Sources of Bias in Psycholinguistic Data

Utku Turk

Department of Linguistics, UMD

Agreement Attraction

(1) The **key** **was** rusty.

(Wagers et al., 2009)

Agreement Attraction

(2) *The **key** **were** rusty.

(Wagers et al., 2009)

Agreement Attraction

(3) *The **key** to the *cells* **were** rusty.

(Wagers et al., 2009)

Agreement Attraction

(3) *The **key** to the *cells* **were** rusty.

(sometimes)

(Wagers et al., 2009)

Agreement Attraction

[An example study]

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Journal of Memory and Language

Volume 61, Issue 2, August 2009, Pages 206-237

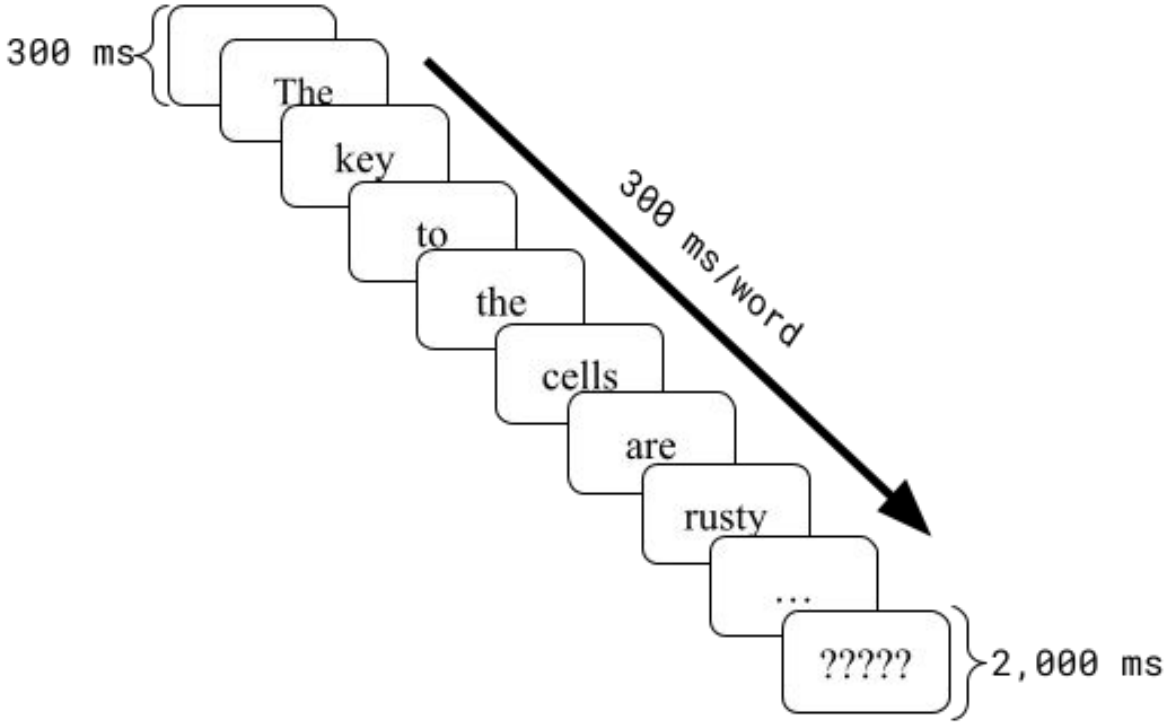
Agreement attraction in comprehension: Representations and processes

Matthew W. Wagers [a] [1] ✉, Ellen F. Lau [b, 1], Colin Phillips [b, c]

(Wagers et al., 2009)

Agreement Attraction

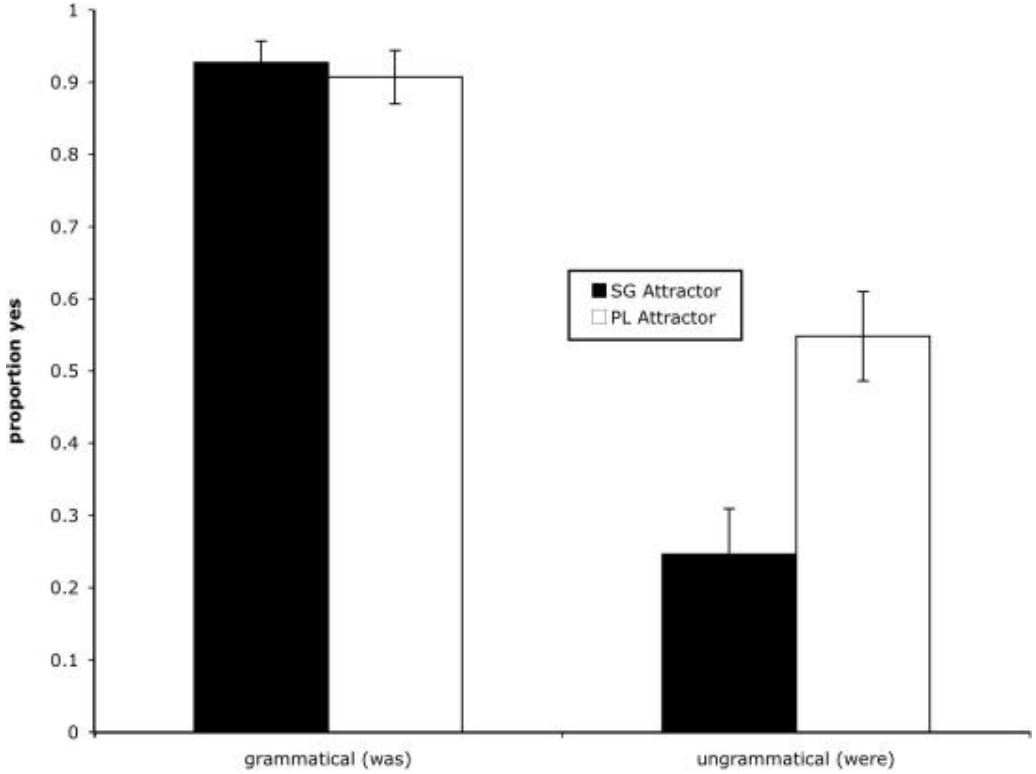
[An example study: Exp7]



(Wagers et al., 2009)

Agreement Attraction

[An example study: Exp7]



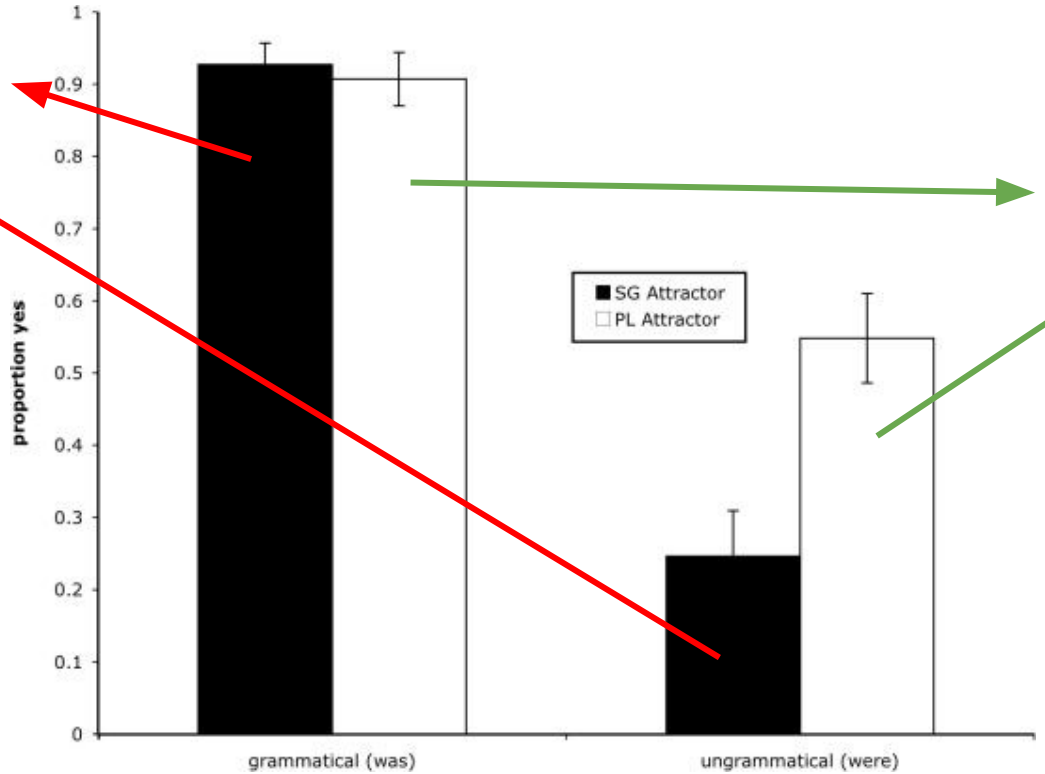
(Wagers et al., 2009)

Agreement Attraction

[An example study: Exp7]

The key to the cell

The key to the cells



(Wagers et al., 2009)

Agreement Attraction **[Empirical Findings]**

PP > RC Attraction

Linear Distance Effects

Syntactic Distance Effects

Grammaticality Asymmetry

Distributivity Effects

Clause-external attractors

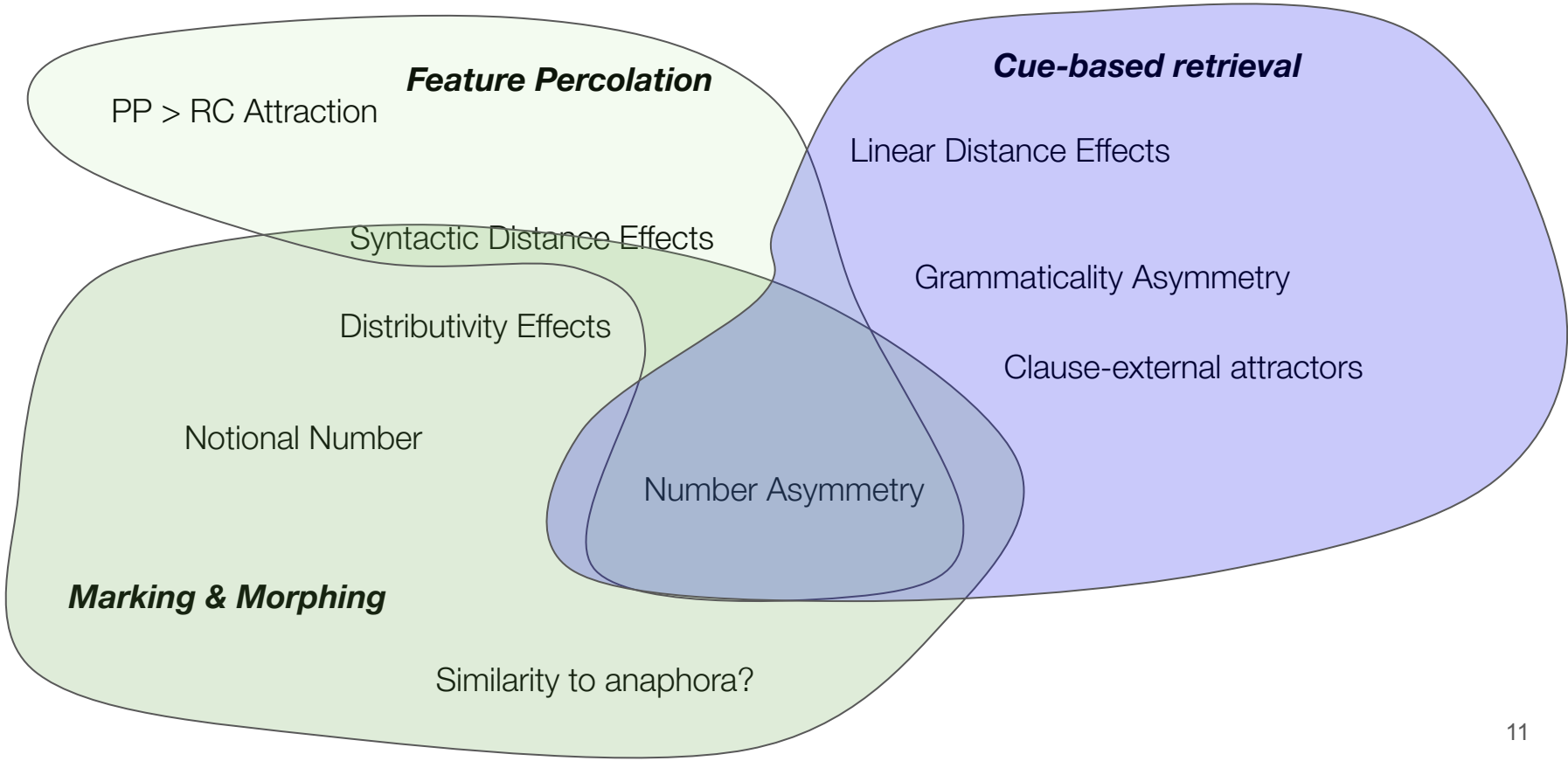
Notional Number

Number Asymmetry

Similarity to anaphora?

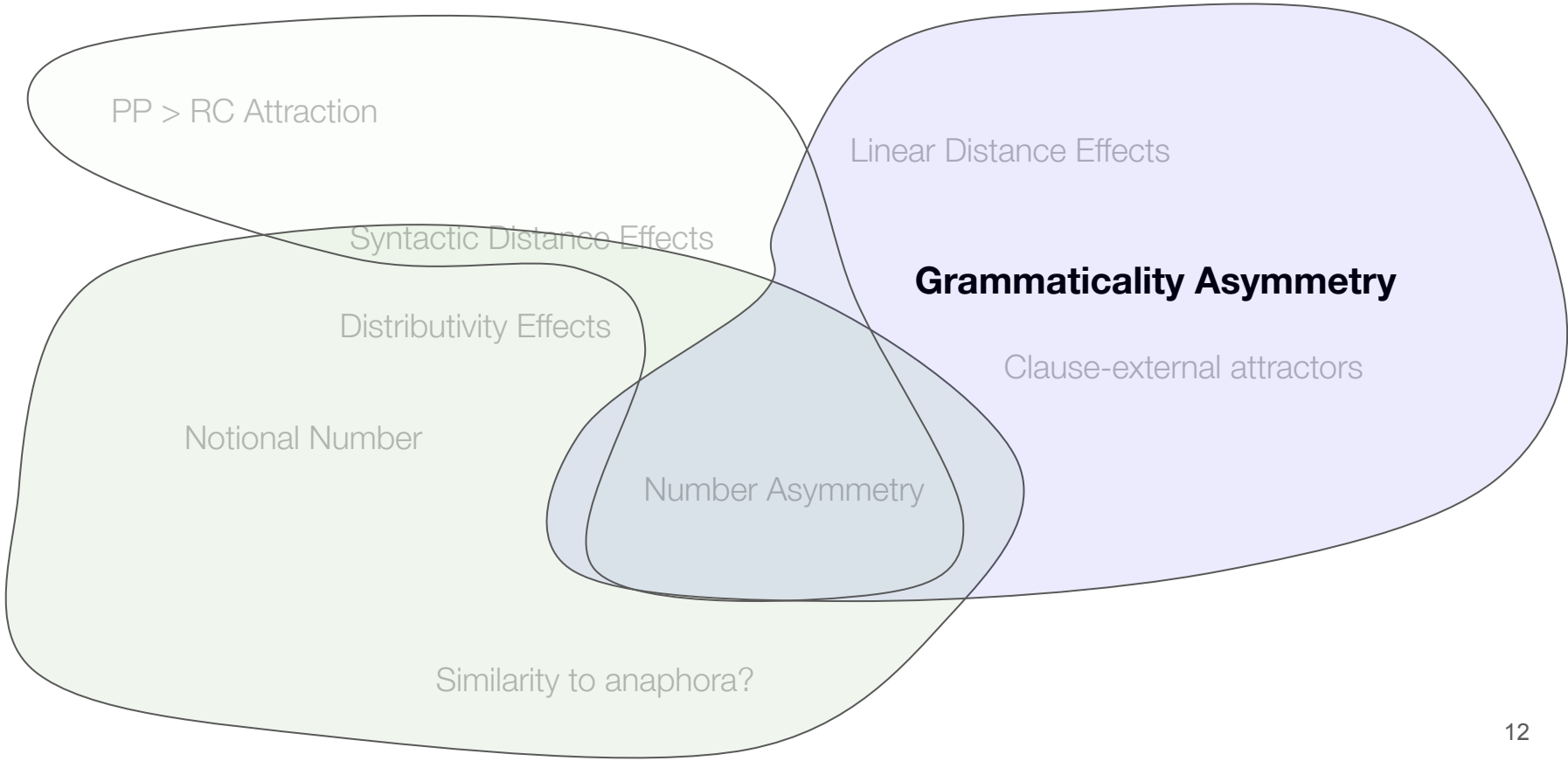
Agreement Attraction

[Empirical Findings]



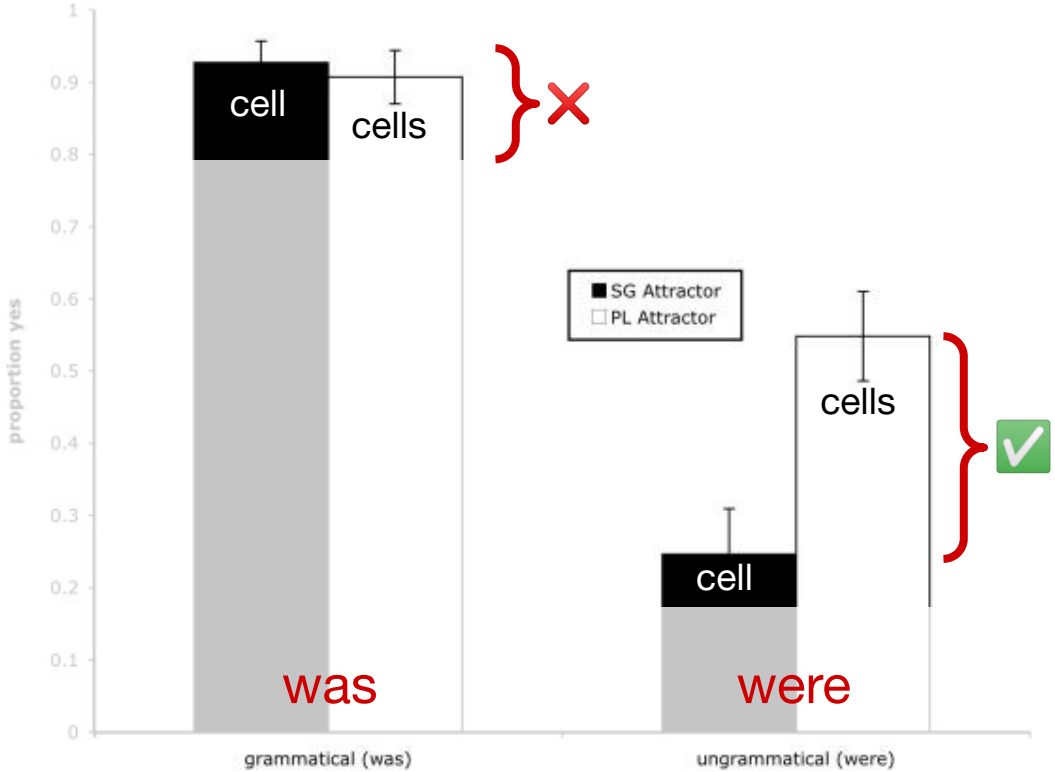
Agreement Attraction

[My Question]



Agreement Attraction

[An example study: Exp7]



(Wagers et al., 2009)

Grammaticality Asymmetry

(4) *The key to the *cells* were rusty.

(5) The key to the *cells* was rusty.

(Wagers et al., 2009)

Grammaticality Asymmetry

[Theories]

(4) *The key to the *cells* were rusty.

(5) The key to the *cells* was rusty.

Retrieval ✅

Representational ❌

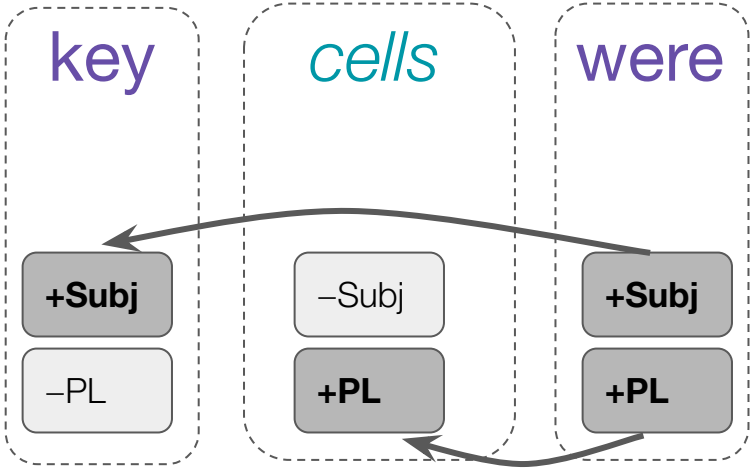
(Bock & Miller, 1991; Eberhard et al., 2005; Wagers et al., 2009)

Grammaticality Asymmetry

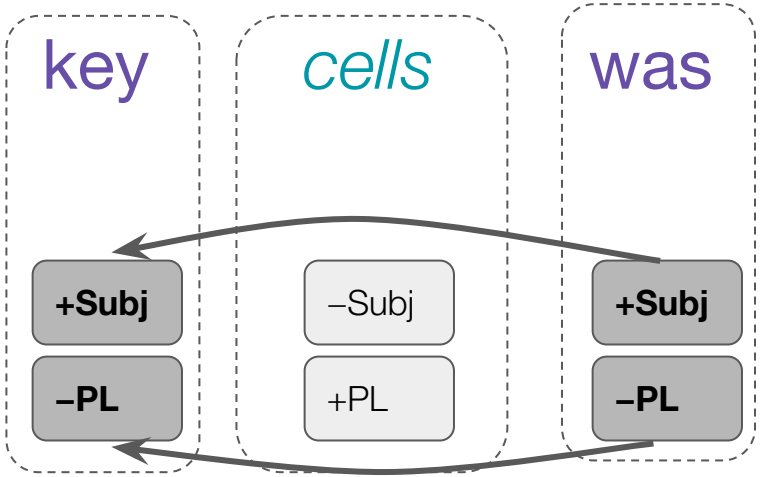
[Theories]

Retrieval ✅

(4)



(5)

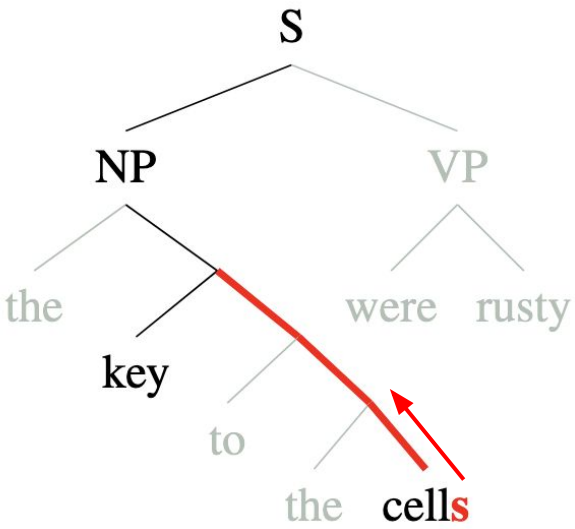


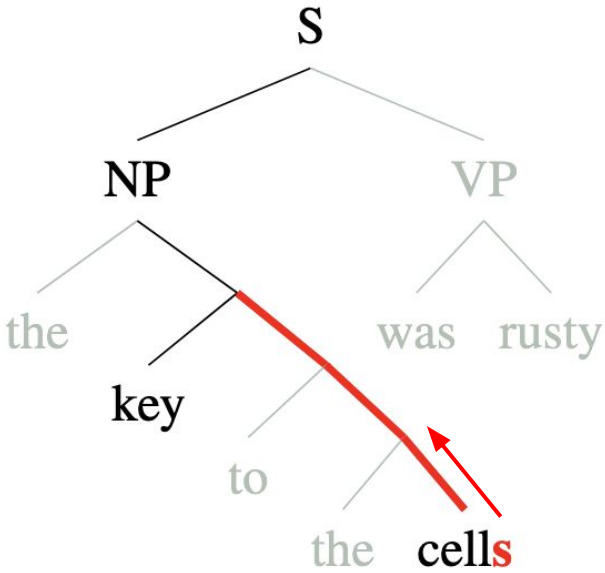
(Jäger et al., 2020)

Grammaticality Asymmetry

[Theories]

Representational ❌





(Bock et al., 1991; Eberhard et al., 2005; Wagers et al., 2009)

Interim Summary

- People do systematic **errors** in **agreement** comprehension
- Errors surface in **only ungrammatical sentences**
- **Retrieval** accounts explains findings better
  *(compared to **representational** accounts)*

(Bock et al., 1991; Eberhard et al., 2005; Wagers et al., 2009)

Grammaticality Asymmetry

[HSD]

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Cognitive Psychology

Volume 110, May 2019, Pages 70-104

The grammaticality asymmetry in agreement attraction reflects response bias: Experimental and modeling evidence ☆

Christopher Hammerly [a], Adrian Staub [b], Brian Dillon [a]

- Grammaticality asymmetry due to response bias
- People have **a priori bias** to grammaticality

Grammaticality Asymmetry

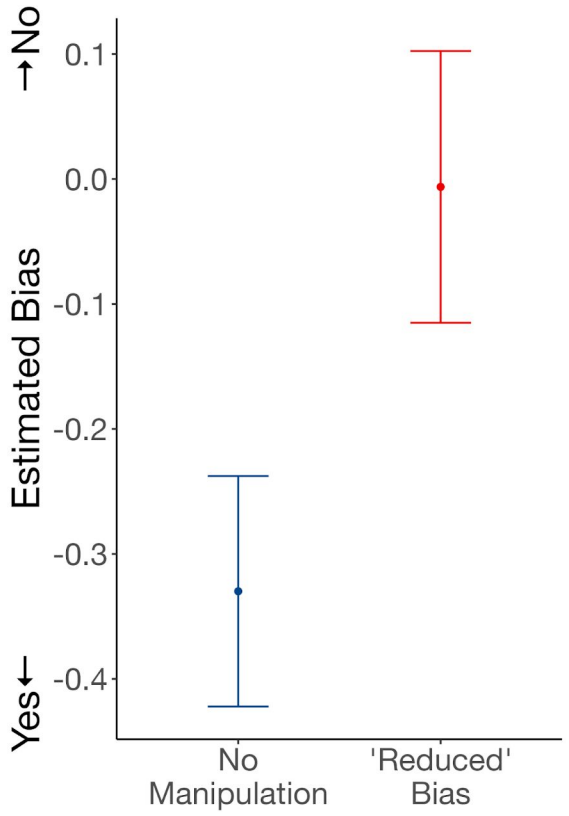
[HSD]

Bias Manipulation

- Manipulating the percentage of ungrammatical fillers

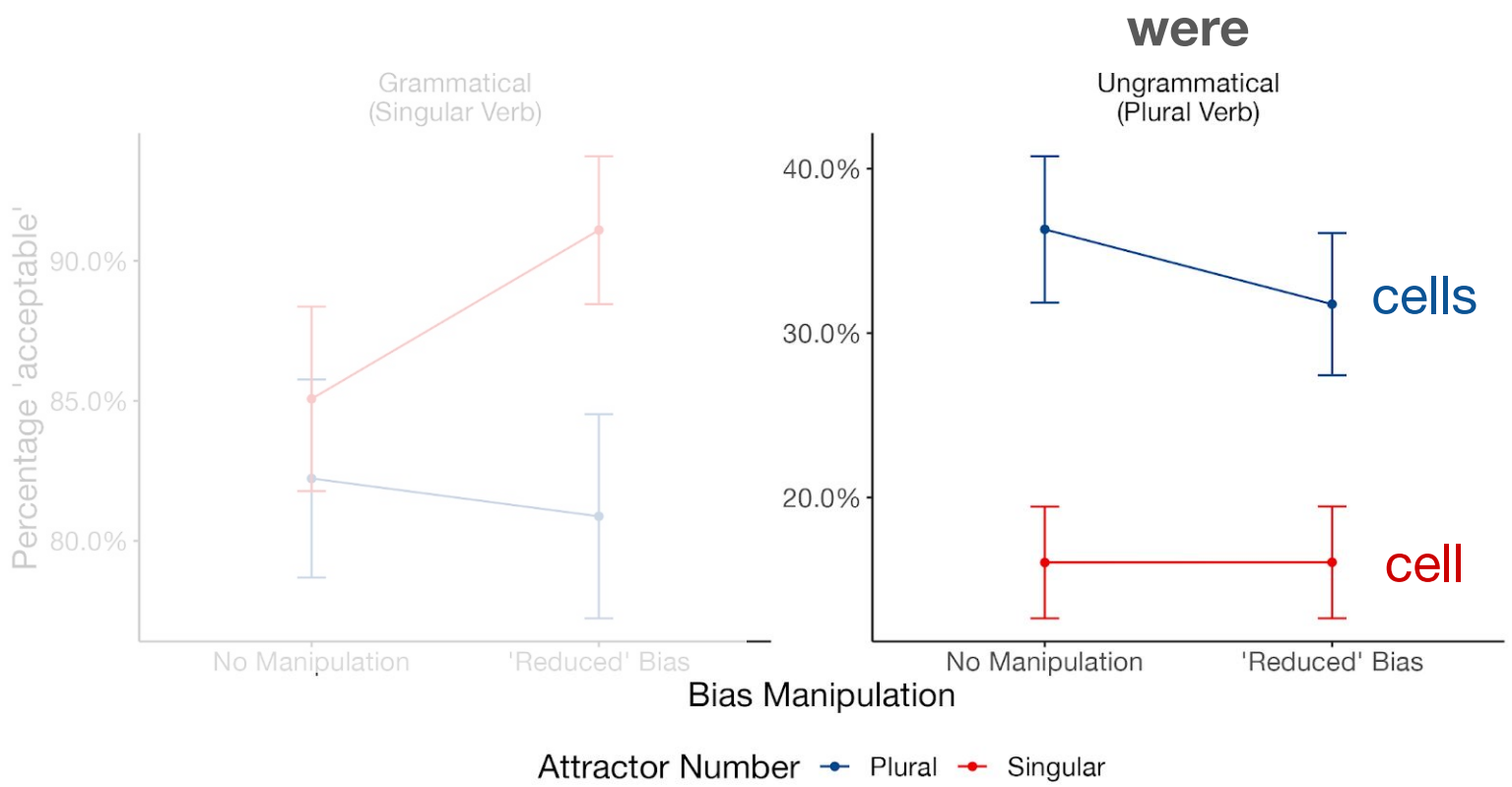
  &

- Using instructions



Grammaticality Asymmetry

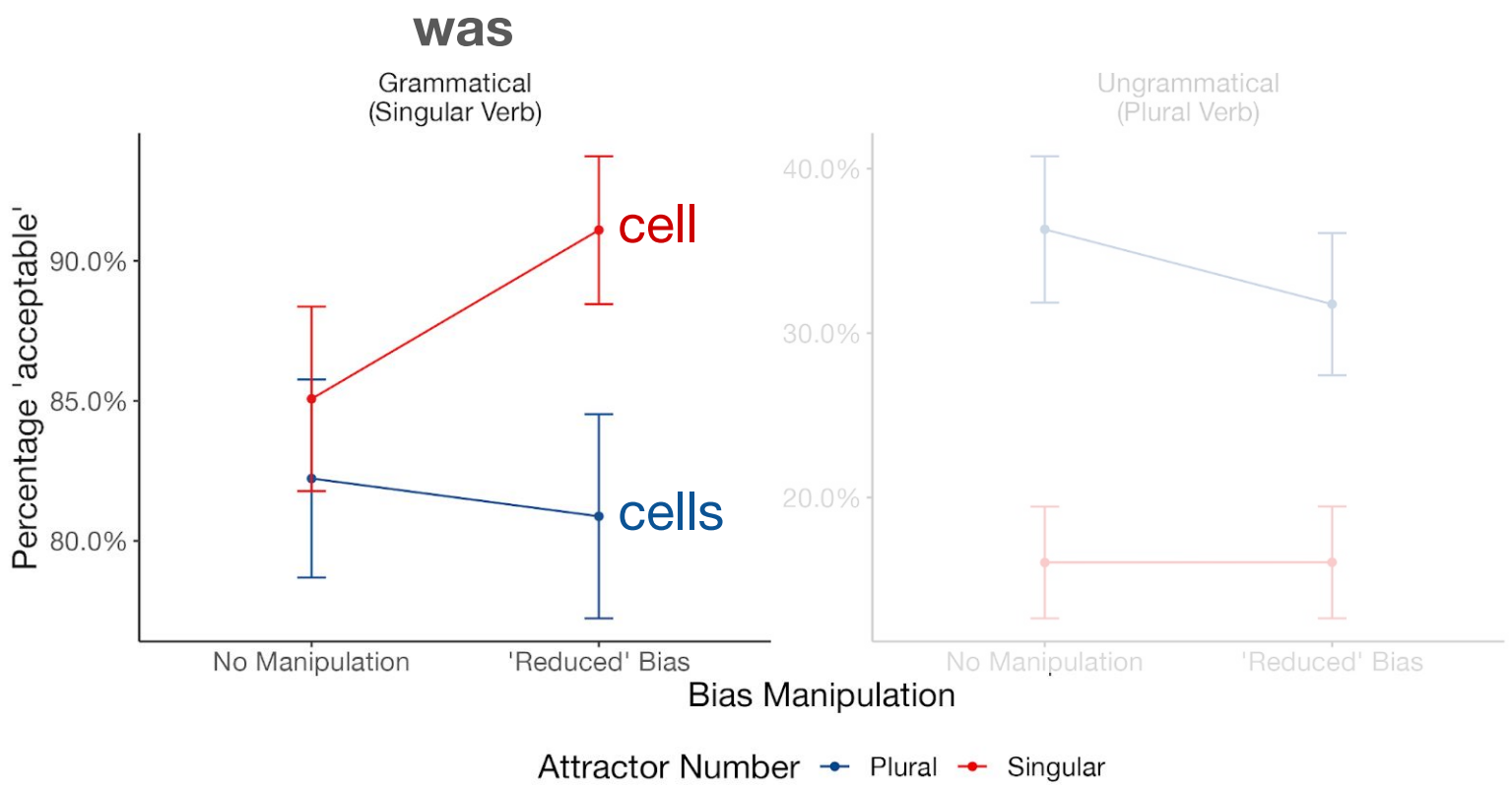
[HSD]



(Cousineau, 2005; Morey, 2008)

Grammaticality Asymmetry

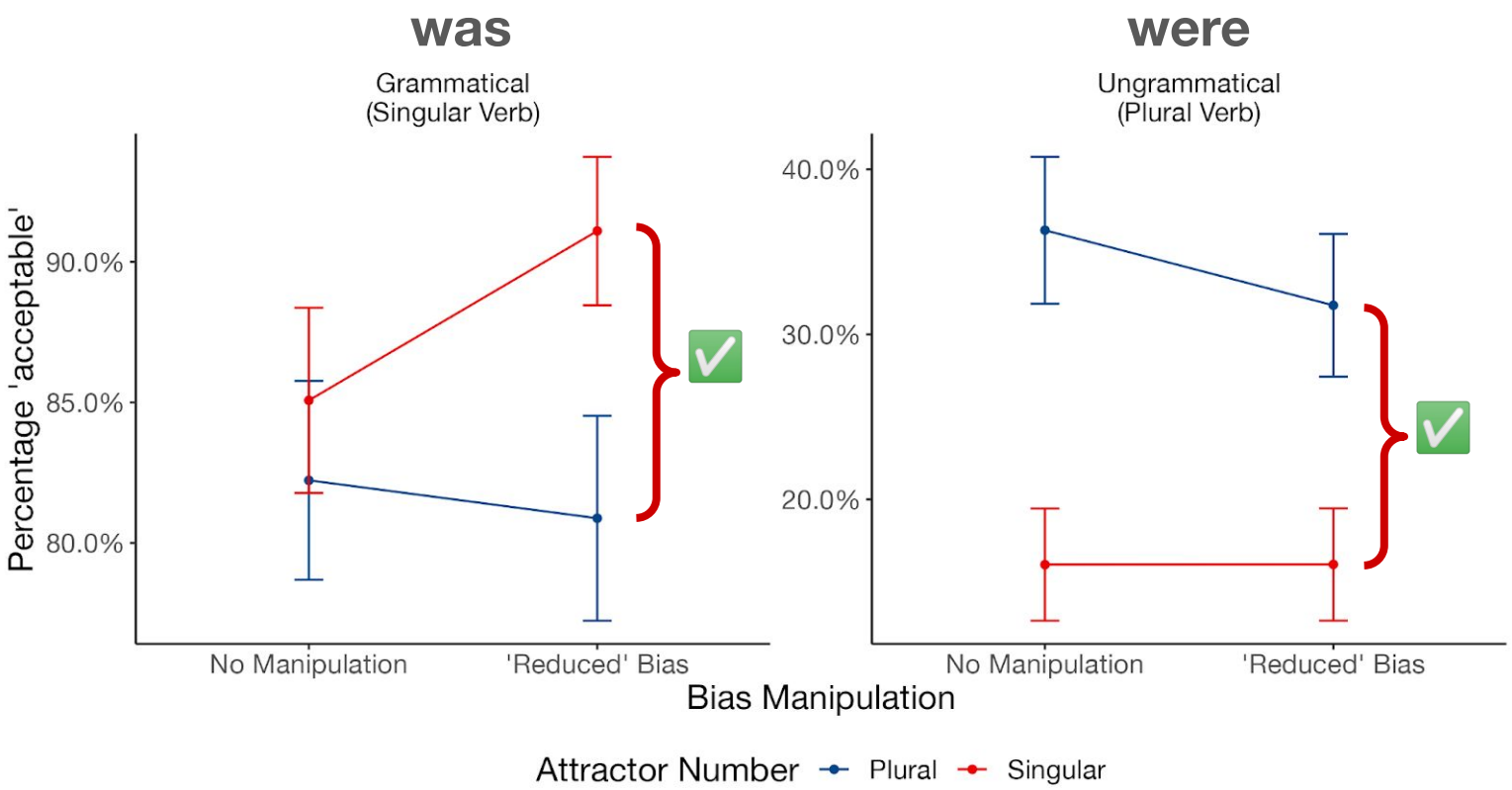
[HSD]



(Cousineau, 2005; Morey, 2008)

Grammaticality Asymmetry

[HSD]



(Cousineau, 2005; Morey, 2008)

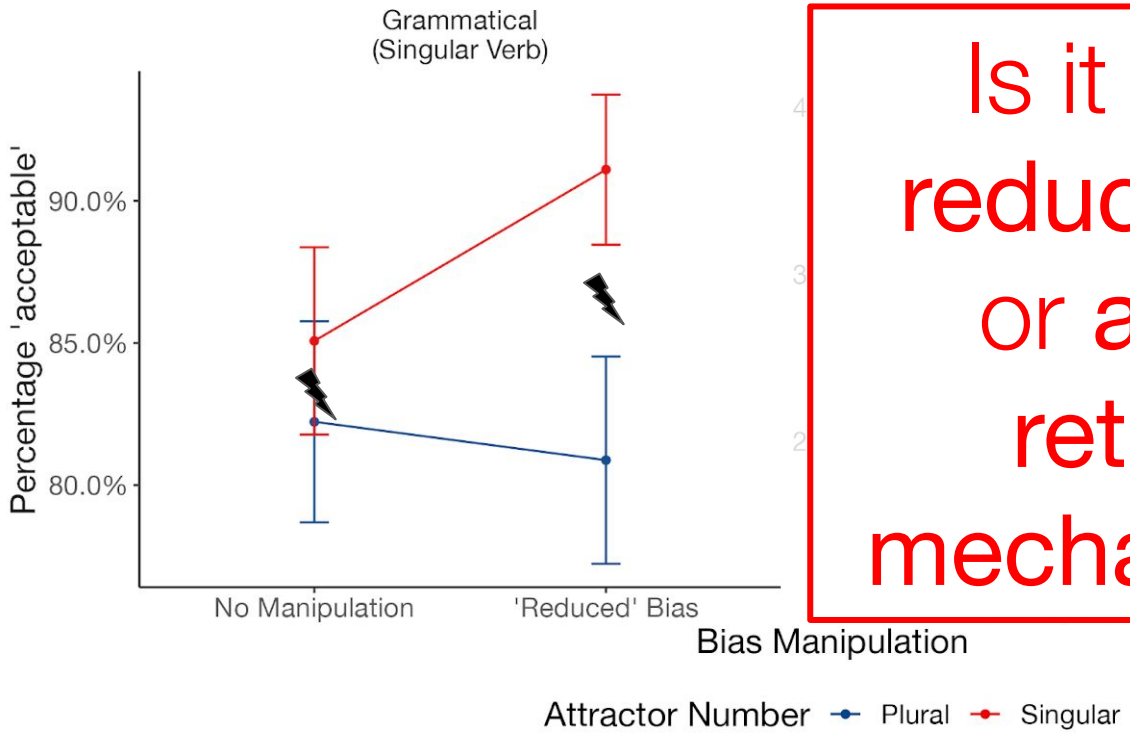
Grammaticality Asymmetry

[HSD]

- **Problem:** Teasing apart experimental manipulation and response bias.

Grammaticality Asymmetry

[HSD]

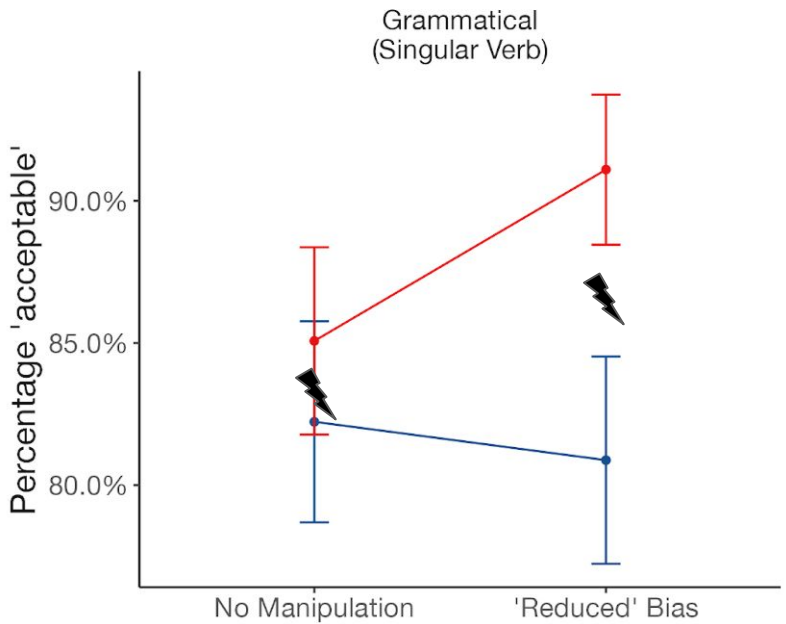


Is it due to **reduced bias** or **altered retrieval mechanisms** ?

(Cousineau, 2005; Morey, 2008)

Grammaticality Asymmetry

[HSD]

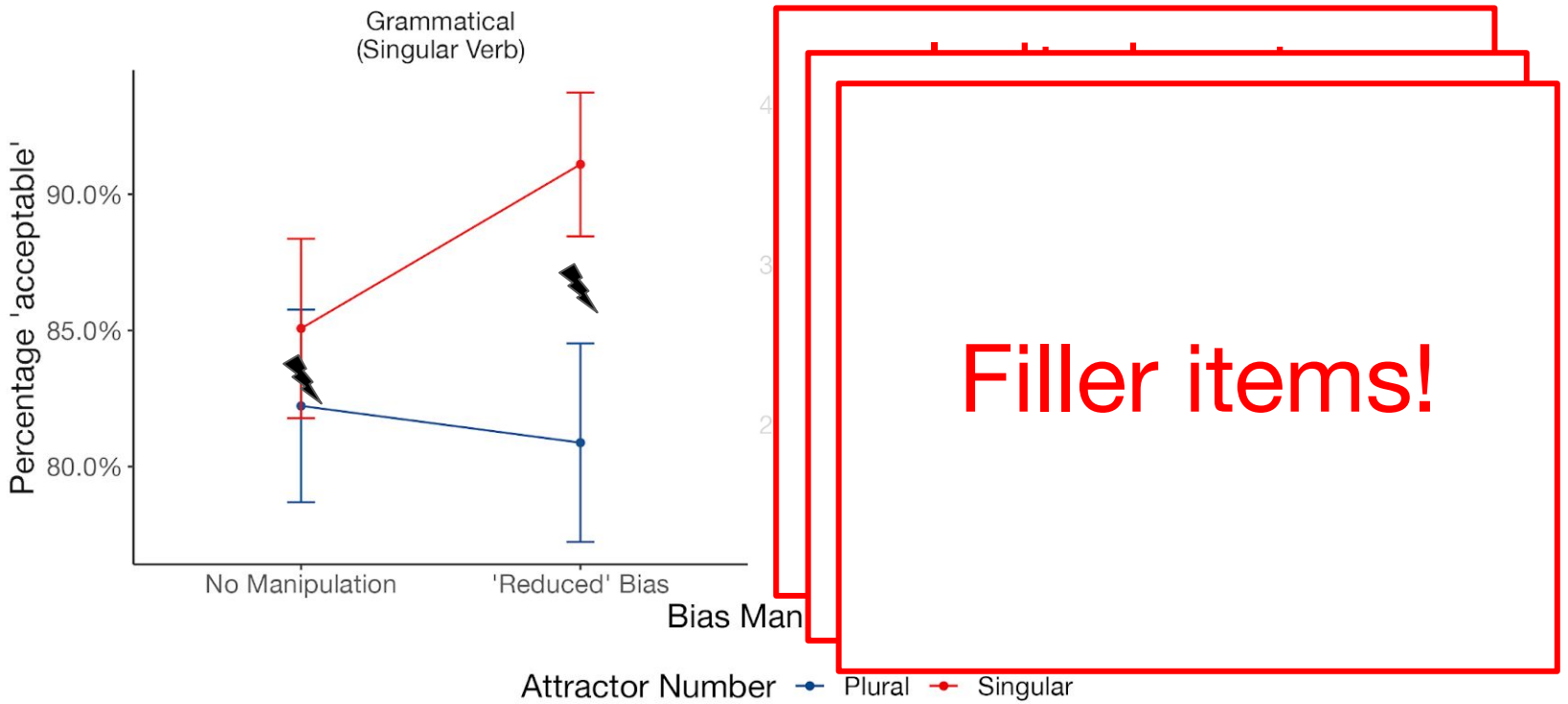


Is there a way to **isolate** response bias?

(Cousineau, 2005; Morey, 2008)

Grammaticality Asymmetry

[HSD]



(Cousineau, 2005; Morey, 2008)

Grammaticality Asymmetry

[HSD]

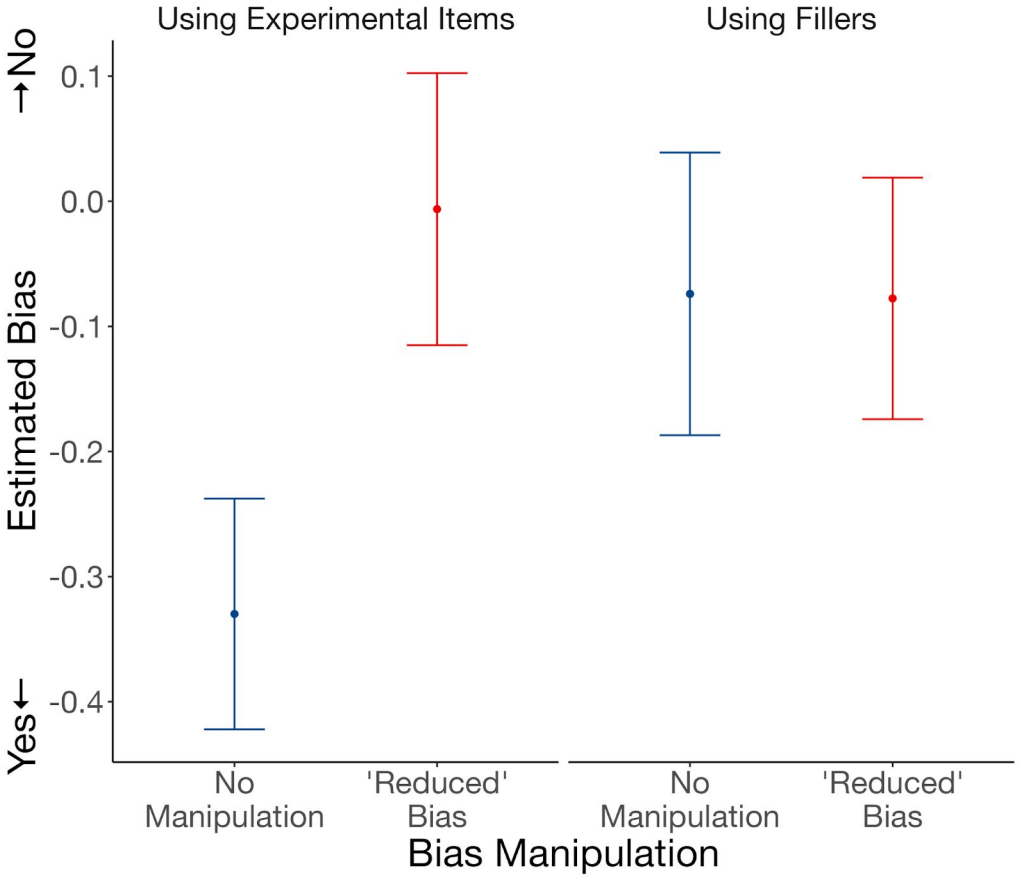
Wait?

…

What?

…

What?



[Replication: Method]

Our Goal: Replicate Hammerly et al.'s findings in another language with another construction and verify bias-related findings

Grammaticality Asymmetry **[Replication: Method]**

Our Goal: Replicate Hammerly et al.'s findings in another language with another construction and verify bias-related findings

- Speeded Acceptability Judgment, N = 114
- Within-subject factors: *Verb x Attractor number*
- Between-subject factor: *Bias*

Grammaticality Asymmetry

[Replication: Method]

Our Goal: Replicate Hammerly et al.'s findings in another language with another construction and verify bias-related findings

- Speeded Acceptability Judgment, N = 114
- Within-subject factors: *Verb x Attractor number*
- Between-subject factor: *Bias*

(10) a. * [*Milyoner-ler-in* terzi-si] tamamen gereksizce kov-ul-du-lar.
millionaire-PL-GEN tailor-POSS completely without_reason fire-PASS-PST-PL
*The tailor of *the millionaires* were fired for no reason at all.

b. * *Milyonerin* terzisi tamamen gereksizce kovuldular.

c. *Milyonerlerin* terzisi tamamen gereksizce kovuldu.

d. *Milyonerin* terzisi tamamen gereksizce kovuldu.

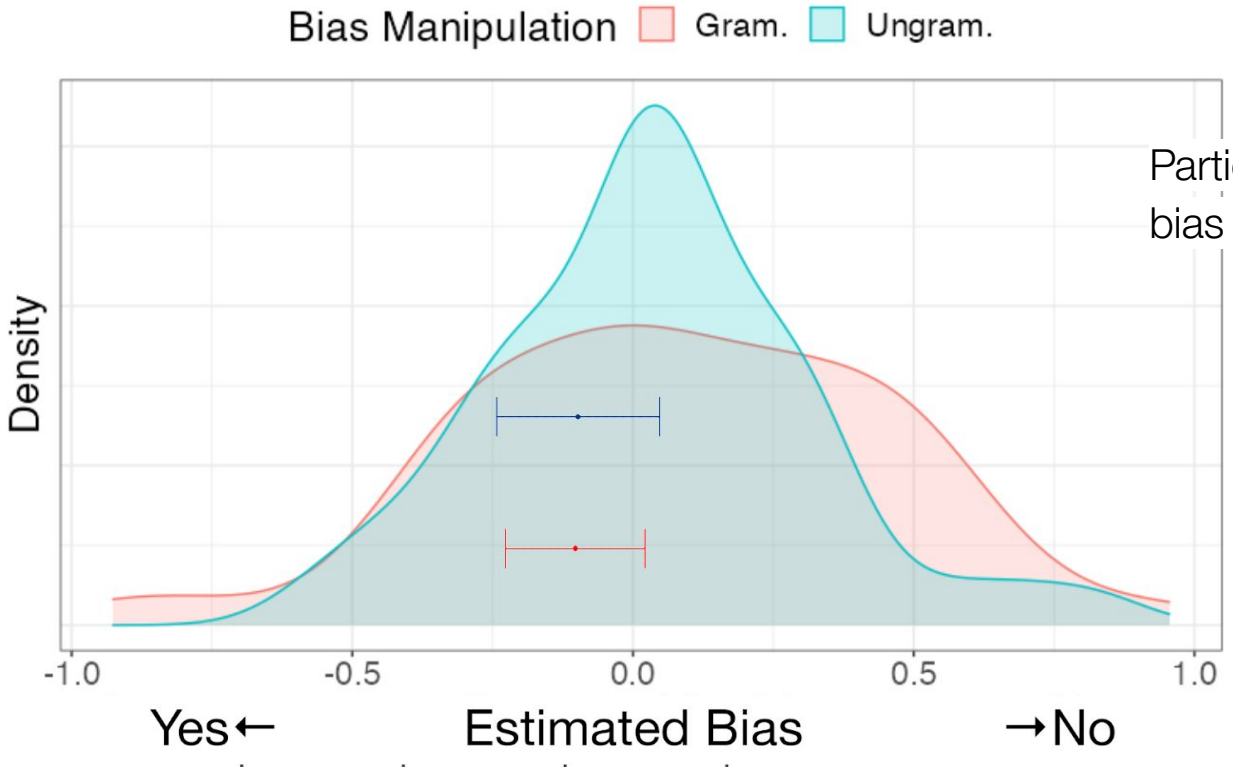
Grammaticality Asymmetry

[Replication: Bias]

Participants did not respond to our bias manipulation as well

Grammaticality Asymmetry

[Replication: Bias]



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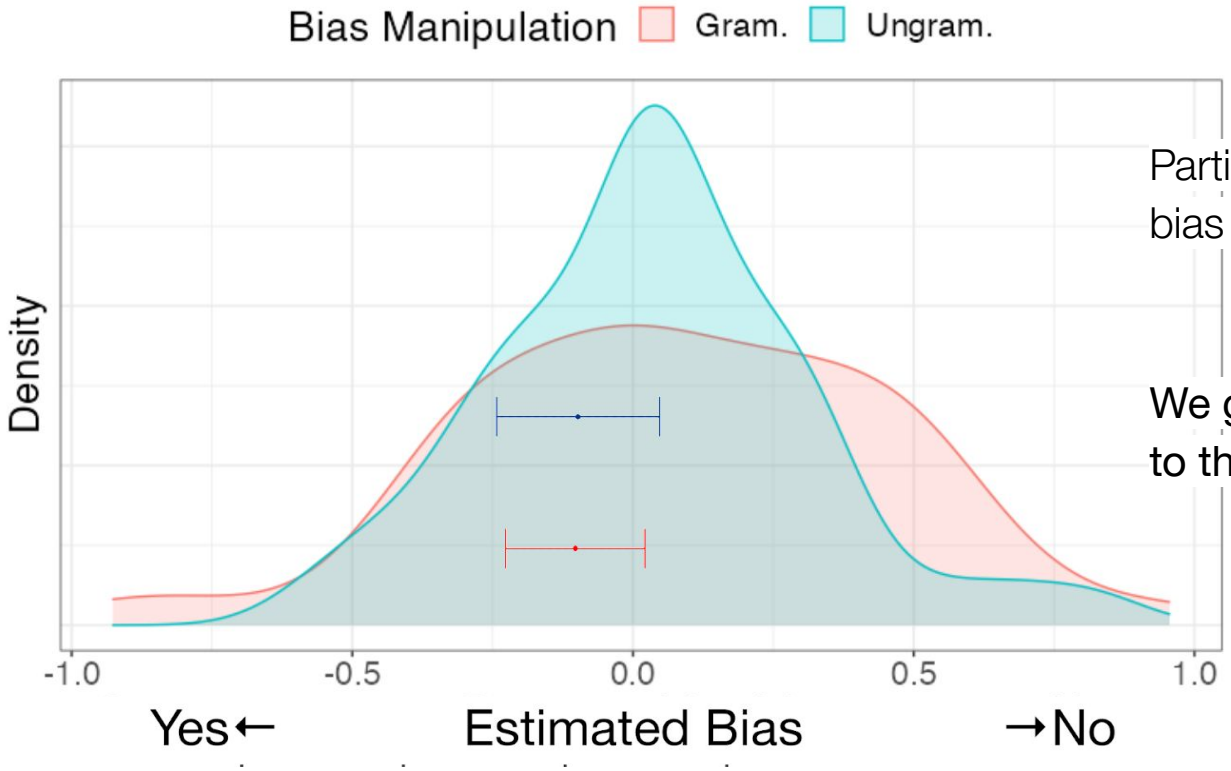
Grammaticality Asymmetry

[Replication: Bias]

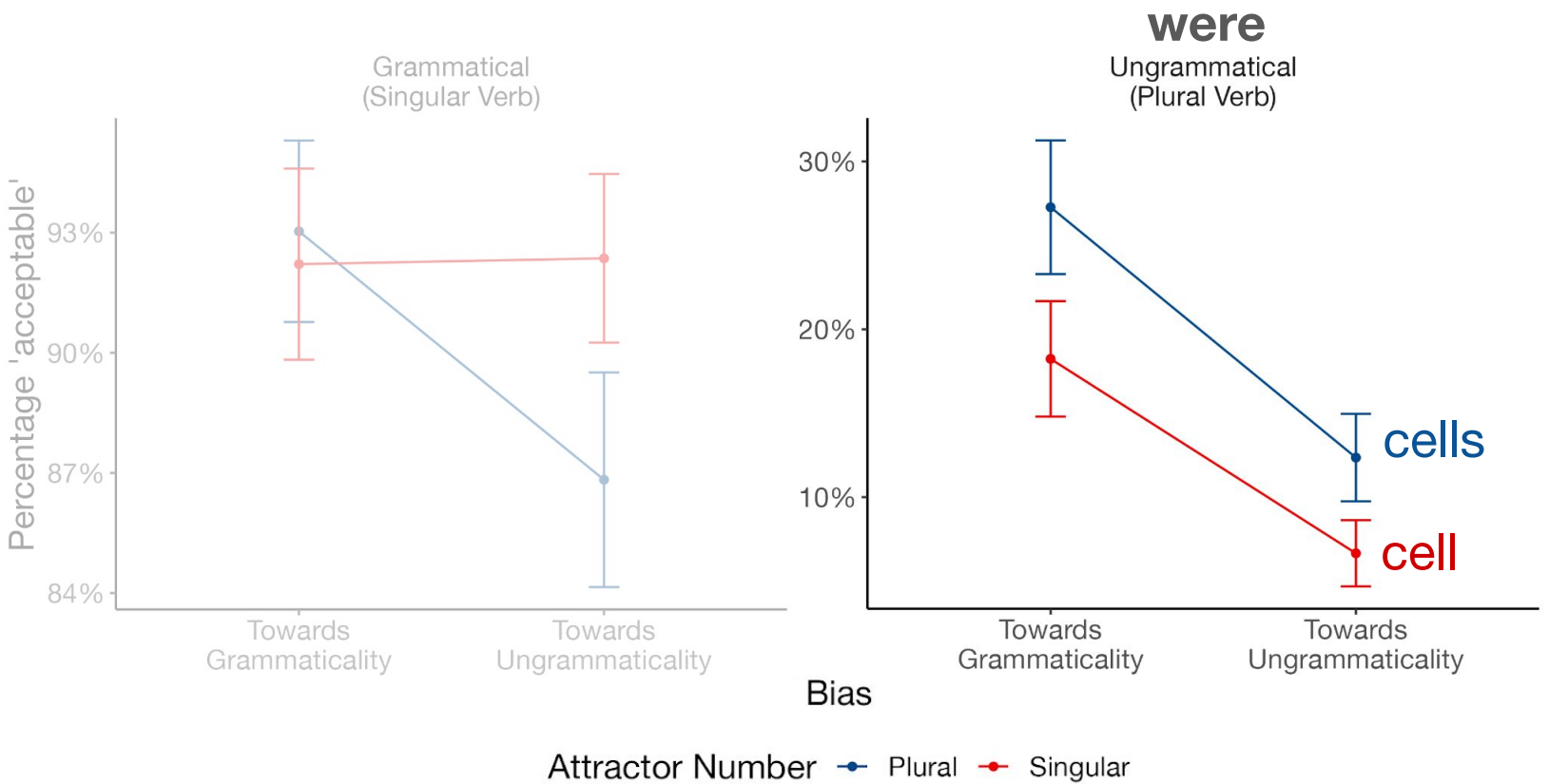


Participants did not respond to our bias manipulation as well

We grouped participants according to their response bias value

Grammaticality Asymmetry

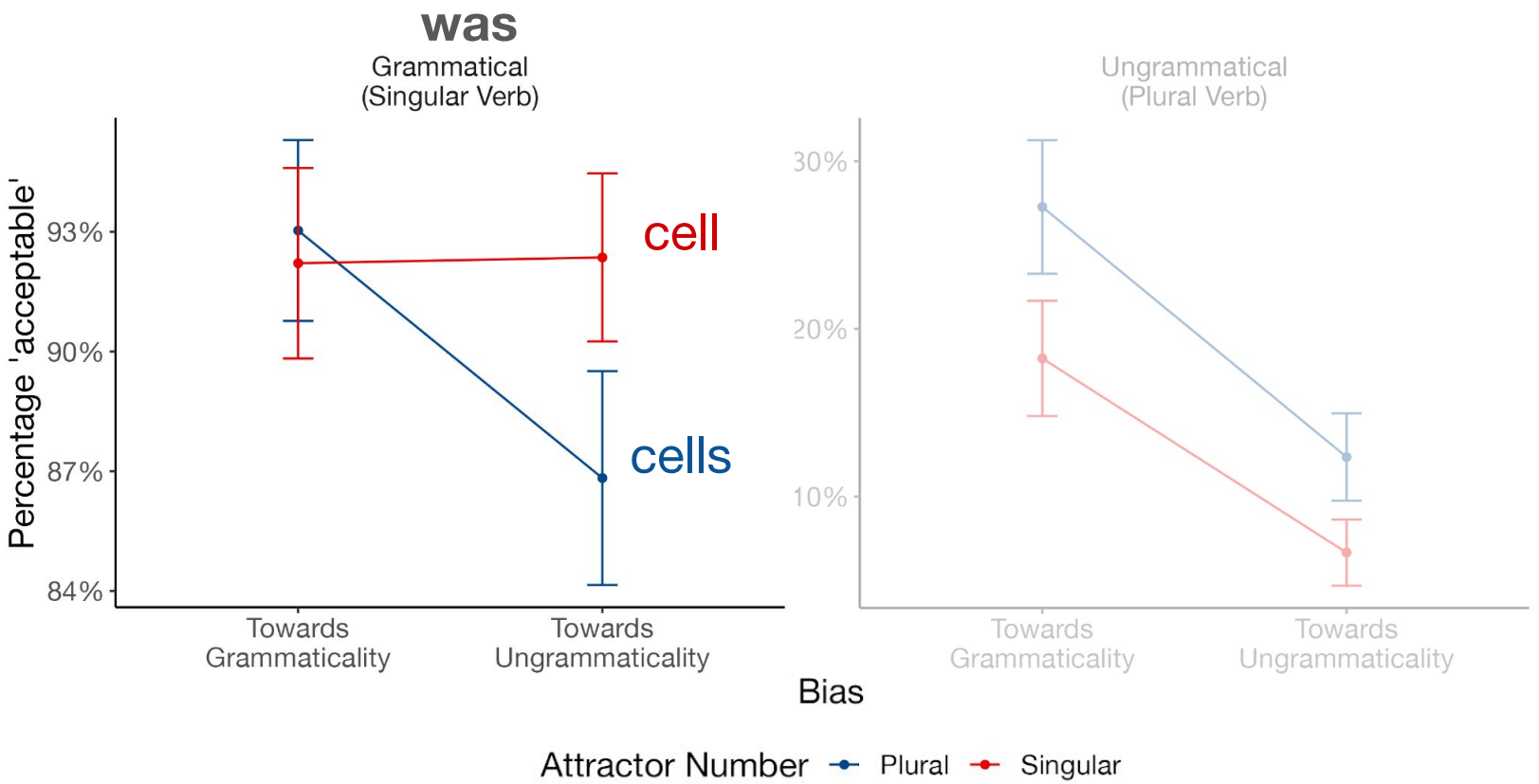
[Replication: Results]



(Cousineau, 2005; Morey, 2008)

Grammaticality Asymmetry

[Replication: Results]



(Cousineau, 2005; Morey, 2008)

Grammaticality Asymmetry **[Replication: Modeling]**

- Fit a maximal Bayesian GLM to ‘yes’ responses to **grammatical** sentences

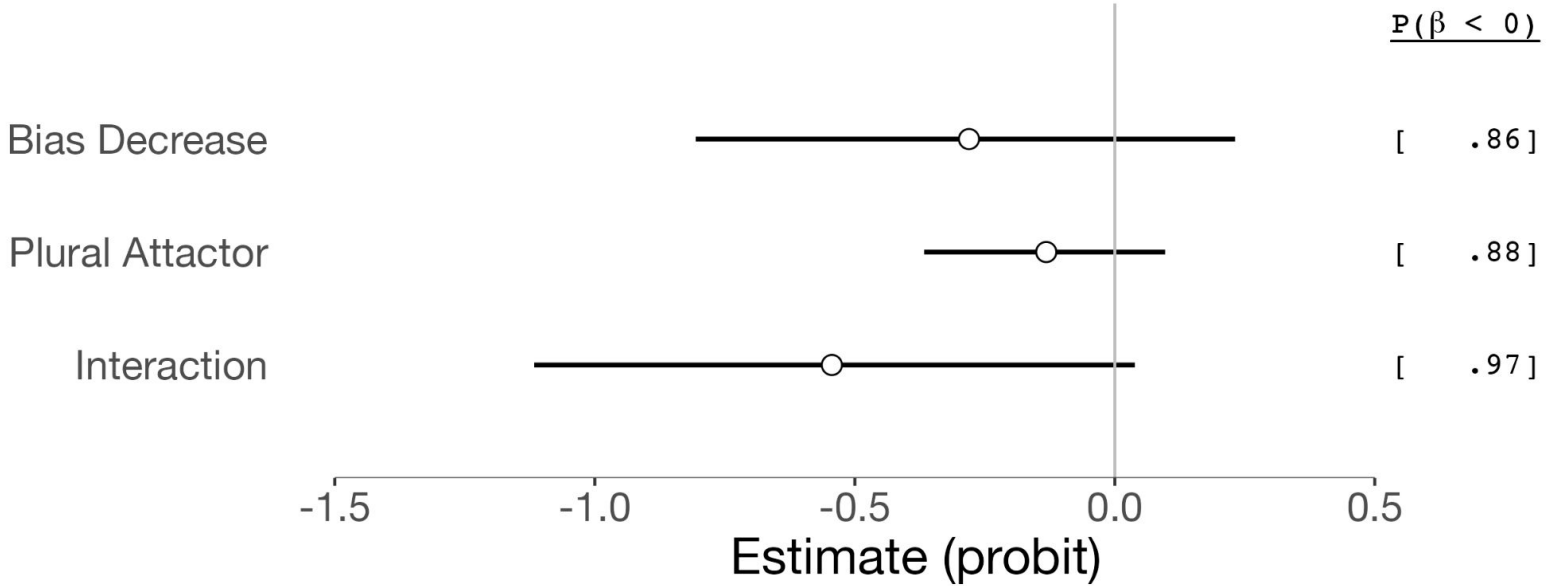
  - Predictors:
    - Continuous Response Bias Value
    - Attractor Number
    - The interaction
    - (Trial number) & (Word Frequency)

  - All models were maximal

(Gelman & Hill, 2007; Barr et al., 2013; Nicenboim & Vasishth, 2016; Kruschke, 2018)

Grammaticality Asymmetry **[Replication: Modeling]**

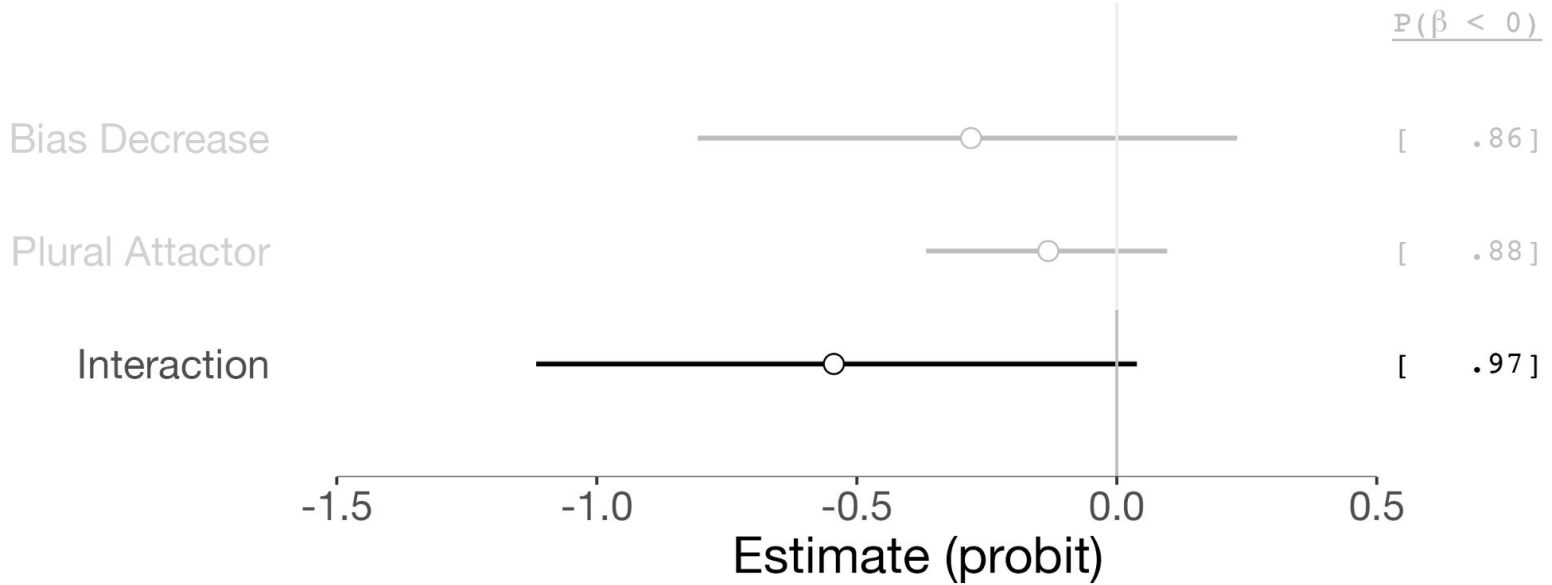
- Fit a maximal Bayesian GLM to ‘yes’ responses to **grammatical** sentences



(Gelman & Hill, 2007; Barr et al., 2013; Nicenboim & Vasishth, 2016; Kruschke, 2018)

Grammaticality Asymmetry **[Replication: Modeling]**

- Fit a maximal Bayesian GLM to ‘yes’ responses to **grammatical** sentences



➔ The effect of plural attractor is more pronounced in people with less “yes” bias in grammatical sentences

(Gelman & Hill, 2007; Barr et al., 2013; Nicenboim & Vasishth, 2016; Kruschke, 2018)

Grammaticality Asymmetry **[Take-away]**

∴ Replicated theoretically significant findings of HSD

Grammaticality Asymmetry **[Take-away]**

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∴ Grammaticality asymmetry due to response bias

Grammaticality Asymmetry **[Take-away]**

∴ Replicated theoretically significant findings of HSD

∴ Grammaticality asymmetry due to response bias

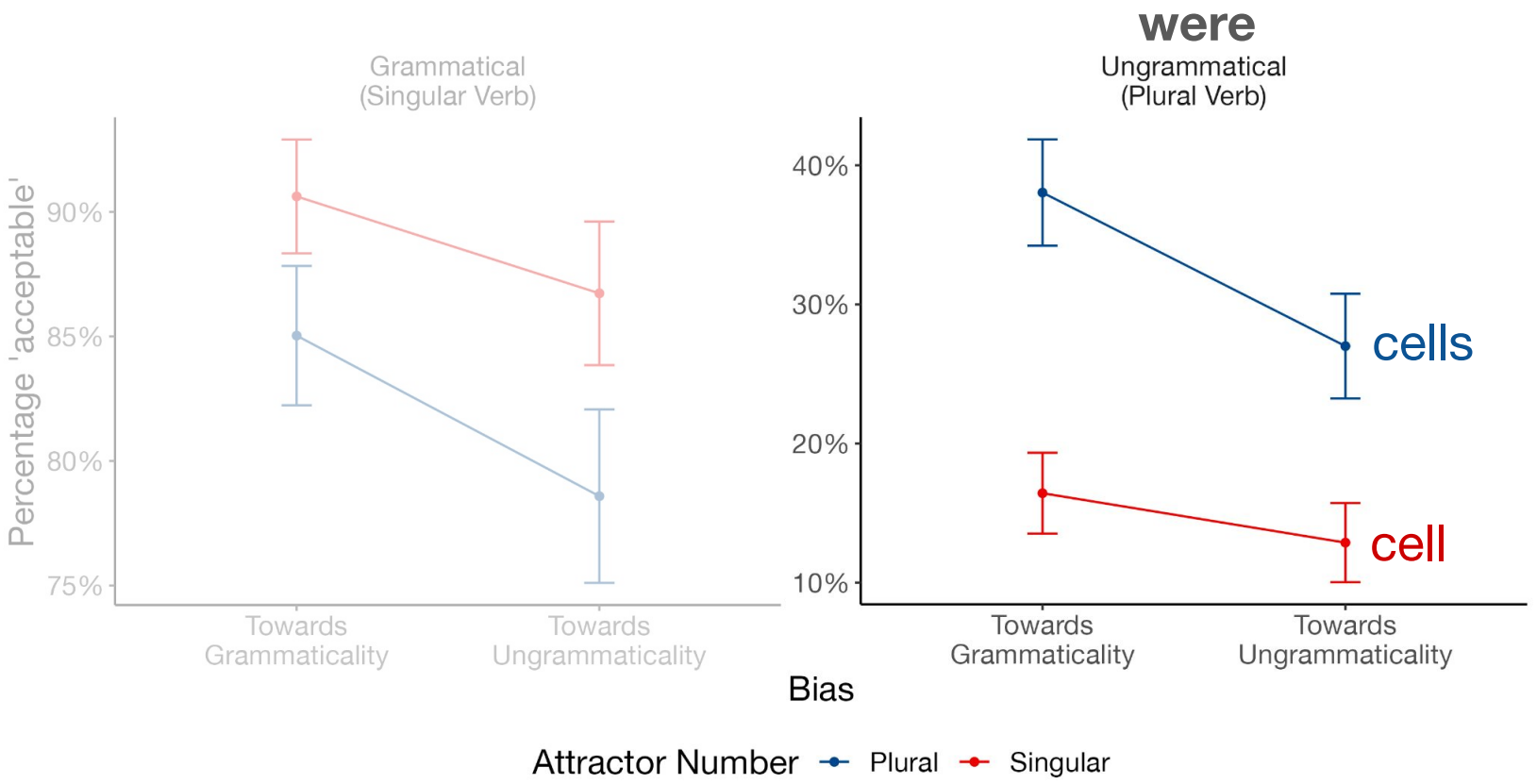
∴ Retrieval models cannot predict these results

Remember funky HSD biases?

(Cousineau, 2005; Morey, 2008)

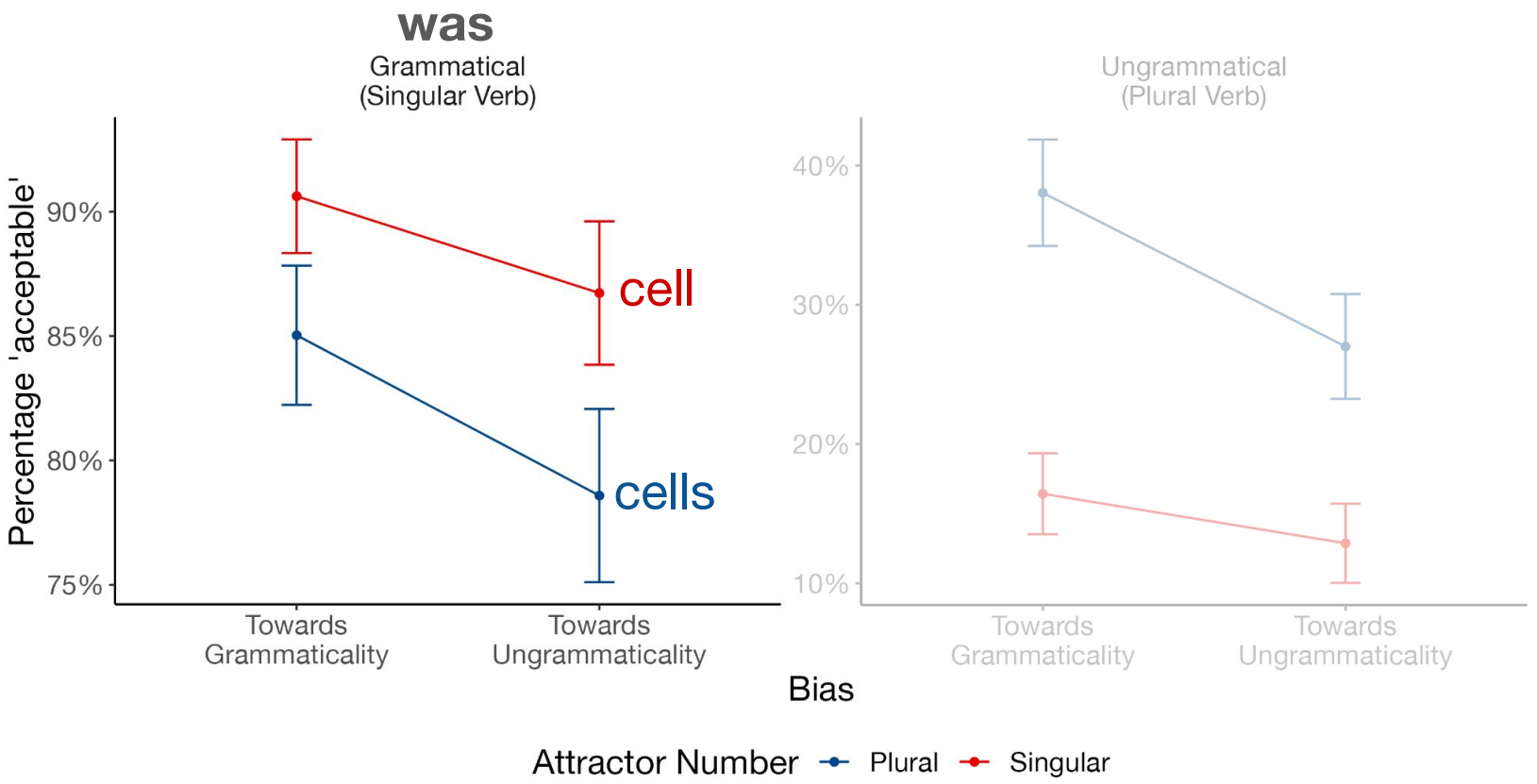
Grammaticality Asymmetry

[Reanalysis of HSD]



(Cousineau, 2005; Morey, 2008)

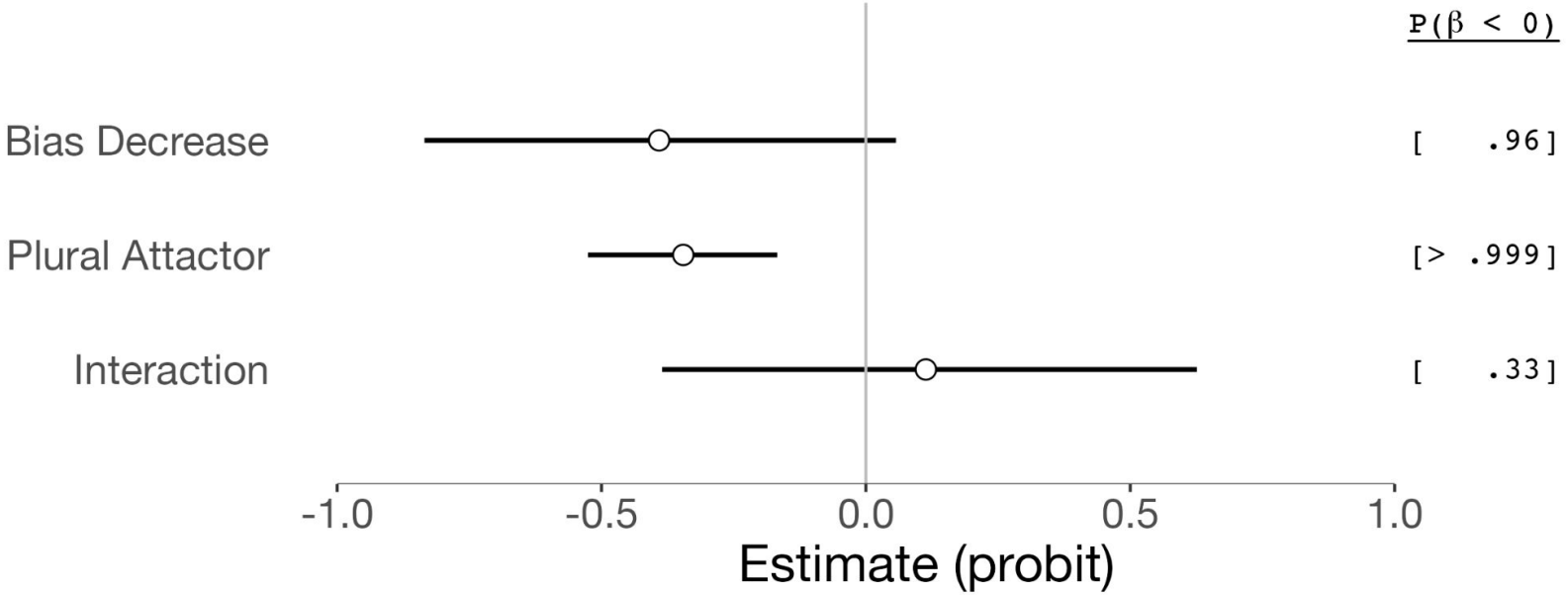
Grammaticality Asymmetry [Reanalysis of HSD]



(Cousineau, 2005; Morey, 2008)

Grammaticality Asymmetry **[Reanalysis of HSD]**

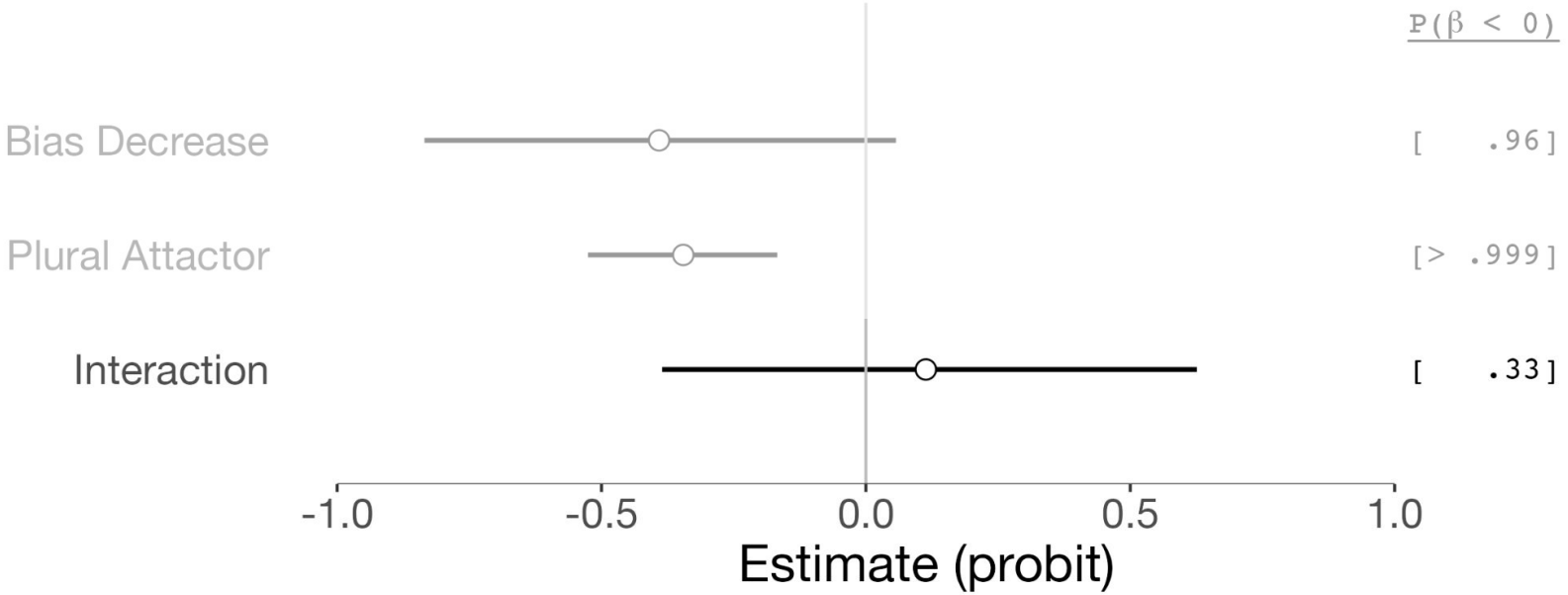
- Fit a maximal Bayesian GLM to ‘yes’ responses to **grammatical** sentences



(Gelman & Hill, 2007; Barr et al., 2013; Nicenboim & Vasishth, 2016; Kruschke, 2018)

Grammaticality Asymmetry **[Reanalysis of HSD]**

- Fit a maximal Bayesian GLM to ‘yes’ responses to **grammatical** sentences



➔ Reducing Bias did not affect the contribution of the plural attractor

(Gelman & Hill, 2007; Barr et al., 2013; Nicenboim & Vasishth, 2016; Kruschke, 2018)

Grammaticality Asymmetry **[Reanalysis of HSD]**

∴ They were not able to manipulate bias

∴ Attraction in grammatical sentences surfaces with “yes” bias

Grammaticality Asymmetry **[Reanalysis of HSD]**

∴ They were not able to manipulate bias

∴ Attraction in grammatical sentences surfaces with “yes” bias

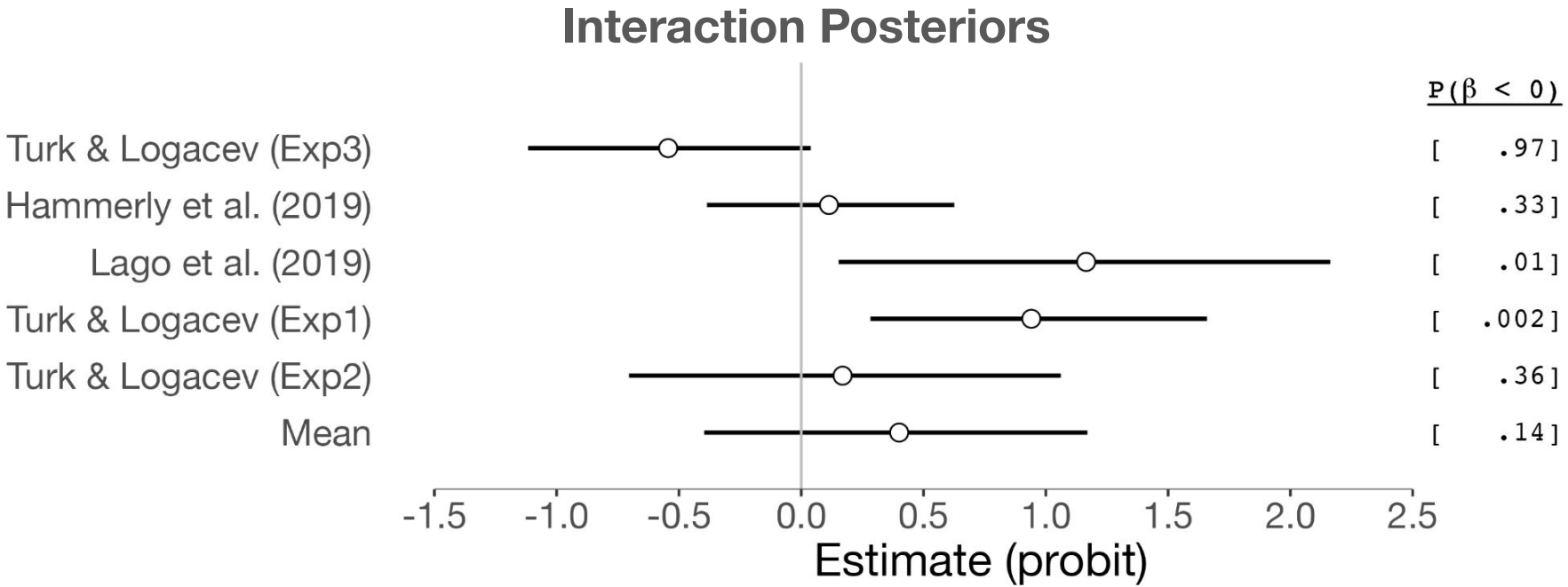
∴ Retrieval accounts are still problematic

Grammaticality Asymmetry **[Meta-Analysis]**

- What about other experiments without bias manipulation?

Grammaticality Asymmetry **[Meta-Analysis]**

- What about other experiments without bias manipulation?



(Gelman & Hill, 2007; Barr et al., 2013; Nicenboim & Vasishth, 2016; Kruschke, 2018)

Grammaticality Asymmetry

[Take-away]

∴ Reduced “yes” bias ↛ Attraction in grammatical sentences

Grammaticality Asymmetry

[Take-away]

∴ Reduced “yes” bias ↛ Attraction in grammatical sentences

∴ Retrieval accounts, as it is, does not support these findings

Grammaticality Asymmetry

[Take-away]

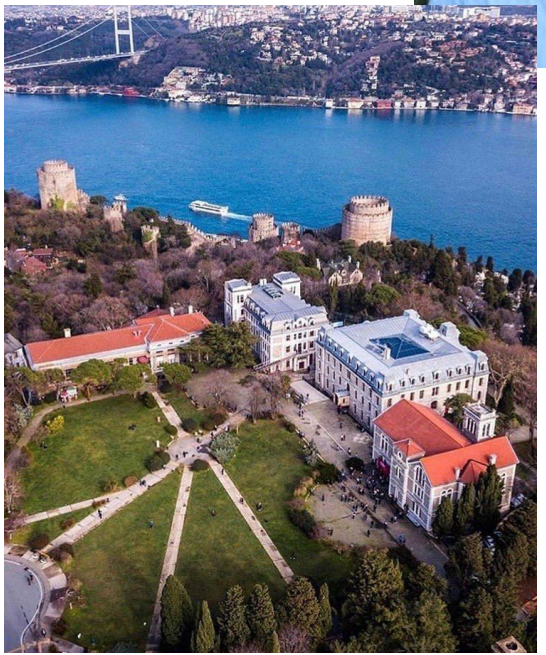
∴ Reduced “yes” bias ↛ Attraction in grammatical sentences

∴ Retrieval accounts, as it is, does not support these findings

A way out: Properties of retrieval are prone to bias manipulation

joint work with **Pavel Logačev**

@ **Bogazici** University



for my **MA thesis**

github.com/utkuturk/attraction_meta

Thank you!

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