Remember ‘him’, forget ‘her’: Gender bias in the comprehension of pronominal referents

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Titus von der Malsburg (University of Potsdam)
Till Poppels (UCSD)
Roger Levy (MIT)

March 29, 2019

von der Malsburg, Poppels, and Levy (2017)

- Presidential election season in 2016

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  He? She? They?

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von der Malsburg, Poppels, and Levy (2017)

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How likely is ... to be the next president?

von der Malsburg, Poppels, and Levy (2017)

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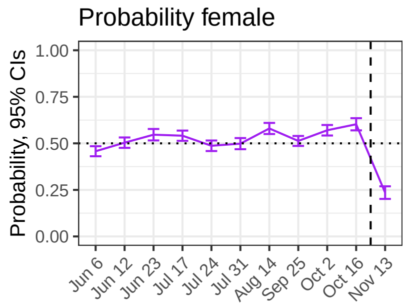

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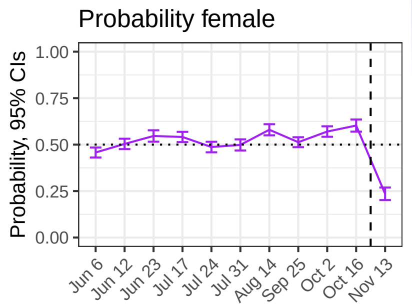

How likely is ... to be the next president?

The next US president will be sworn into office in January 2017. After moving into the Oval Office, one of the first things that ... ________________________

von der Malsburg, Poppels, and Levy (2017)

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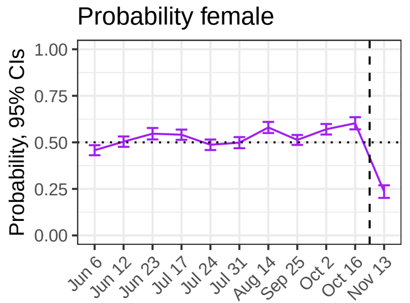

Probability female

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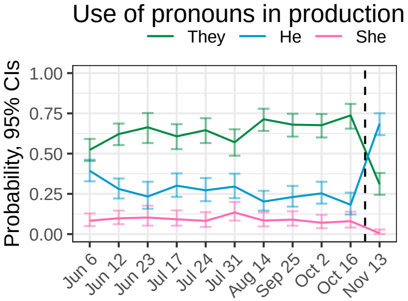

Use of pronouns in production

von der Malsburg, Poppels, and Levy (2017)

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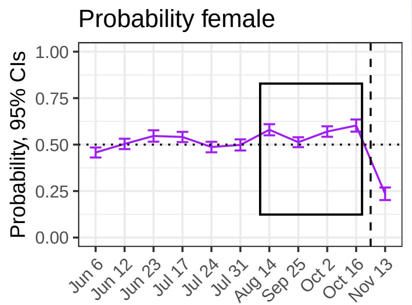
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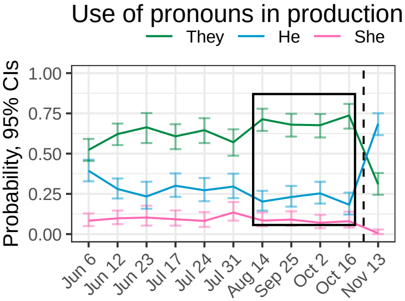
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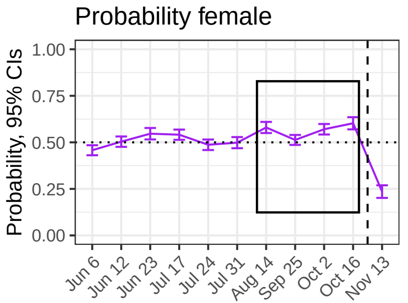
Probability female

$P(\mathit{female}) \sim 60\%$

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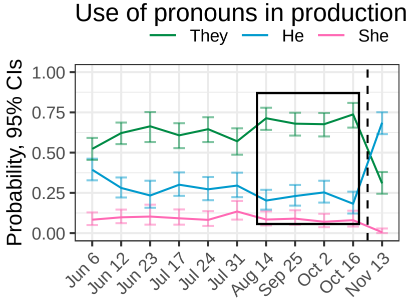
Use of pronouns in production

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65% They, 25% He, 10% She

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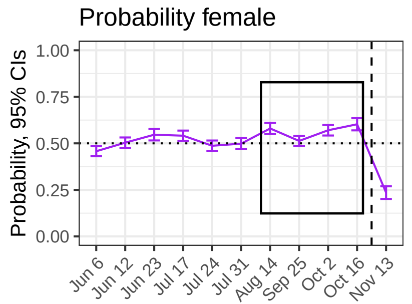
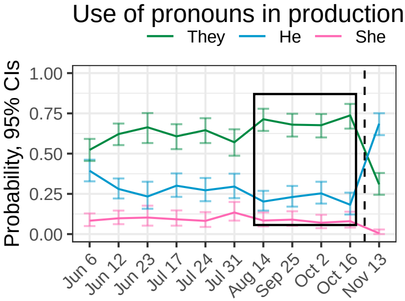

Probability female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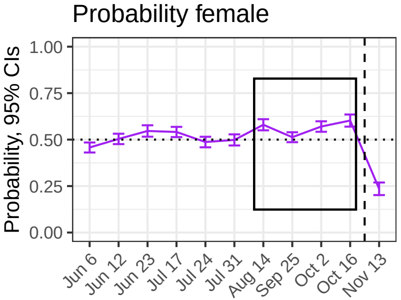
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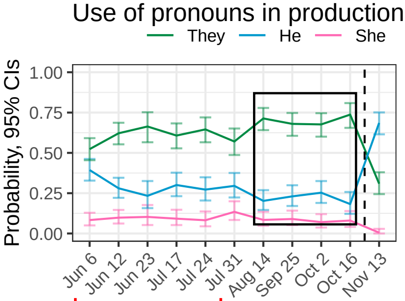
Use of pronouns in production

This production asymmetry may be a surprise.
But is it a concern?

What do comprehenders do?

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Two possibilities:

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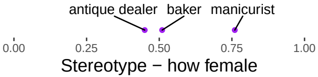
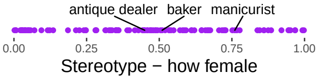
1. Comprehenders “reverse” the production asymmetry in interpretation
    - ‘He’ is a weaker signal of referent gender than ‘She’
    - Production pattern not necessarily a concern

What do comprehenders do?

Two possibilities:

1. Comprehenders “reverse” the production asymmetry in interpretation
   - ‘He’ is a weaker signal of referent gender than ‘She’
   - Production pattern not necessarily a concern
2. Comprehenders do **not** “reverse” the production asymmetry in interpretation
   - ‘He’ is not a sufficiently weaker signal of referent gender than ‘She’
   - Female gender is systematically under-conveyed


antique dealer
baker
manicurist
0.00
0.25
0.50
0.75
1.00
Stereotype − how female



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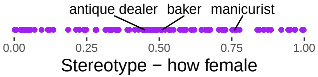
Stereotype − how female

Before the baker took out the trash, ...



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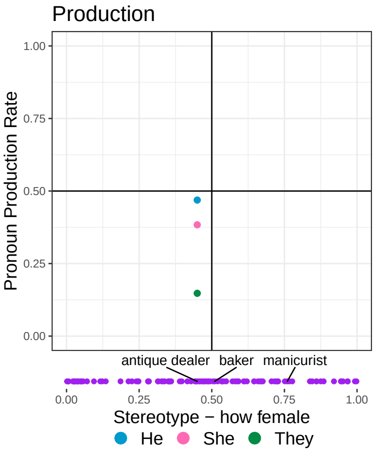

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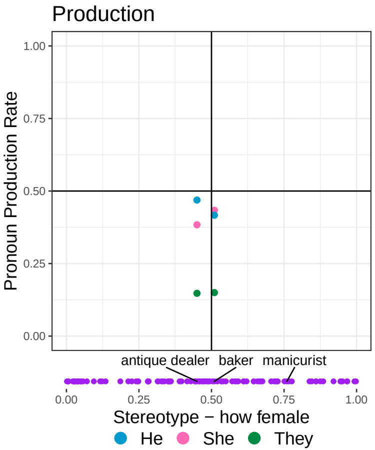

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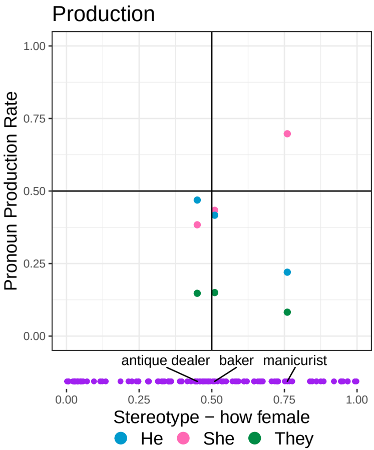

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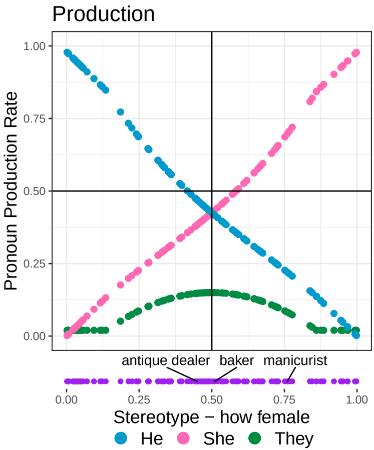
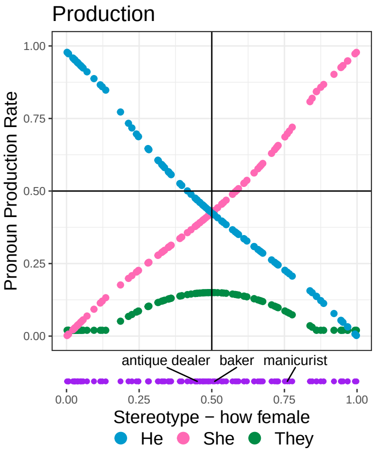


Symmetric

Before the baker took out the trash, ... he swept the floor and wiped down the counter.



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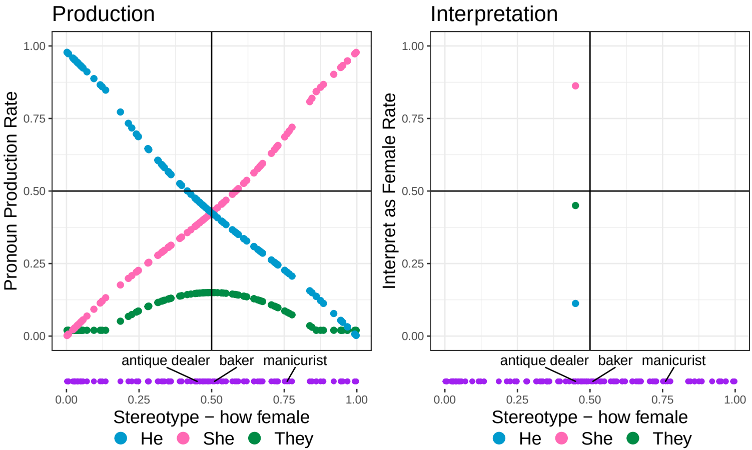

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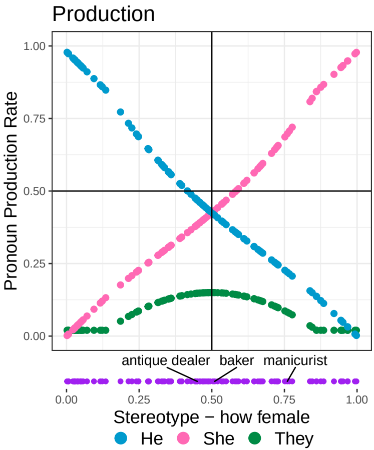

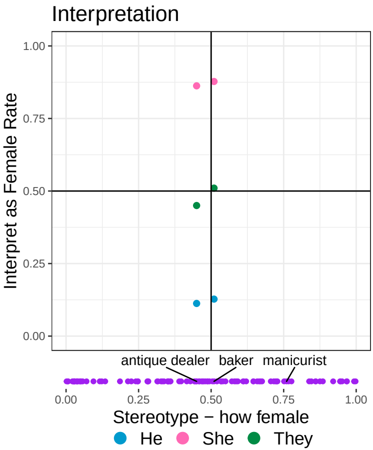

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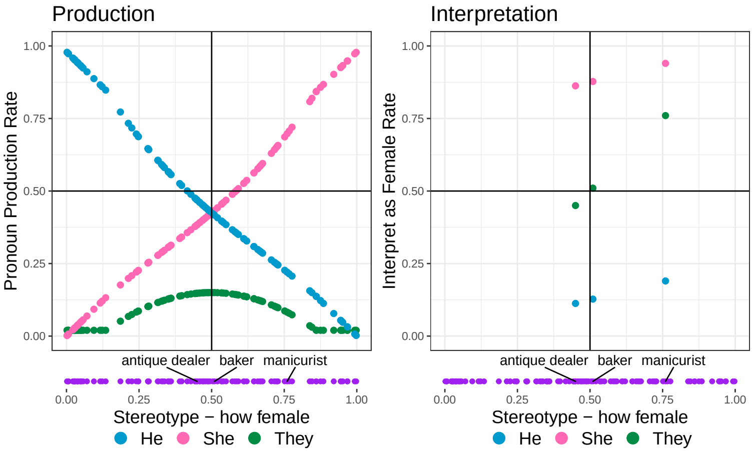

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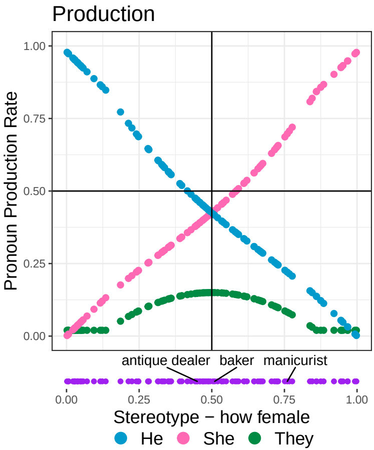
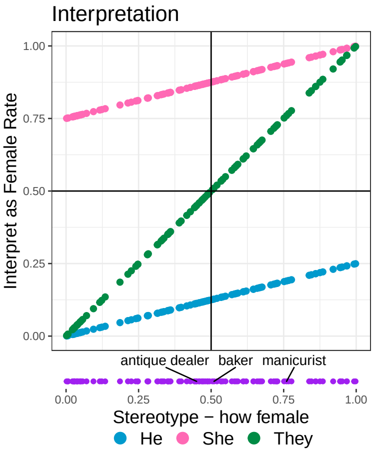

Production


Interpretation

Symmetric

Symmetric

Are speakers’ referent gender expectations faithfully conveyed?

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$$P_S(\mathit{ref.gender}) \overset{?}{=} P_L(\mathit{ref.gender})$$

Speaker

Listener

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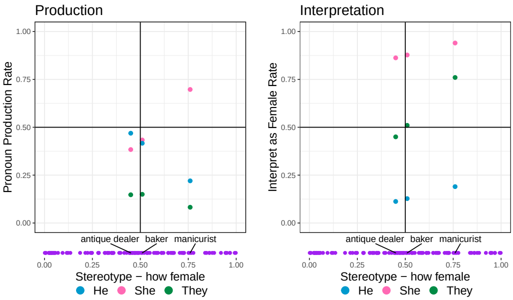
Speaker

Listener



Symmetric

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Are speakers' referent gender expectations faithfully conveyed?

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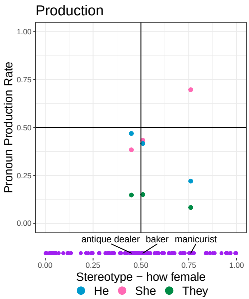
Speaker

Listener



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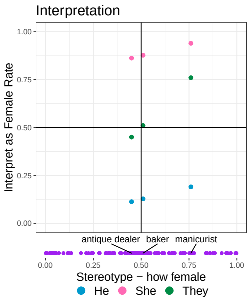

Symmetric

$$\sum_{pro} P(pro|P_S(ref.gender)) \cdot P(ref.gender|pro) = P_L(ref.gender)$$

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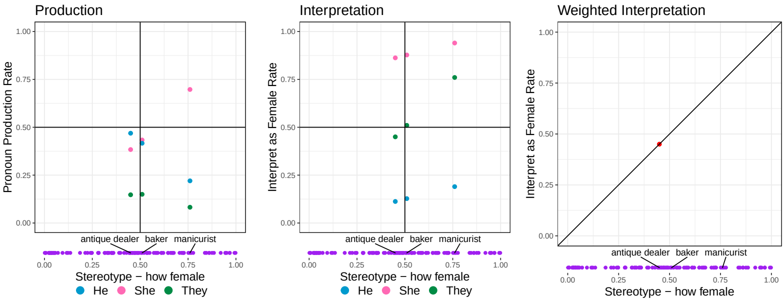

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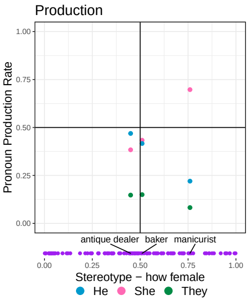
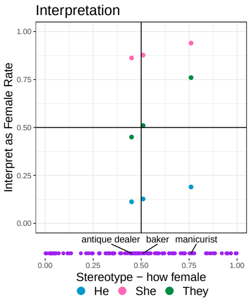
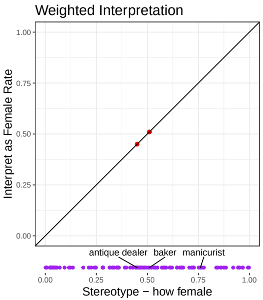

Production


Interpretation


Weighted Interpretation

Symmetric

Symmetric

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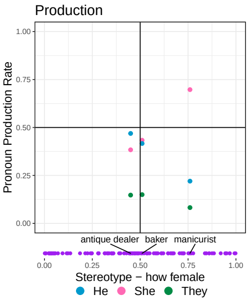
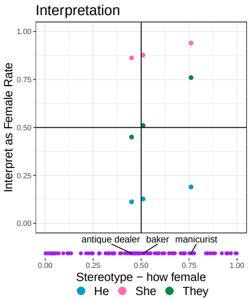
Speaker

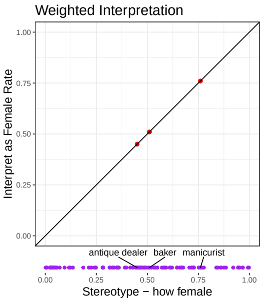
Listener



Symmetric



Symmetric



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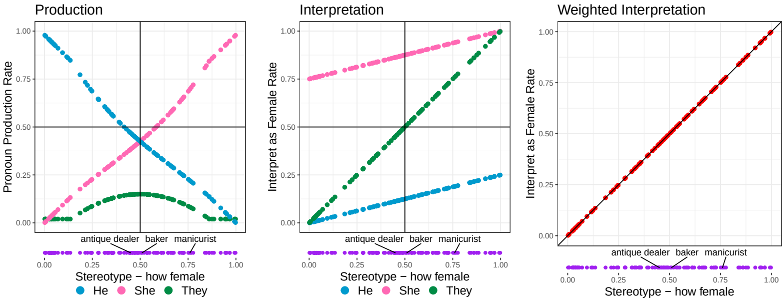

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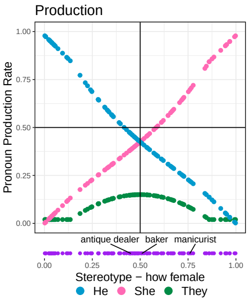
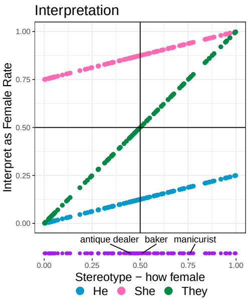
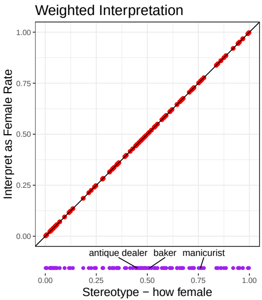

Production

Symmetric

Calibrated


Interpretation

Symmetric


Weighted Interpretation

Faithfully Conveyed

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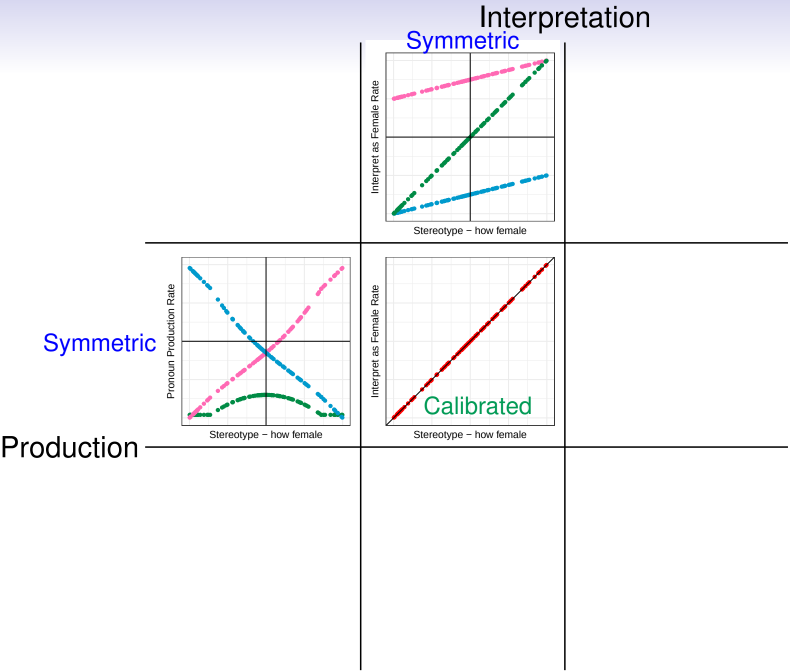
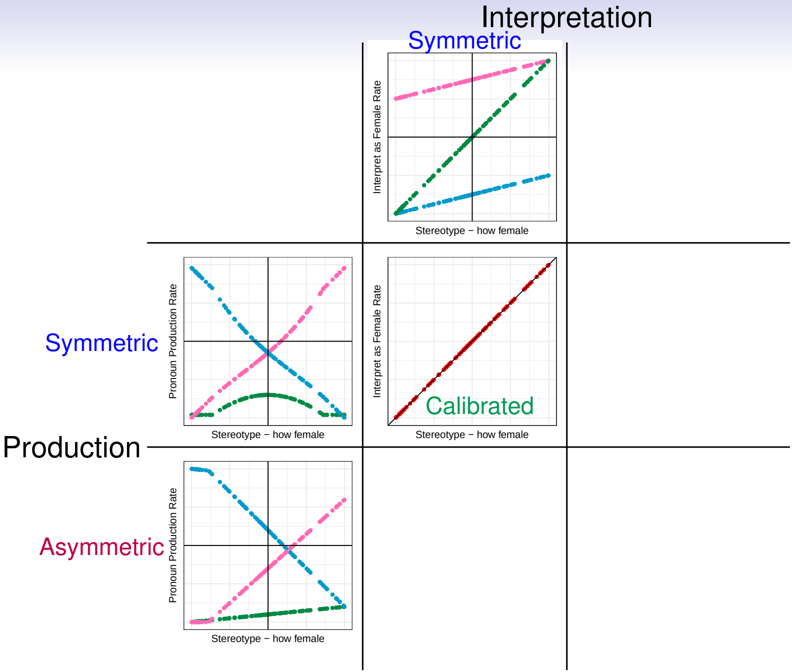


Interpretation

Symmetric

Symmetric

Production


Interpretation
Symmetric
Interpret as Female Rate
Stereotype − how female
Symmetric
Pronoun Production Rate
Stereotype − how female
Interpret as Female Rate
Calibrated
Stereotype − how female
Production
Asymmetric
Pronoun Production Rate
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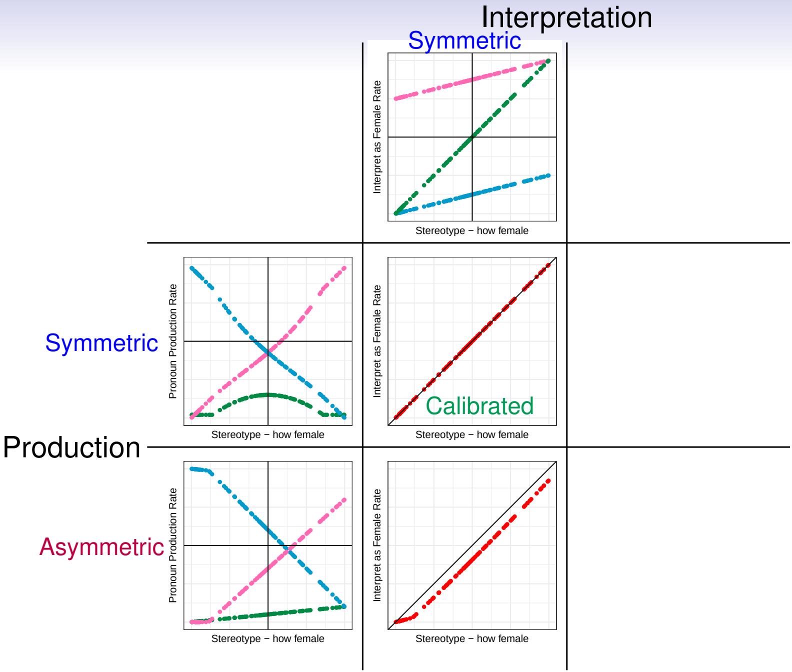
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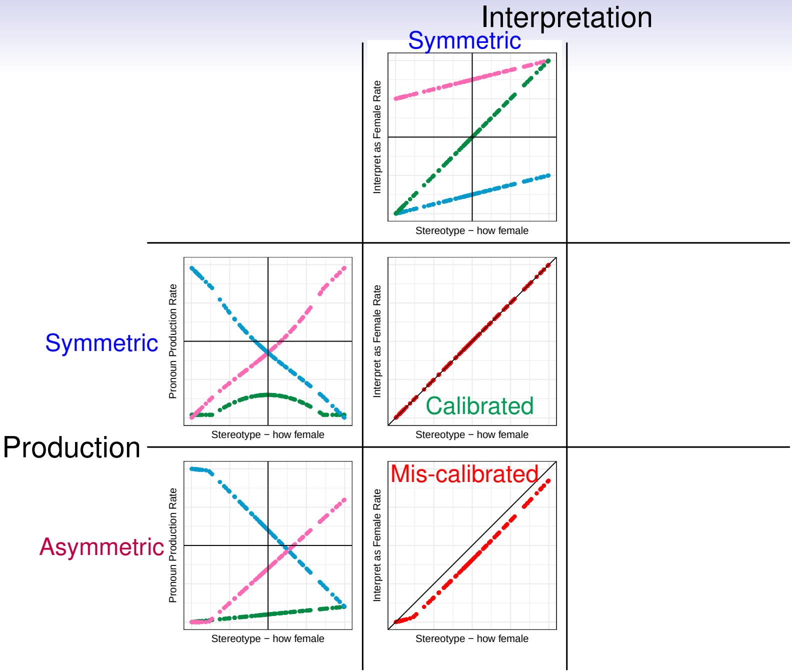


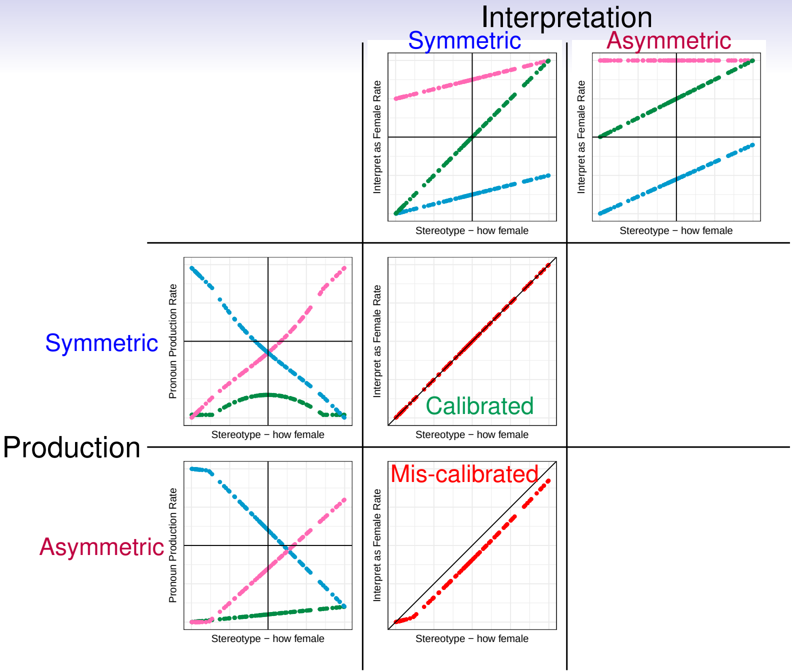
Interpretation

Symmetric

Production

Symmetric

Asymmetric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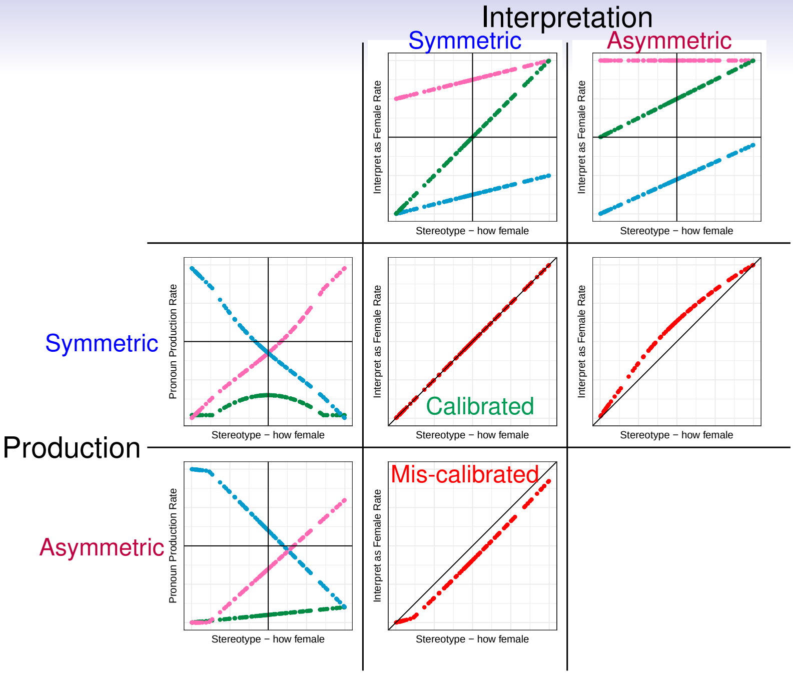

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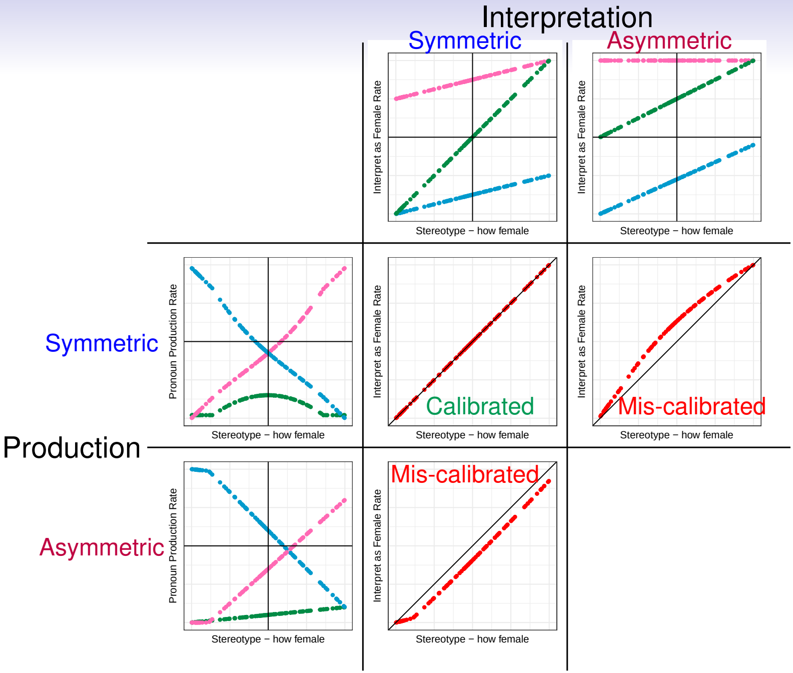
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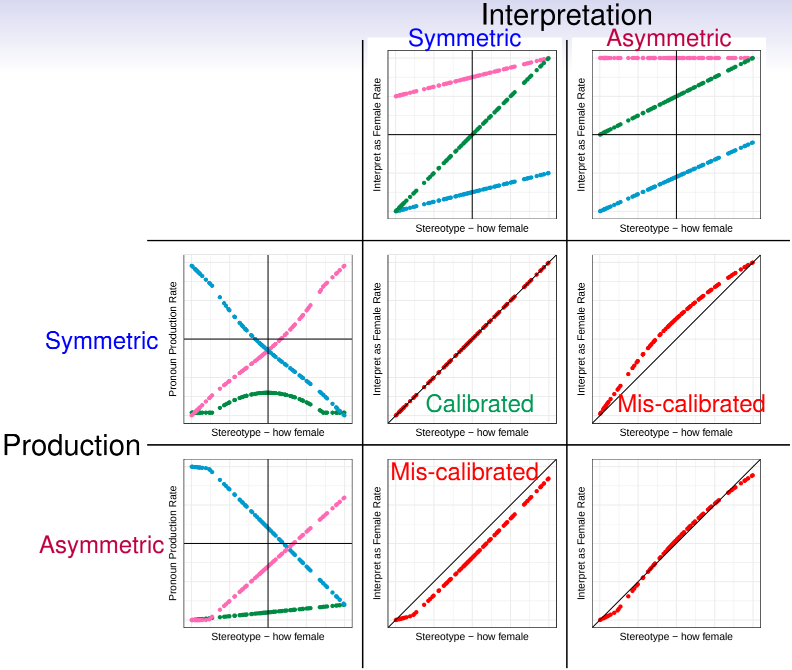
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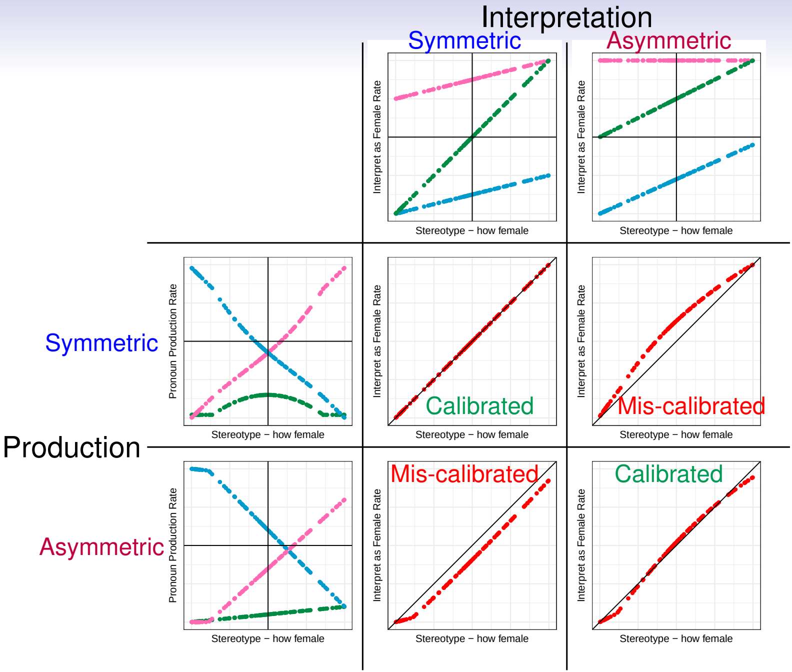

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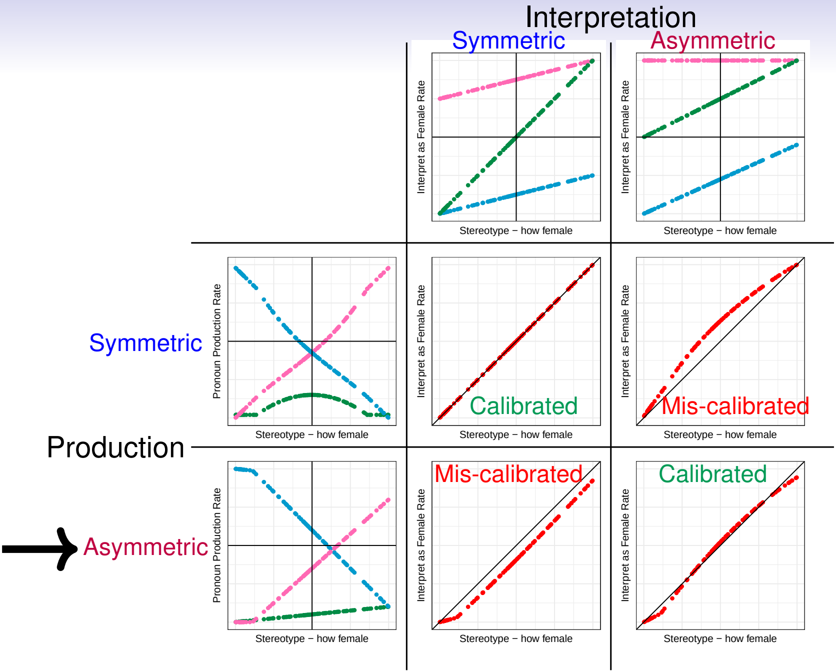


Interpretation

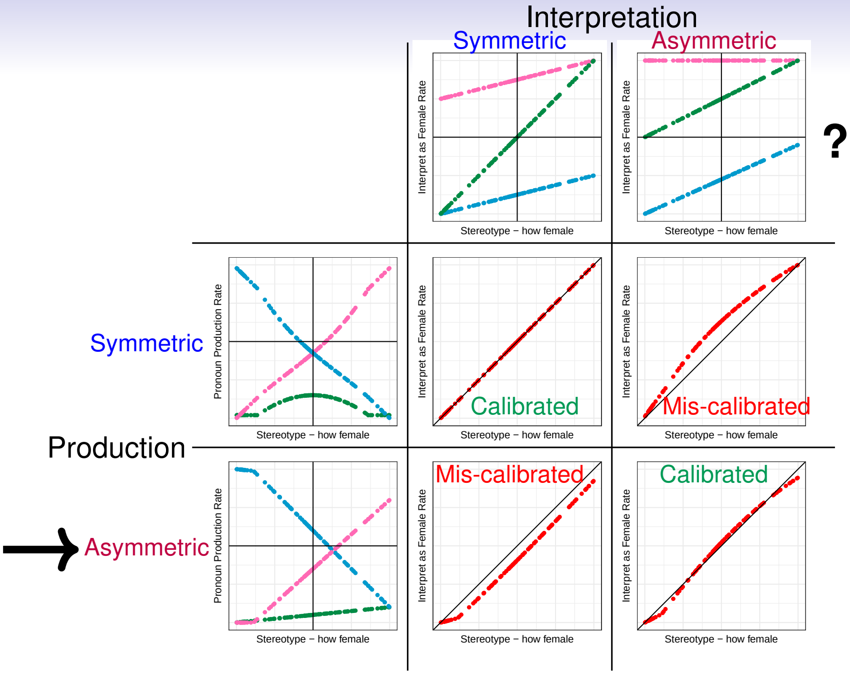
Symmetric

Asymmetric

Symmetric

Production

→ Asymmetric



Interpretation

Symmetric

Asymmetric

?

Production

Symmetric

→ Asymmetric

Experiments

Experiments

Test with 80 role nouns (ex. *diplomat, butler, nanny, reporter*)

Experiments

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a. Explicit Norm

If you encounter a baker, how likely are they to be female?

Experiments

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b. Production

Before the baker took out the trash, ... ____________

Experiments

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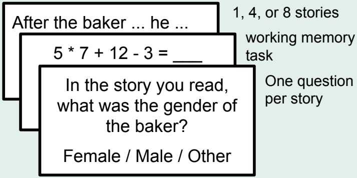
b. Production

Before the baker took out the trash, ... ____________

c. Gender recall



After the baker ... he ...

5 * 7 + 12 - 3 = ___

In the story you read, what was the gender of the baker?

Female / Male / Other

1, 4, or 8 stories

working memory task

One question per story

Experiments

a. Explicit Norm

If you encounter a **baker**, how likely are they to be female?

- 51 participants each rated all 80 nouns
- Half asked "how male", half asked "how female"
- We averaged results into a 0-1 'how female' norm

Experiments

b. Production

After the shop on High Street closed for the night, a **baker** stayed to tidy up. Before the **baker** took out the trash, **...**

____

- 149 participants each completed 20 items
- We coded pronoun completions

Experiments

c. Gender recall

After the shop on High Street closed for the night, a **baker** stayed to tidy up. Before the **baker** took out the trash, **he** swept the floor and wiped down the counter.

1,4, or 8 stories

Experiments

c. Gender recall

$$(70 - 4) \div 3 + 9 =$$

Experiments

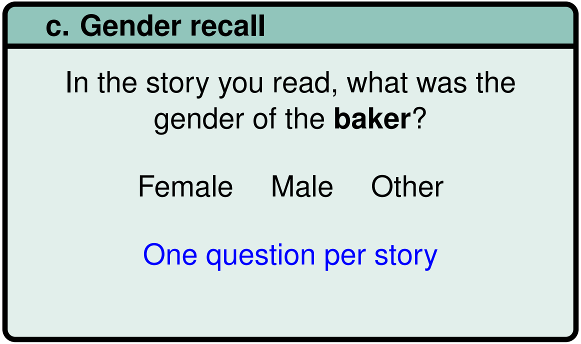
c. Gender recall

In the story you read, what was the gender of the **baker**?

Female Male Other

One question per story

Experiments



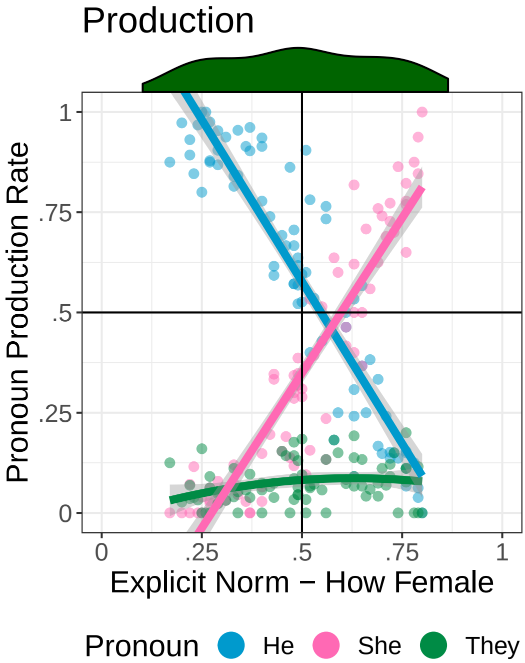
c. Gender recall

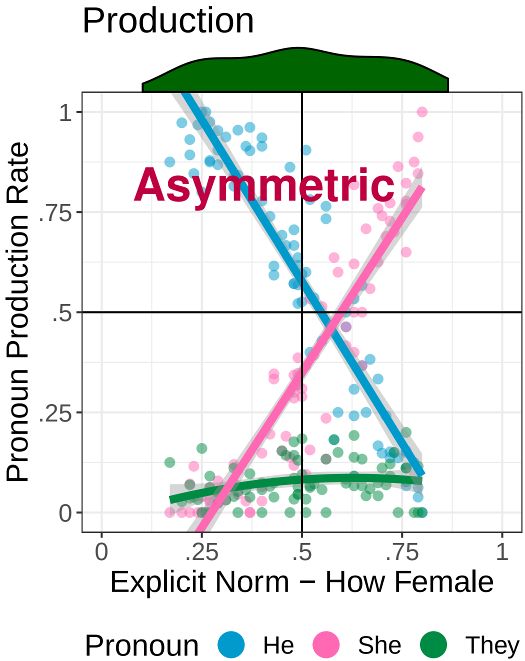
In the story you read, what was the gender of the **baker**?

Female Male Other

One question per story

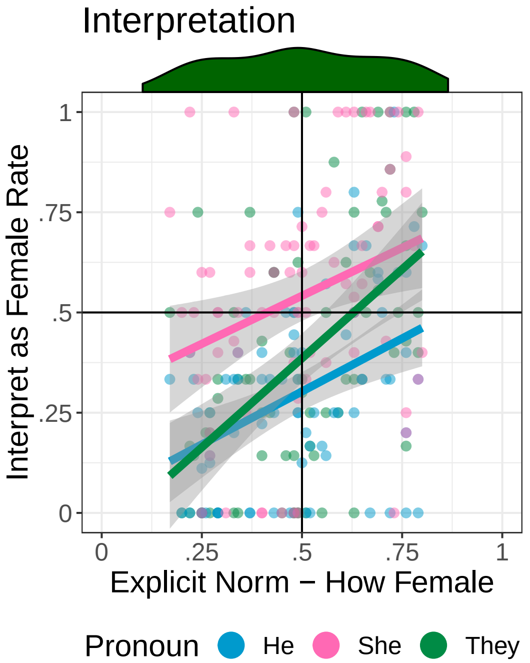
- 712 participants
- We only consider male, female responses

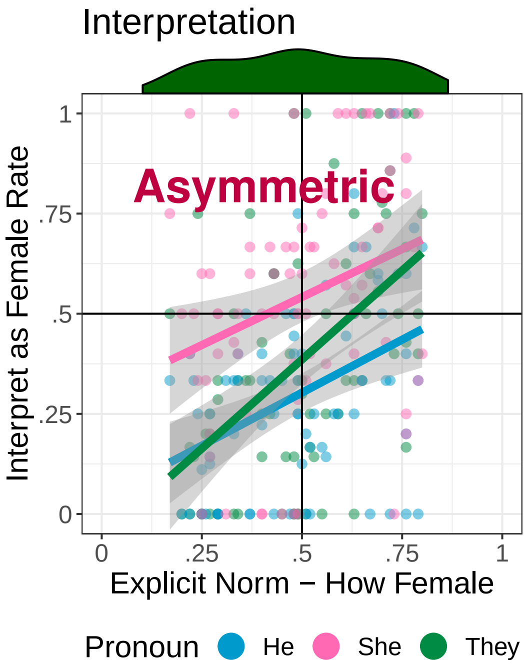

Production
Pronoun Production Rate
1
.75
.5
.25
0
0
.25
.5
.75
1
Explicit Norm − How Female
Pronoun
He
She
They



Production

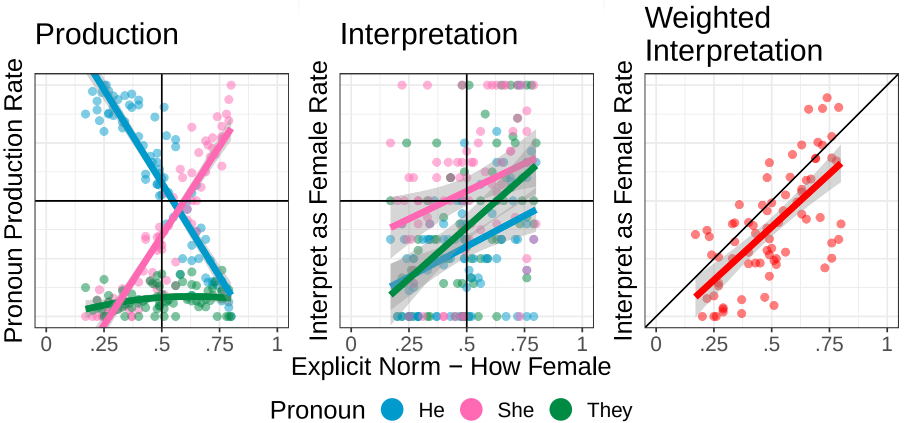
Asymmetric


Interpretation
Interpret as Female Rate
1
.75
.5
.25
0
0
.25
.5
.75
1
Explicit Norm − How Female
Pronoun
He
She
They


Interpretation
Interpret as Female Rate
1
.75
.5
.25
0
0
.25
.5
.75
1
Explicit Norm − How Female
Pronoun
He
She
They

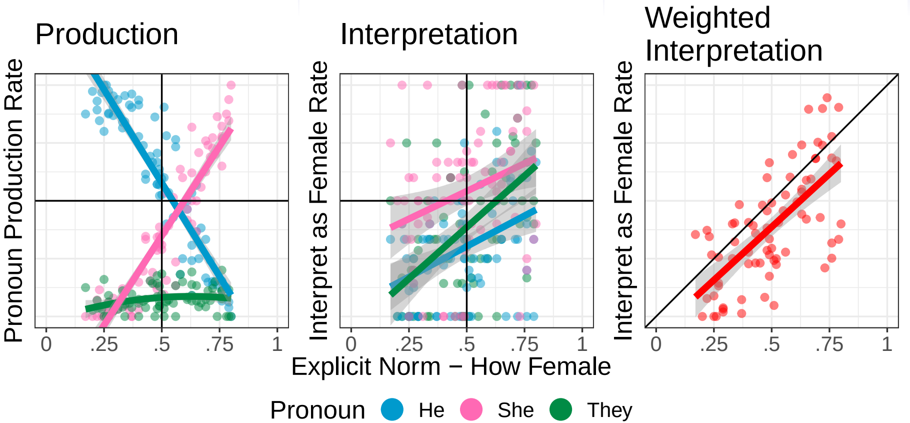
Asymmetric

Asymmetric **Asymmetric**

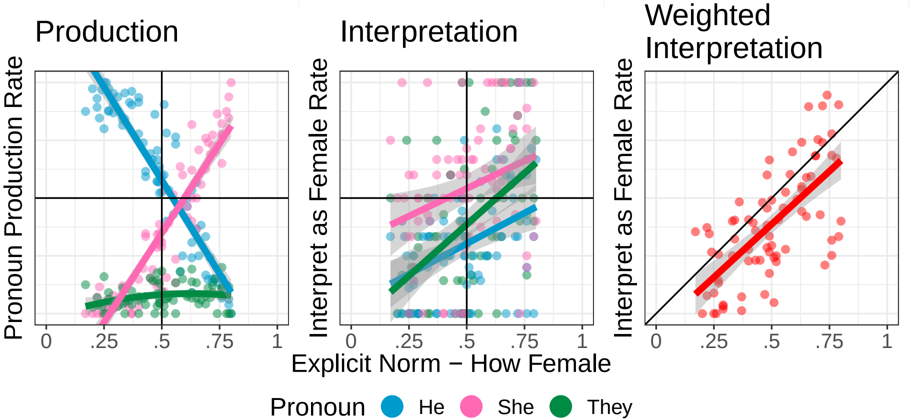


$$\sum_{pro} P(pro|P_S(ref.gender)) \cdot P(ref.gender|pro) = P_L(ref.gender)$$

Asymmetric **Asymmetric** **Mis-calibrated**



$$\sum_{pro} P(pro|P_S(ref.gender)) \cdot P(ref.gender|pro) = P_L(ref.gender)$$



Asymmetric

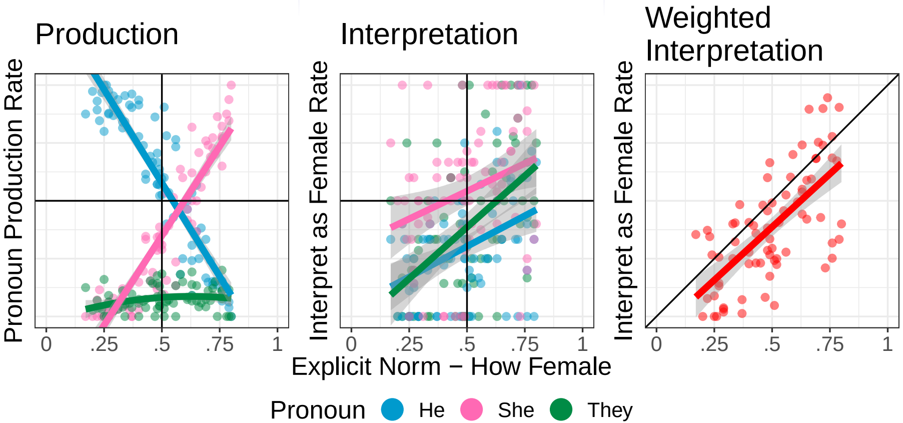
Asymmetric

Mis-calibrated

Gender of referent not faithfully conveyed!

$$\sum_{pro} P(pro|P_S(ref.gender)) \cdot P(ref.gender|pro) = P_L(ref.gender)$$

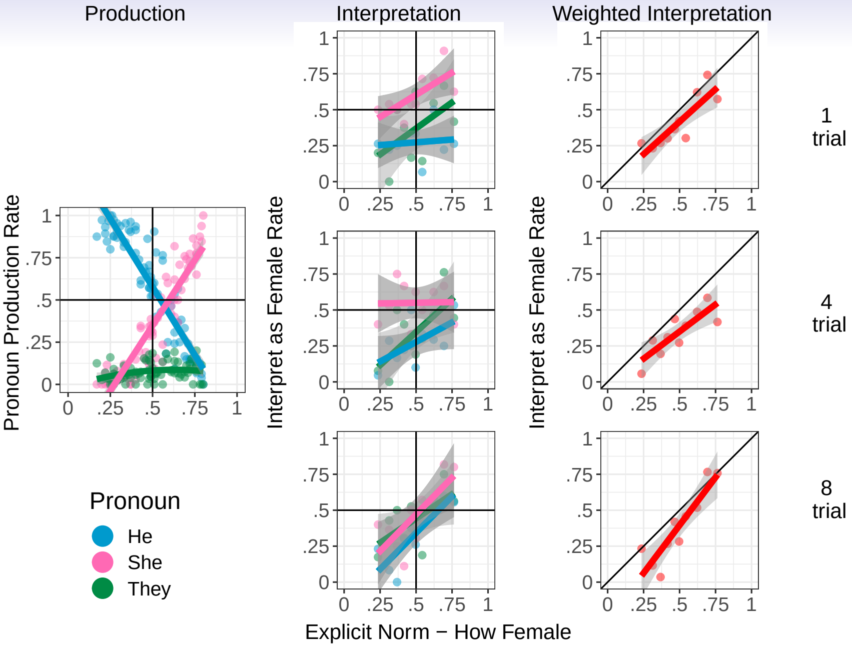
Asymmetric **Asymmetric** **Mis-calibrated**



Gender of referent not faithfully conveyed!

Female gender expectations are under-recovered!

$$\sum_{pro} P(pro|P_S(ref.gender)) \cdot P(ref.gender|pro) = P_L(ref.gender)$$


Production
Interpretation
Weighted Interpretation
Pronoun Production Rate
Interpret as Female Rate
Interpret as Female Rate
Explicit Norm − How Female
0
.25
.5
.75
1
1
trial
4
trial
8
trial
Pronoun
He
She
They

Conclusion

Gender of referent not faithfully conveyed!

Conclusion

Gender of referent not faithfully conveyed!

- Pronoun production and interpretation are not mutually calibrated

Conclusion

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  - A challenge for rational theories that expect listeners and speakers to calibrate for effective communication

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  - Speakers and listeners are rational, but they consider misgendering a male as female as costlier than vice versa?

Conclusion

Gender of referent not faithfully conveyed!

- Pronoun production and interpretation are not mutually calibrated
  - A challenge for rational theories that expect listeners and speakers to calibrate for effective communication
- What might be the source of the miscalibration?
  - Grammatical gender is often not central to communicative goals, so may not be under much pragmatic pressure?
  - Speakers and listeners are rational, but they consider misgendering a male as female as costlier than vice versa?
- Socially concerning – what are consequences of this miscalibration?

Implicit Norm

d. Implicit Norm

After the shop on High Street closed for the night, a **baker** stayed to tidy up. Before the **baker** took out the trash, the **baker** swept the floor and wiped down the counter.

1,4, or 8 stories

Implicit Norm

d. Implicit Norm

$$(70 - 4) \div 3 + 9 =$$

Implicit Norm

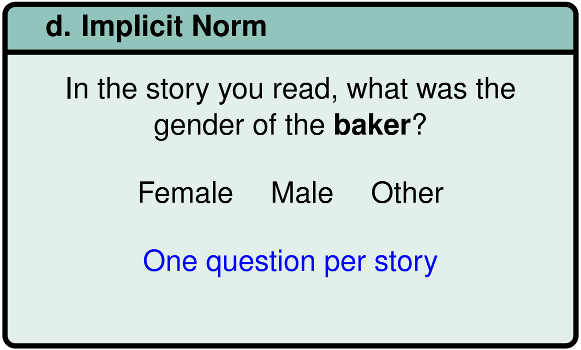
d. Implicit Norm

In the story you read, what was the gender of the **baker**?

Female Male Other

One question per story

Implicit Norm



d. Implicit Norm

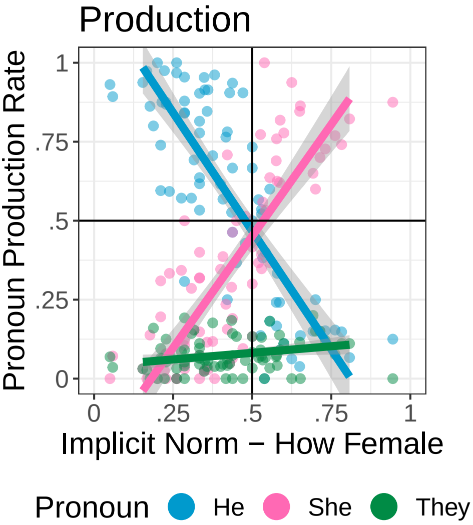
In the story you read, what was the gender of the **baker**?

Female Male Other

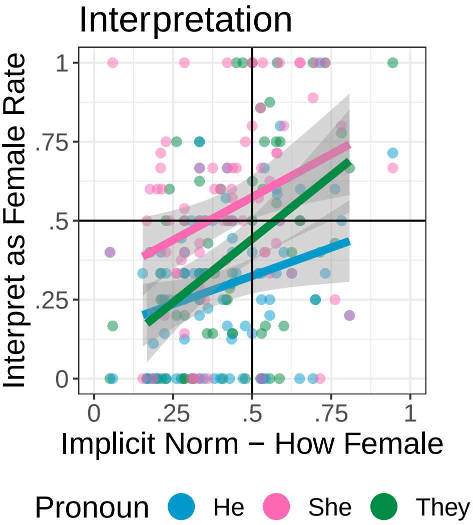
One question per story

- 569 participants
- Only consider male, female responses

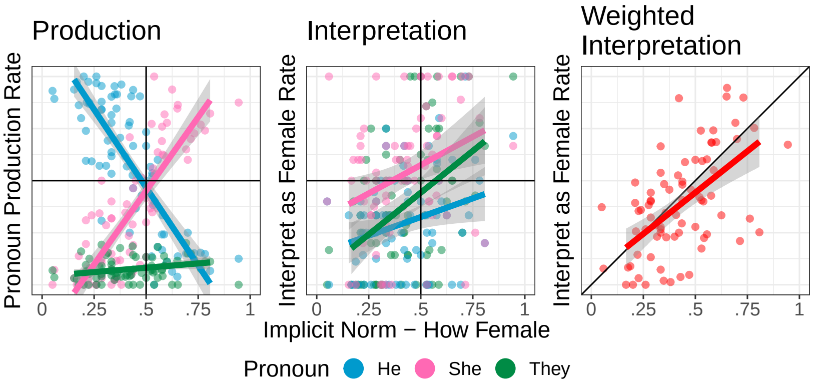
Implicit Norm



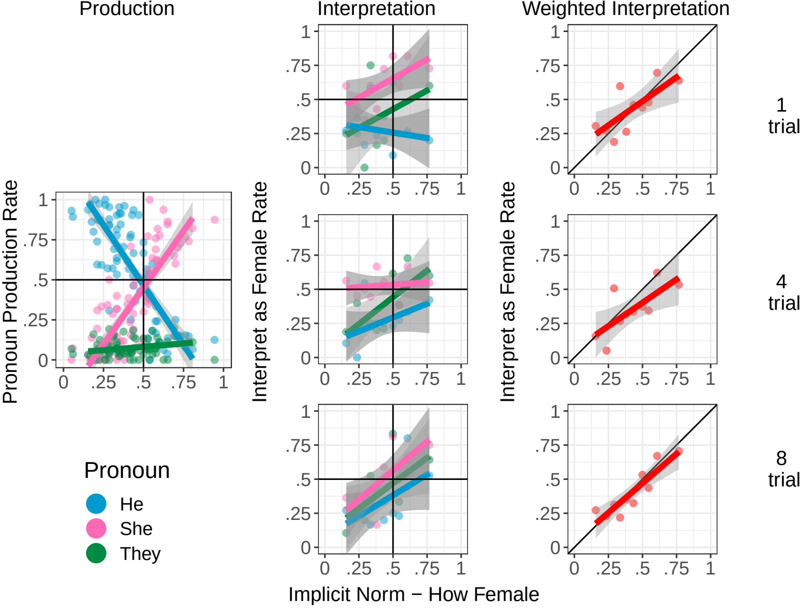
Implicit Norm



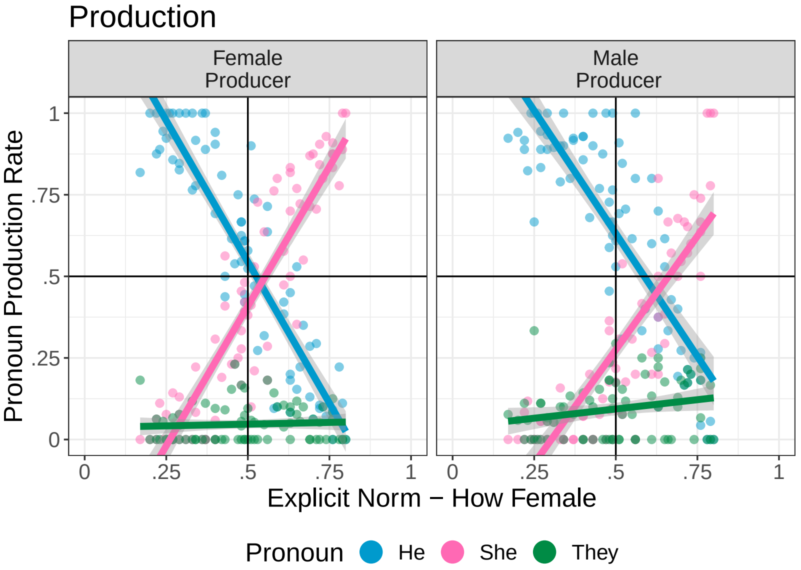
Implicit Norm



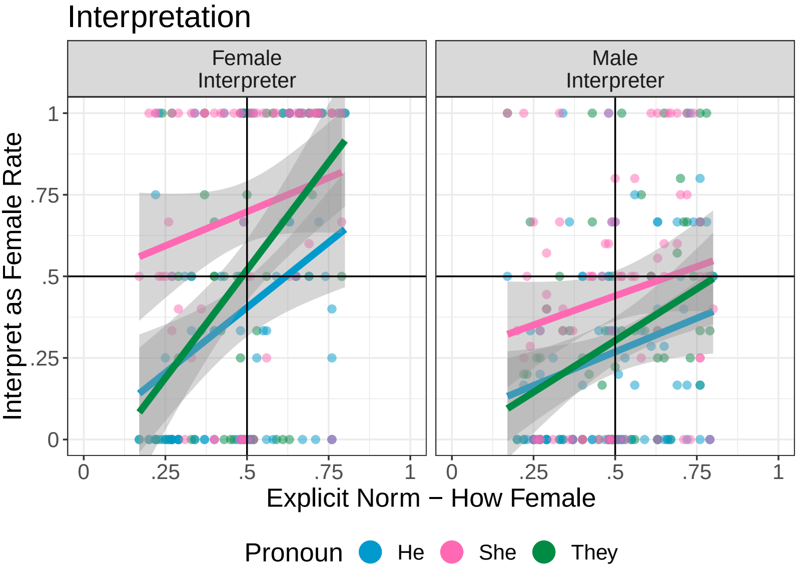
Implicit Norm



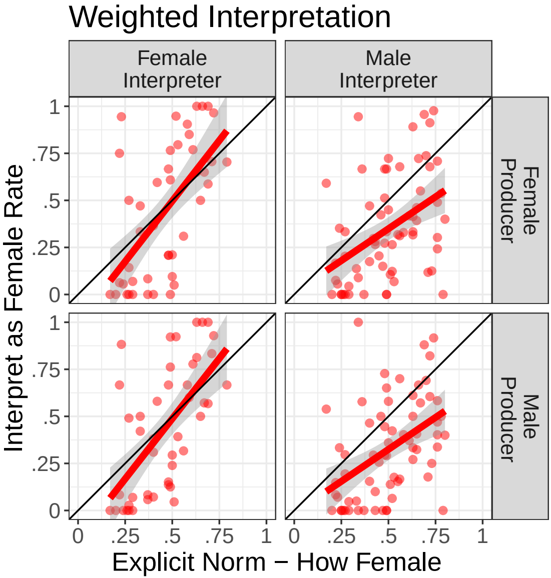
By gender


Production
Female Producer
Male Producer
Pronoun Production Rate
1
.75
.5
.25
0
0
.25
.5
.75
1
Explicit Norm − How Female
Pronoun
He
She
They

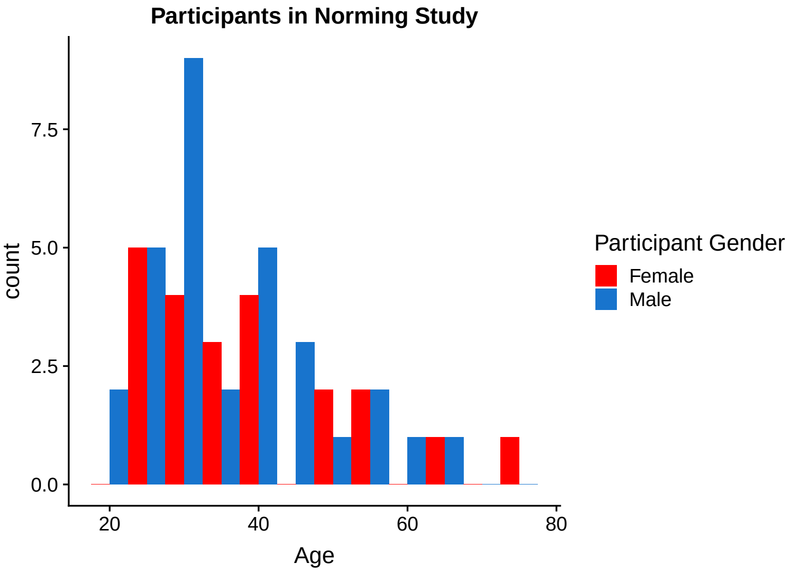
By gender


Interpretation
Female
Interpreter
Male
Interpreter
Interpret as Female Rate
1
.75
.5
.25
0
0
.25
.5
.75
1
0
.25
.5
.75
1
Explicit Norm − How Female
Pronoun
He
She
They

By gender

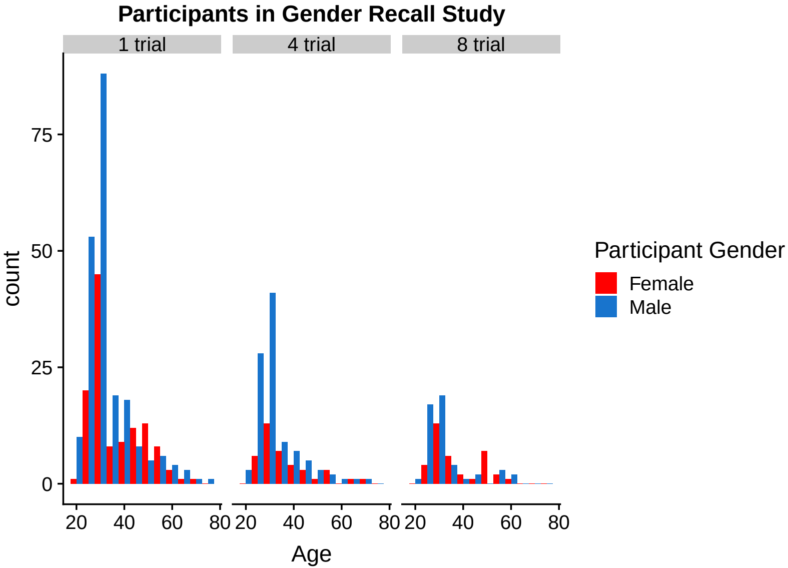

Weighted Interpretation
Female Interpreter
Male Interpreter
Female Producer
Male Producer
Interpret as Female Rate
Explicit Norm − How Female
0
.25
.5
.75
1

Participant Demographics

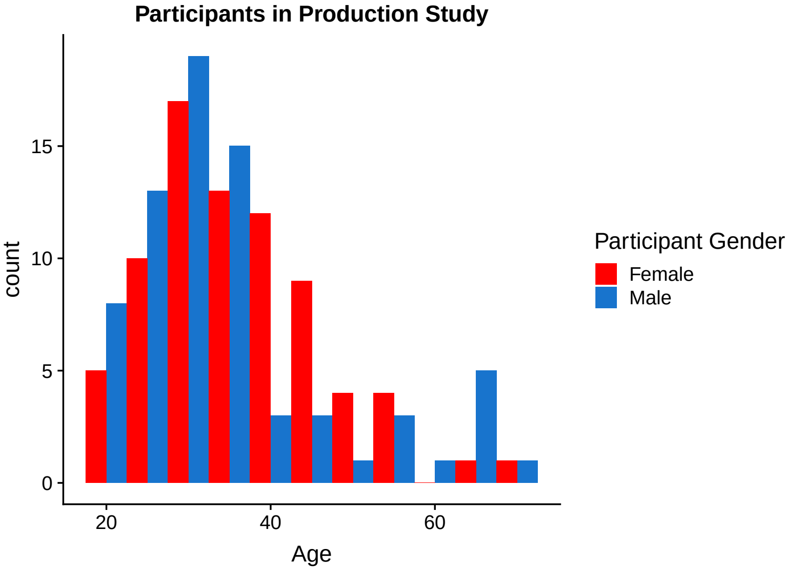


Participant Demographics

Gender recall study



Participant Demographics

Production study