns in Romanian. The experiments corroborate this assumption.

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Prediction: regular pronouns like *el* are preferred to emphatic reflexives like *el înşuşi* when they achieve the same meaning.

Experiment 1

Procedure *Experiment 1 & 2*

- The experiment took place at the University of Bucharest.
- Participants were recruited through flyers, class anouncements and via online platforms.
- The experiment was coded and ran in PsychoPy.
- Participants were walked through the Instructions.
- Participants were instructed to choose a continuation before uttering the entire sentence.
- Participants' responses were recorded, transcribed and annotated.
- The entire process, including debriefing, lasted between 45-60 minutes per participant.

Raw Results *Experiment 1*

The rate of production for each on-target response type is as follows:

Response Type	Pronoun	Reflexive			Other	
	him	*himself*	*self*	*own person*	Demonstrative	Name
Coreferent Mismatch	54.5%	34%	5%	2.5%	0%	4%
Coreferent Match	38.8%	49.3 %	6.6%	1.3%	0.5%	3.5%
Disjoint Mismatch	50%	0%	0%	0%	4.4%	45.5%
Disjoint Match	24%	0%	0%	0%	3.7%	72.3%

Table 4.2: *Rate of Production by participant Response Type in Experiment 1.* Translations of Participants' Responses as follows. Pronoun: 'him' / 'her' - *el / ea*; Reflexive: 'himself' / 'herself' - *el însuşi / ea însăşi*, 'self' - *sine*, 'own person' - *propria persoană*; Demonstrative: 'this one' - *acesta / aceasta*.

The rate of regular pronoun production (*el, ea*) can be used to measure the effect of **Ambiguity** in both contexts.

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We also found an overall effect of PICTURE TYPE (z = -2.68, $p < 0.01$) Participants used more regular pronouns in the **Local Coreferent** conditions in both ambiguous and unambiguous contexts.

Experiment 2

Design Experiment 2

- picture description task
- 2 x 2 design: Picture Type x Ambiguity
  Local Bound/Local Disjoint x *Character Gender Match/Mismatch*
- 16 items (distributed in 4 Latin Squared lists)
- 20 fillers
- same procedure as in *Experiment 1*
- 4 referents in the context per item

Participants

- 68 participants (60 female)
- University of Bucharest students
- The age range was between 18 and 33, with an average age of 21.3
- reimbursed 30 RON (≈ 8 USD) for participation

Data Exclusion Experiment 2

- excluded non-target responses
- no participants were excluded from the data analysis
- in total, 1.83% of the collected data was removed
- analysis ran on 1068 target responses out of a total of 1088
- improved rate of target responses in comparison to *Experiment 1* due to having tweaked the instructions to emphasize that the experiment was not a test of creativity.

Data Analysis

For all of the on-target responses, **logistic mixed effects regression** was used to model:

- the effect of **AMBIGUITY** (*Character Gender Mismatch/Match*)
- the effect of **PICTURE TYPE** (*Local Bound/Local Disjoint*)

A second nested model was fitted to estimate size of **AMBIGUITY** within each picture type.

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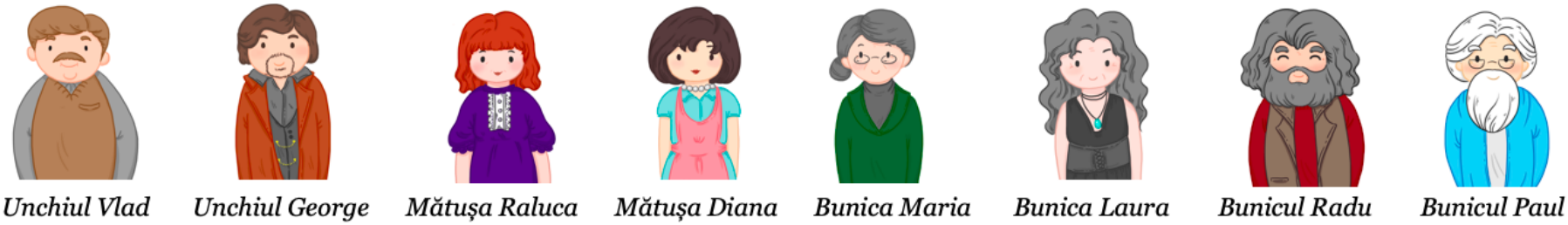
  - → a predicate which takes a PP object (*laugh at*, *cook for*) and is equally plausible with a reflexive and non-reflexive continuation
  - → No transitive verbs were used to avoid clitic doubling.

At Grandpa Vlad's picnic, every girl laughed at ...

Characters in Experiment 2

Given the larger number of characters in *Experiment 2* and due to their familial relationships, the entire list of characters was presented to the participants during the instructions.



Participant Response Types *Experiment 2*

On Target Responses

- pronoun: *el, ea* 'him, her'
- emphatic reflexive: *el însuşi, ea însăşi* 'himself, herself'
- reflexive: *sine* 'self'
- other reflexives: *propria persoana* 'own person', *persoana lui/ei* 'his/her person', etc.
- names: *Grandma Laura*
- demonstrative: *acesta, aceasta* 'this one'

Non Target Responses

- pronouns/names targeting wrong referent
- possessive constructions: *his hair, his grandpa, her success*
- random NPs: *dissatisfactions, etc.*
- full sentences: *what he did, how she feels, etc.*

Raw Results *Experiment 2*

The rate of production for each on-target response type is as follows:

Response Type	Pronoun	Reflexive			Other	
	him	*himself*	*self*	*own person*	Demonstrative	Name
Bound Mismatch	52.6%	35.6%	11%	0.8%	0%	0%
Bound Match	32.5%	48.7 %	16.5%	2.3%	0%	0%
Disjont Mismatch	34.2%	0%	0%	0%	11.8%	54%
Disjoint Match	16.6%	0%	0%	0%	13.3%	70.1%

Rate of Production by participant Response Type in Experiment 2.
Translations of Participants' Responses as follows. Pronoun: 'him' / 'her' - *el / ea*; Reflexive: 'himself' / 'herself' - *el însuşi / ea însăşi*, 'self' - *sine*, 'own person' - *propria persoană*; Demonstrative: 'this one' - *acesta / aceasta*.

The rate of regular pronoun production (*el, ea*) can be used to measure the effect of **Ambiguity** in both contexts.

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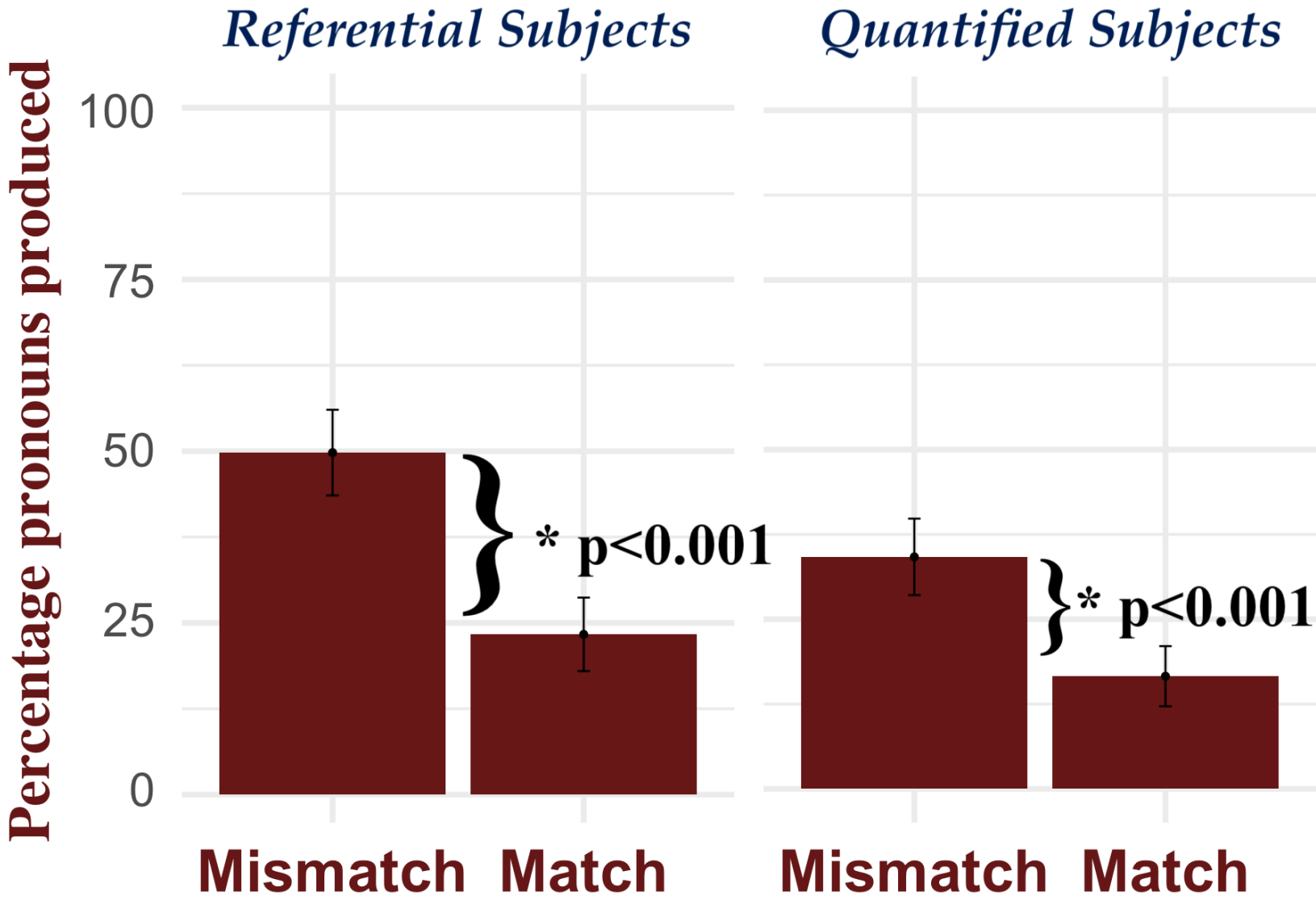
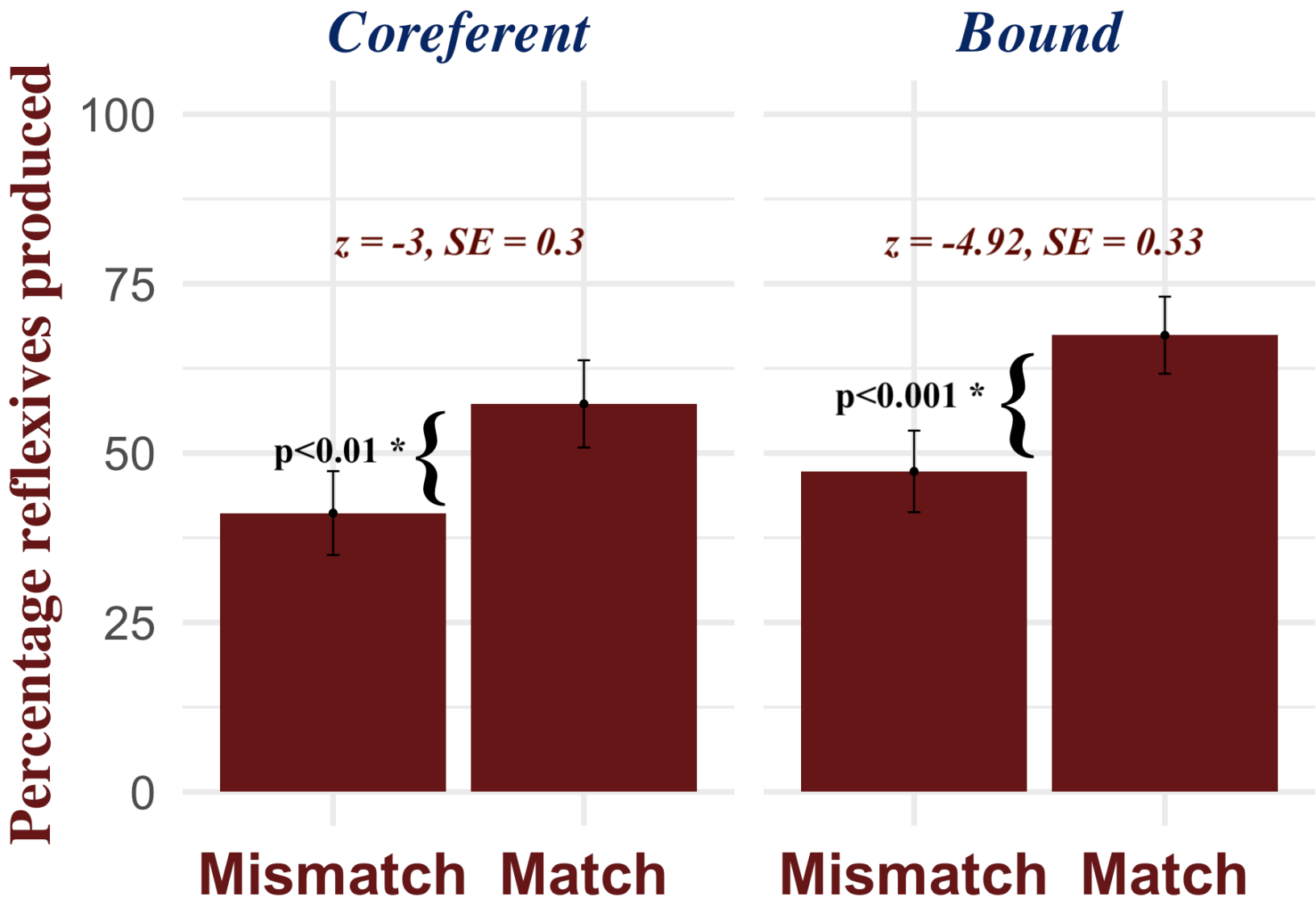
We also found an overall effect of PICTURE TYPE ($z = -3.1$, $p < 0.01$) Participants used more regular pronouns in the **Local Bound** conditions in both ambiguous and unambiguous contexts.

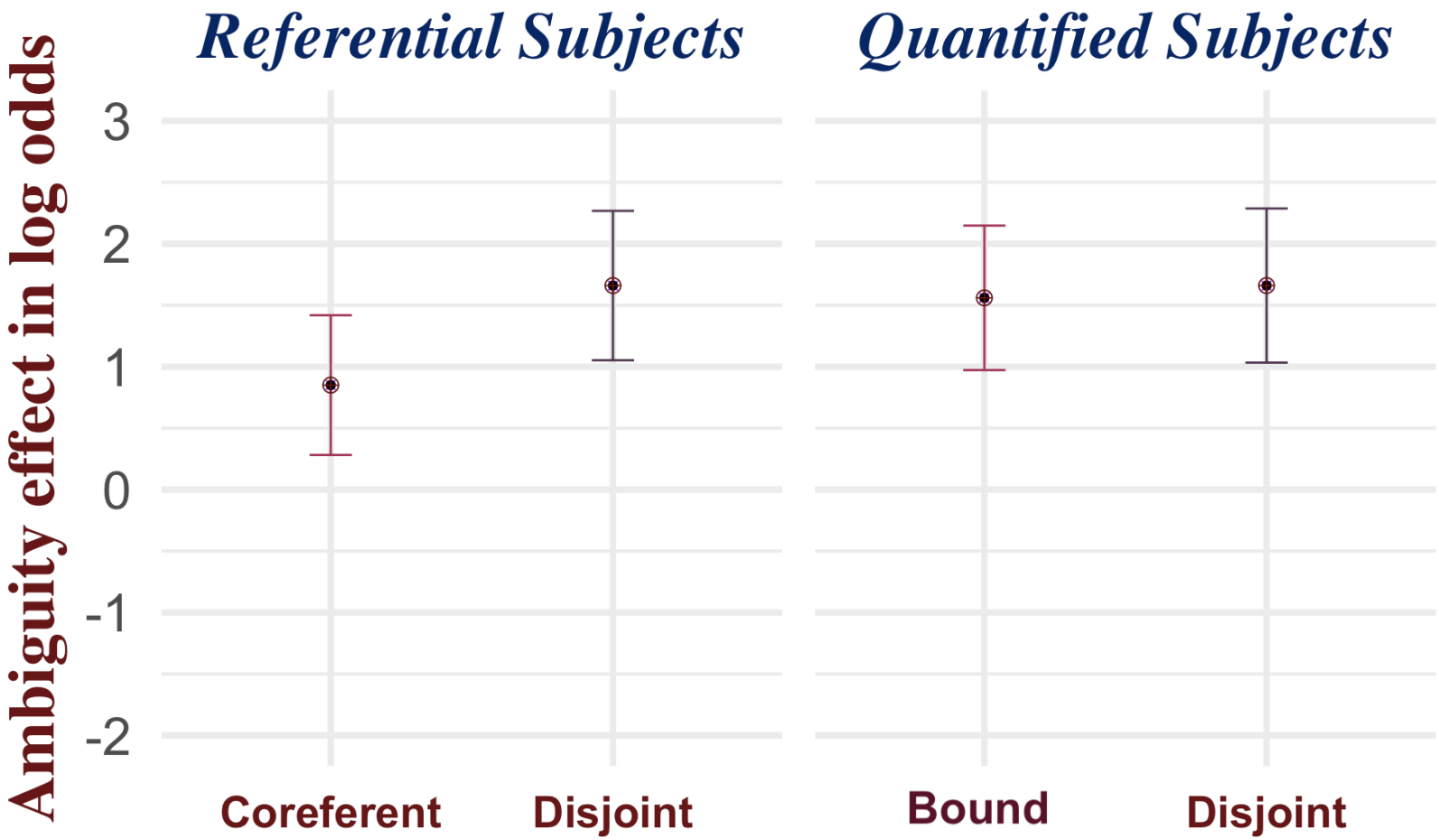
Production Comparison

Cross-experiment comparison: disjoint reference



Rate of reflexive production in both experiments




Referential Subjects
Quantified Subjects
Ambiguity effect in log odds
3
2
1
0
-1
-2
Coreferent
Disjoint
Bound
Disjoint

Comprehension

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- QUANTIFIED SUBJECTS COMPREHENSION
  the comprehension equivalent of EXPERIMENT 2 (4 referents)

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We also wanted to directly manipulate how competition plays out at the level of ***form***.

In both comprehension experiments, we split participants into two groups:

- half of the participants only heard sentences with *him/her*
- half of the participants heard sentences with regular pronouns, emphatic pronouns and demonstratives

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- 2 subgroups in each experiment: *Gender* & *Form*
- 3 conditions: *Ambiguous / Reflexive / Disjoint*

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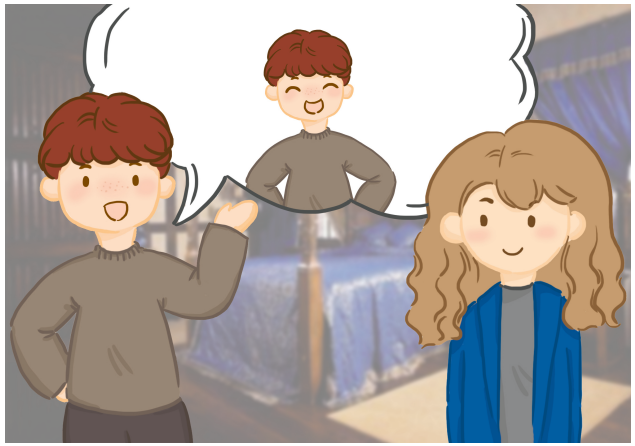
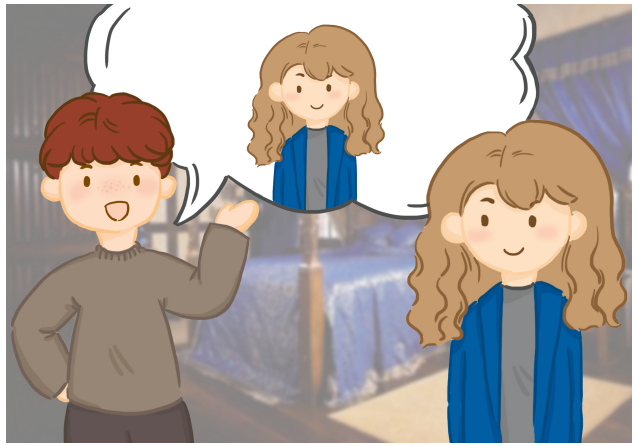
Gender Group, Reflexive



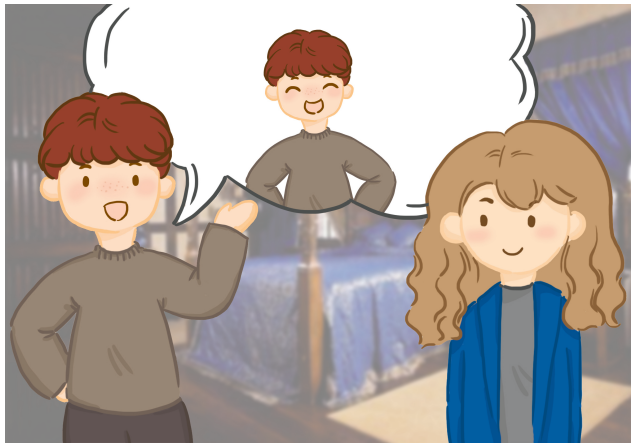
D



K

Auditorily: *At Irina's house, Andrei talked about him.*

Gender Group, Disjoint



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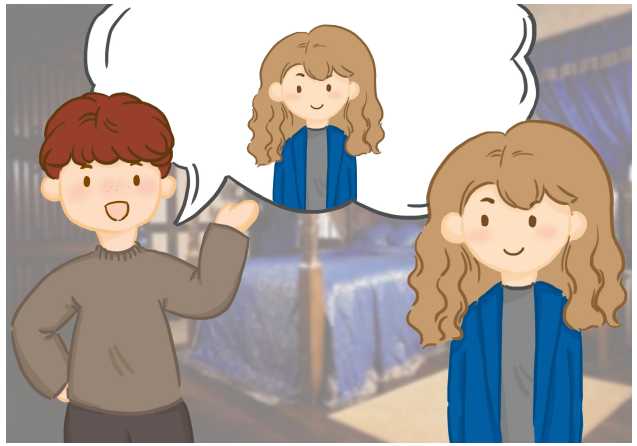

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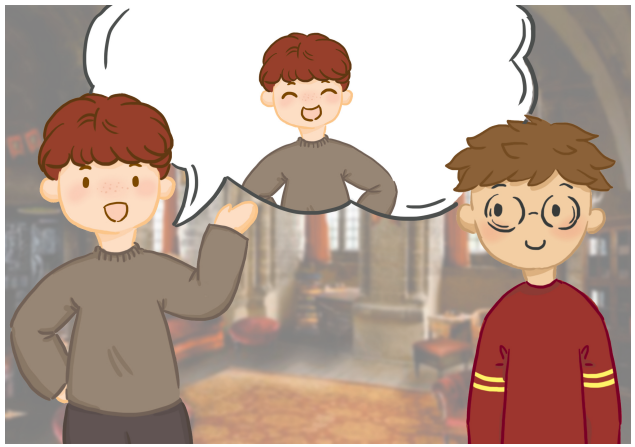
Ambiguous



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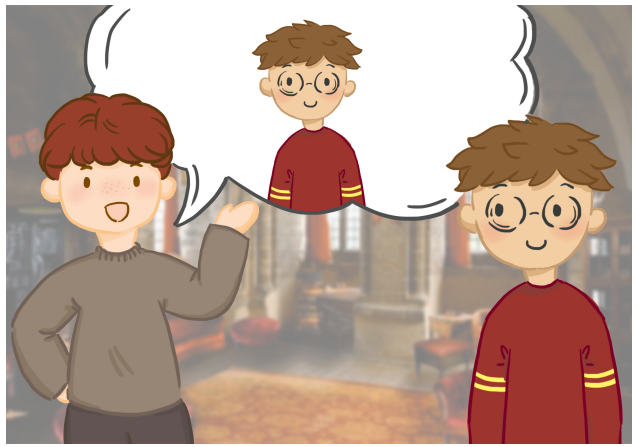
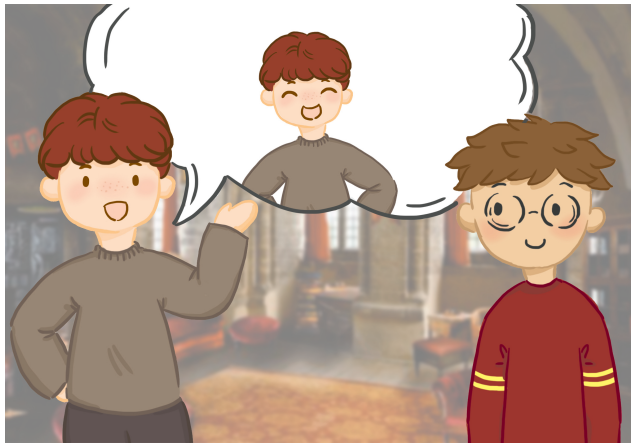


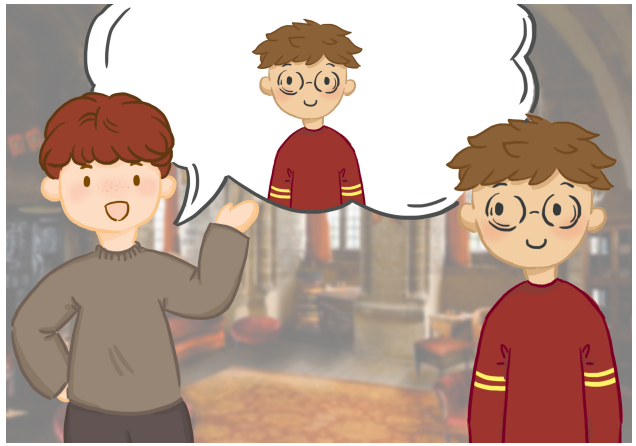
K

Auditorily: *At Mihai's house, Andrei talked about him.*

Form Group, Reflexive



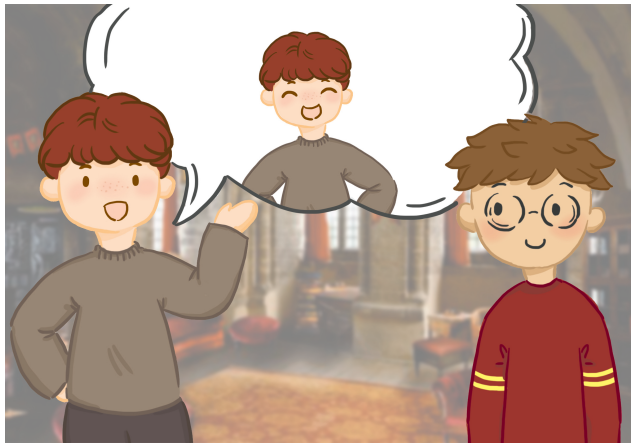
D



K

Auditorily: *At Mihai's house, Andrei talked about him himself.*

Form Group, Disjoint



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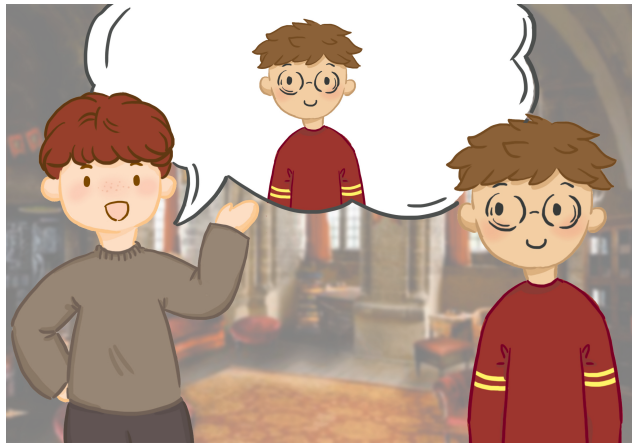
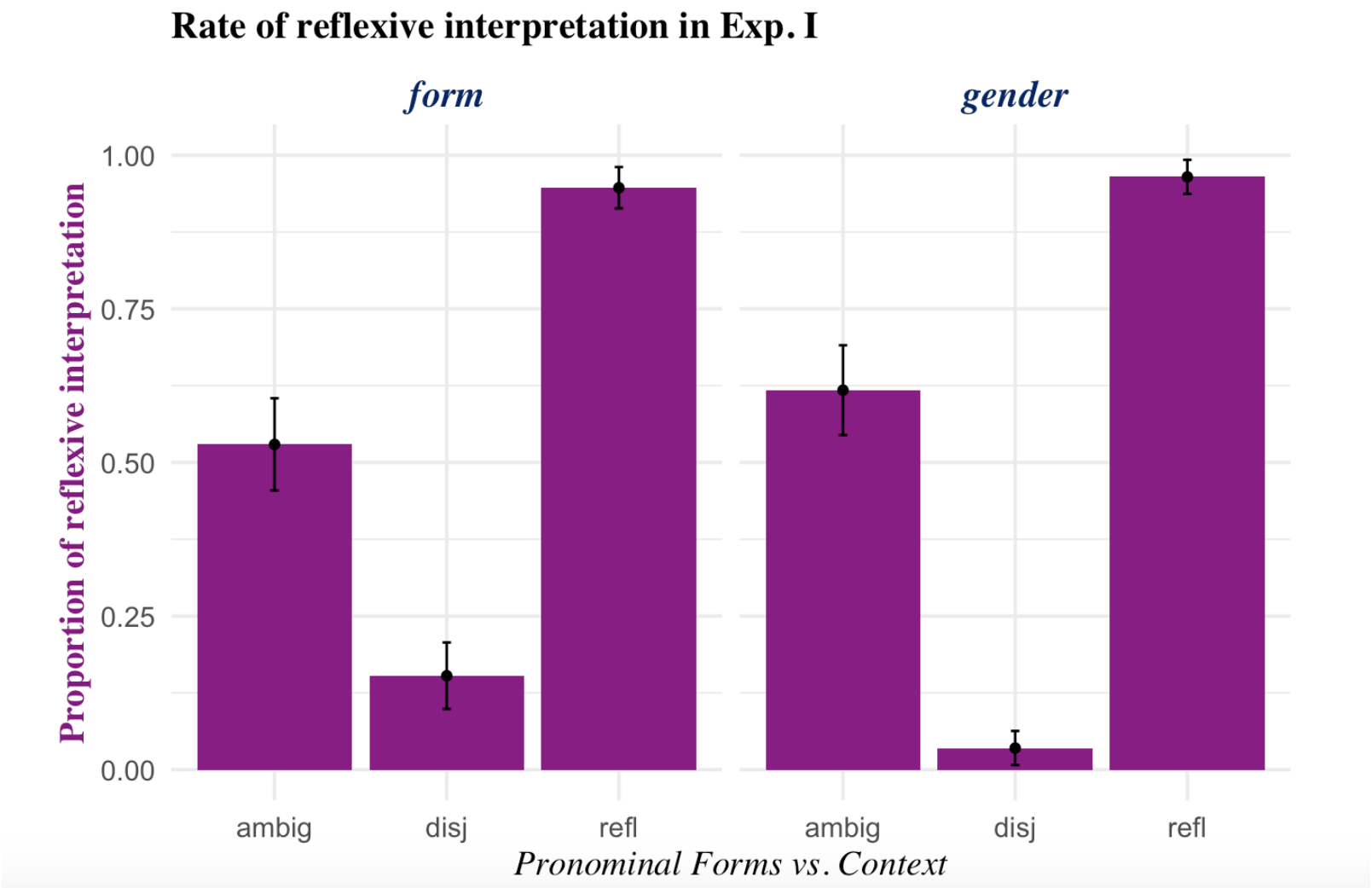
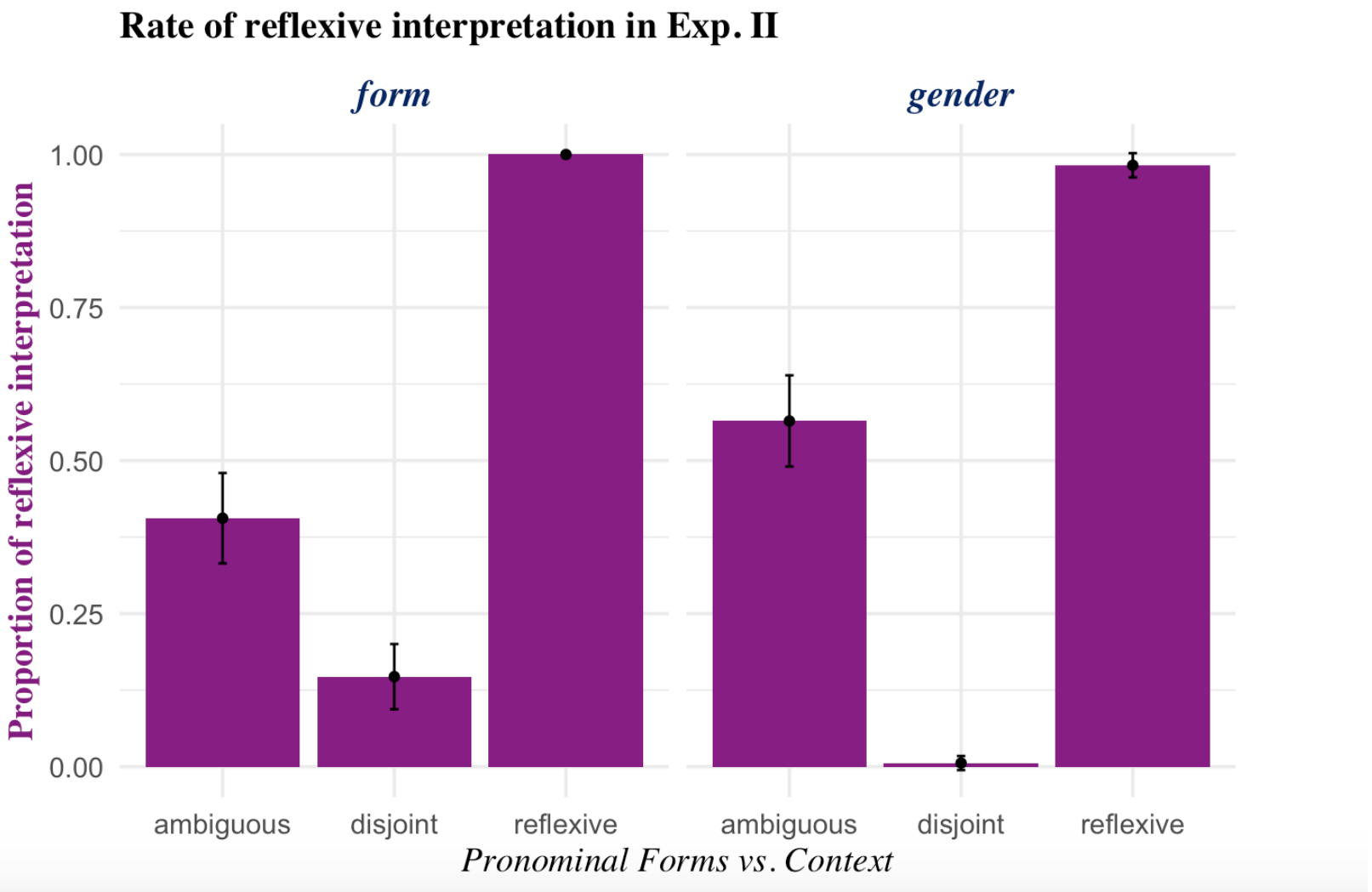


K

Auditorily: *At Mihai's house, Andrei talked about this one.*



REFERENTIAL SUBJECTS



QUANTIFIED SUBJECTS

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We can calculate *p(referent | pronoun)* for the comprehension experiments!

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Big Important Question

How do our models of production and comprehension differ?