Agreement Attraction in Turkish

MA Thesis Defense, supervised by **Pavel Logačev**

Utku Türk

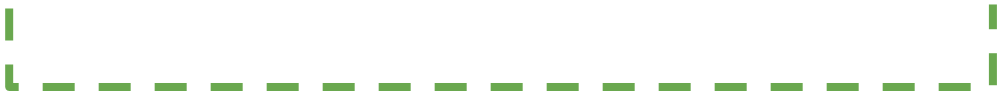
Department of Linguistics, Boğaziçi University

Everything available @ utkuturk.com/ma

- slides
- abstract
- thesis pdf
- graphs
- code

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 *cabinets* **were** rusty.

(Wagers et al., 2009)

Agreement Attraction **[Empirical Findings]**

PP > RC Attraction

Morpho-phonology

Linear Distance Effects

Syntactic Distance Effects

Grammaticality Asymmetry

Distributivity Effects

Clause-external attractors

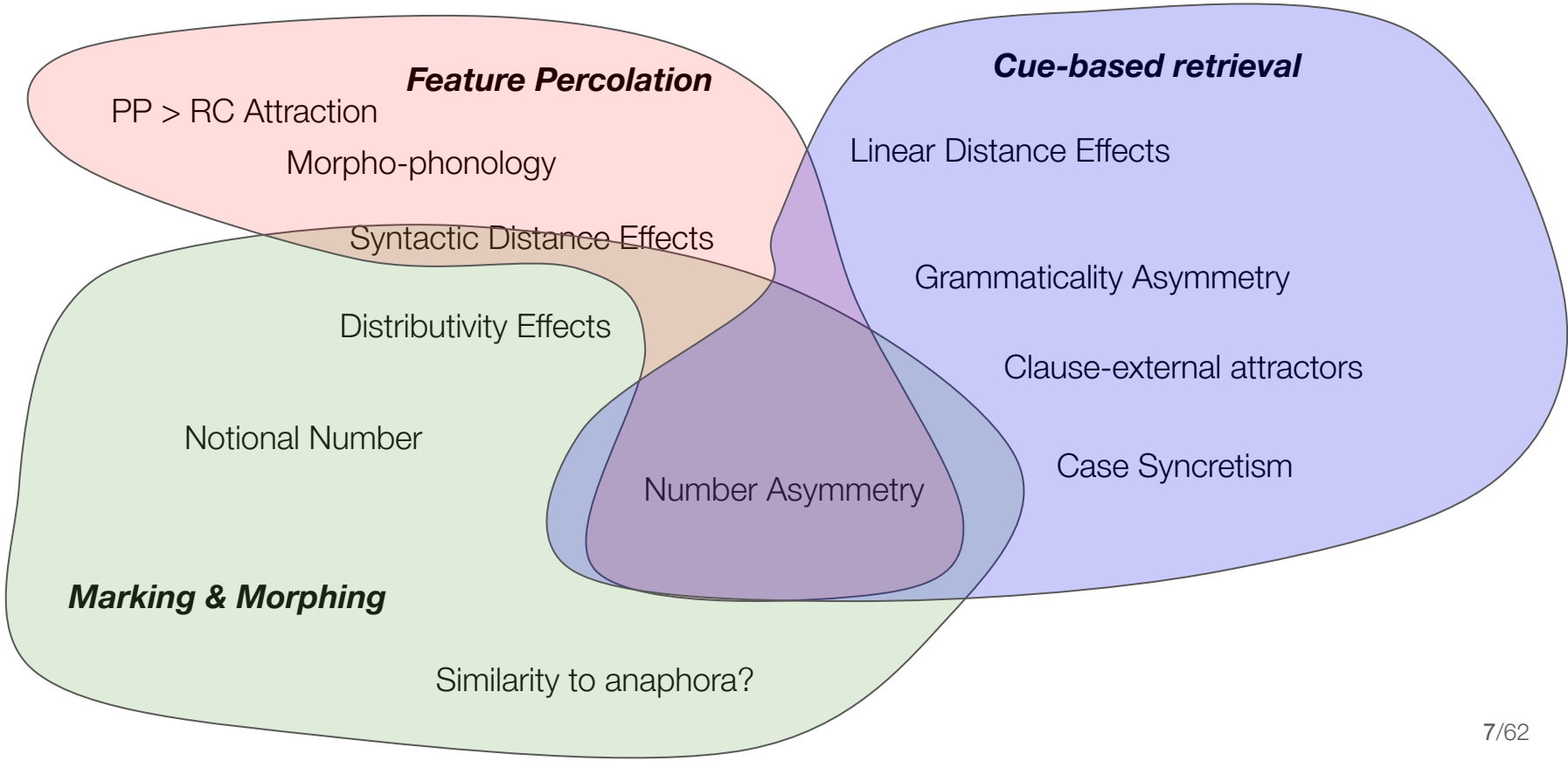
Notional Number

Case Syncretism

Number Asymmetry

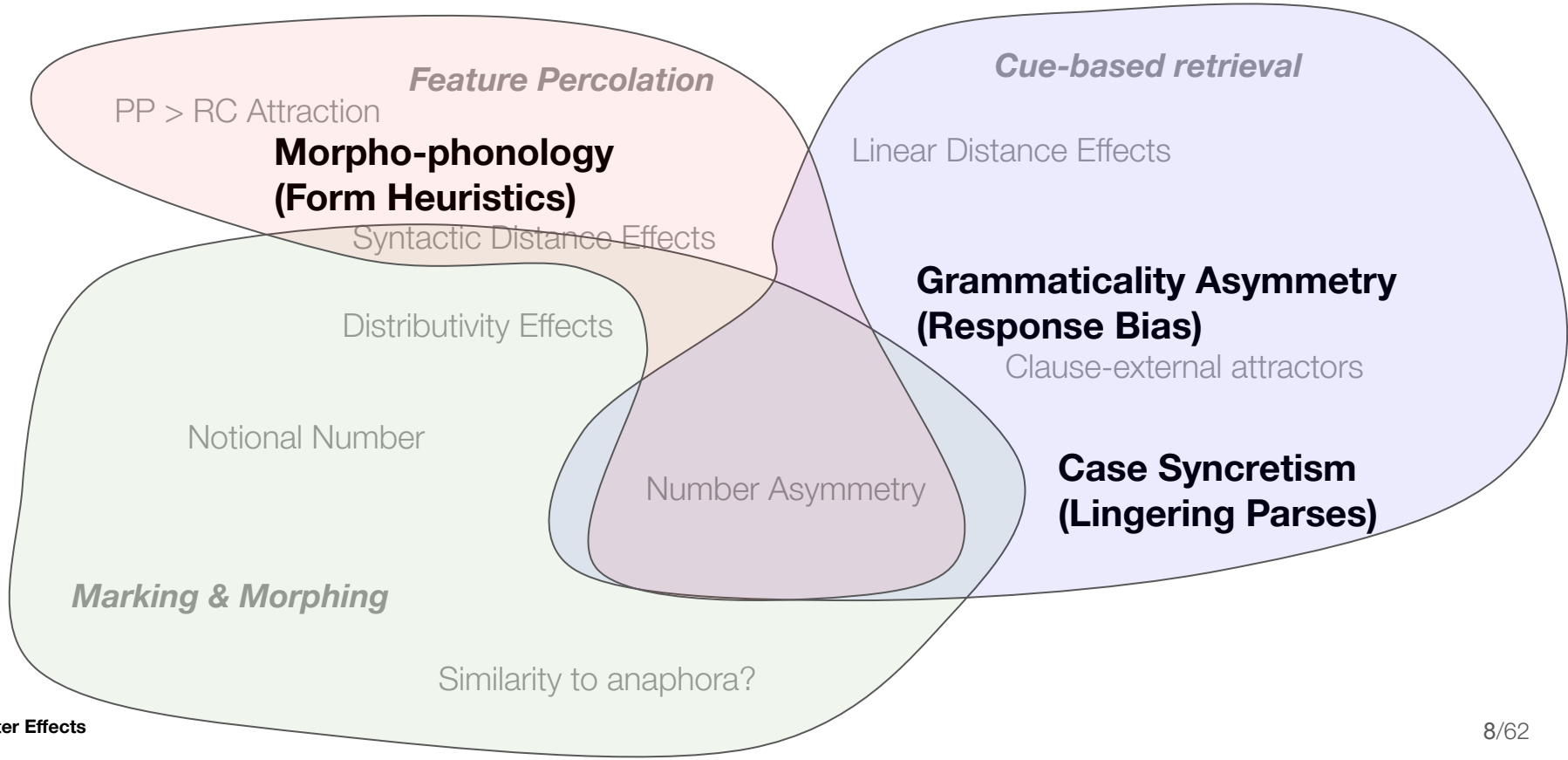
Similarity to anaphora?

Agreement Attraction [Empirical Findings]



Agreement Attraction

[What took me 5 years?*]



*Register Effects

Agreement Attraction

[Turkish]

(Lago et al., 2019)

Agreement Attraction **[Turkish]**

(4) a. * [*Teknisyen-ler-in* eğitmen-i] olağanüstü hızlı koş-tu-lar.
technician-PL-GEN instructor-POSS extraordinarily fast run-PST-PL
*The instructor of *the technicians* run_{PL} extraordinarily fast.

b. * *Teknisyenin* eğitmeni olağanüstü hızlı koştular.

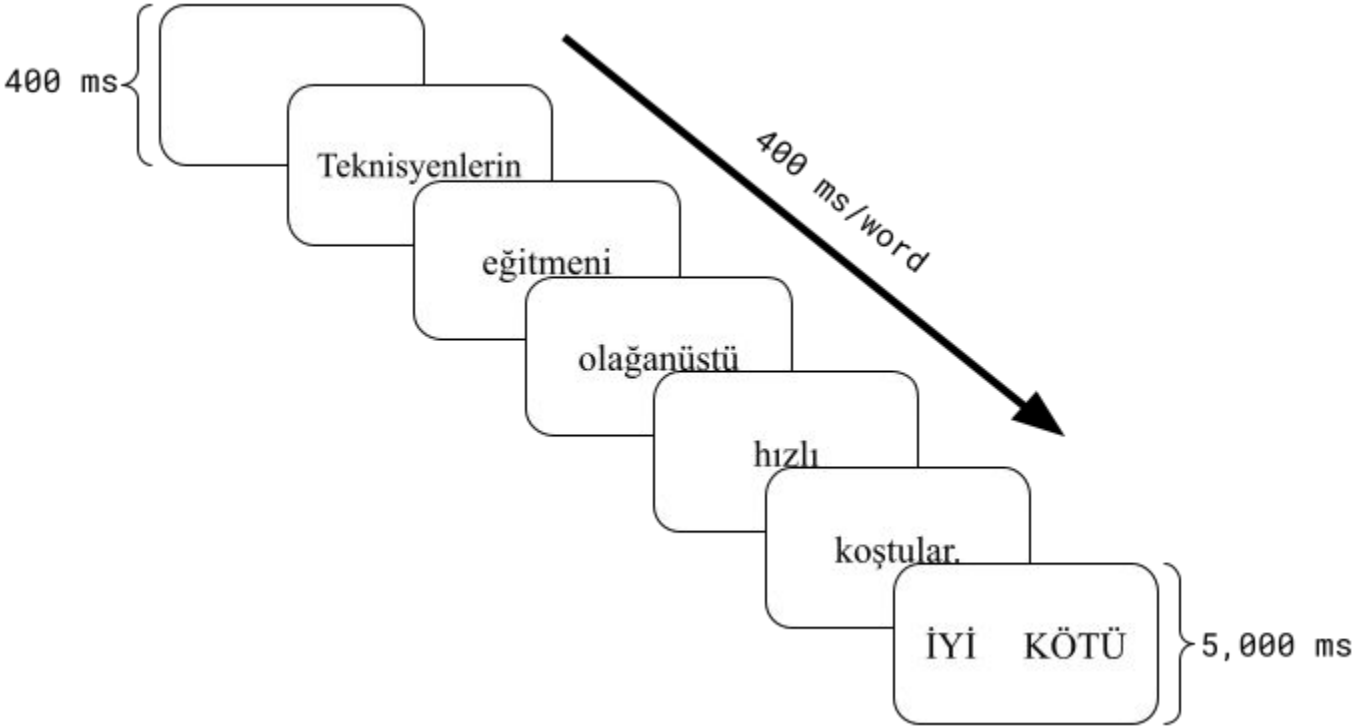
c. *Teknisyenlerin* eğitmeni olağanüstü hızlı koştu.

d. *Teknisyenin* eğitmeni olağanüstü hızlı koştu.

(Lago et al., 2019)

Agreement Attraction

[Turkish]



(Lago et al., 2019)

Agreement Attraction **[Turkish]**

(4) a. * [*Teknisyen-ler-in* eğitmen-i] olağanüstü hızlı koş-tu-lar.
technician-PL-GEN instructor-POSS extraordinarily fast run-PST-PL
*The instructor of *the technicians* run$_{PL}$ extraordinarily fast.

b. * *Teknisyenin* eğitmeni olağanüstü hızlı koştular.

c. *Teknisyenlerin* eğitmeni olağanüstü hızlı koştu.

d. *Teknisyenin* eğitmeni olağanüstü hızlı koştu.

➔ Increased acceptability of ungrammatical sentences with plural *attractors*

(Lago et al., 2019)

Experiment 1: Case Syncretism

! All head nouns were locally ambiguous

Experiment 1: Case Syncretism

! All head nouns were locally ambiguous

(5) a. *Teknisyen-ler-in* eğitmen-i
technician-PL-GEN instructor-POSS/ACC

Experiment 1: Case Syncretism

! All head nouns were locally ambiguous

(5) a. *Teknisyen-ler-in* eğitmen-i
technician-PL-GEN instructor-POSS/ACC

b. [*Teknisyen-ler-in* eğitmen-i] olağanüstü hızlı koş-tu.
technician-PL-GEN instructor-POSS extraordinarily fast run-PST
The instructor of *the technicians* run extraordinarily fast.

c. [Teknisyen-ler-in eğitmen-i gör-düğ-ün-ü] bil-iyor-um.
technician-PL-GEN instructor-ACC see-NMLZ-POSS-ACC know-IMPF-1SG
I know that the technician saw the instructor.

Experiment 1: Case Syncretism **[Hypothesis]**

Lingering effects of an erroneous parse

(Ferreria, 2003; Staub, 2007)

Experiment 1: Case Syncretism **[Hypothesis]**

Lingering effects of an erroneous parse

NP2's reduced association with subjecthood

(Ferreria, 2003; Staub, 2007)

Experiment 1: Case Syncretism

[Method]

Our Goal: Replicate Lago et al.'s findings with disambiguated (vowel-ending) head nouns.

- Speeded Acceptability Judgment, N = 118
- Within-subject factors: *Verb x Attractor number*

(6) 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.

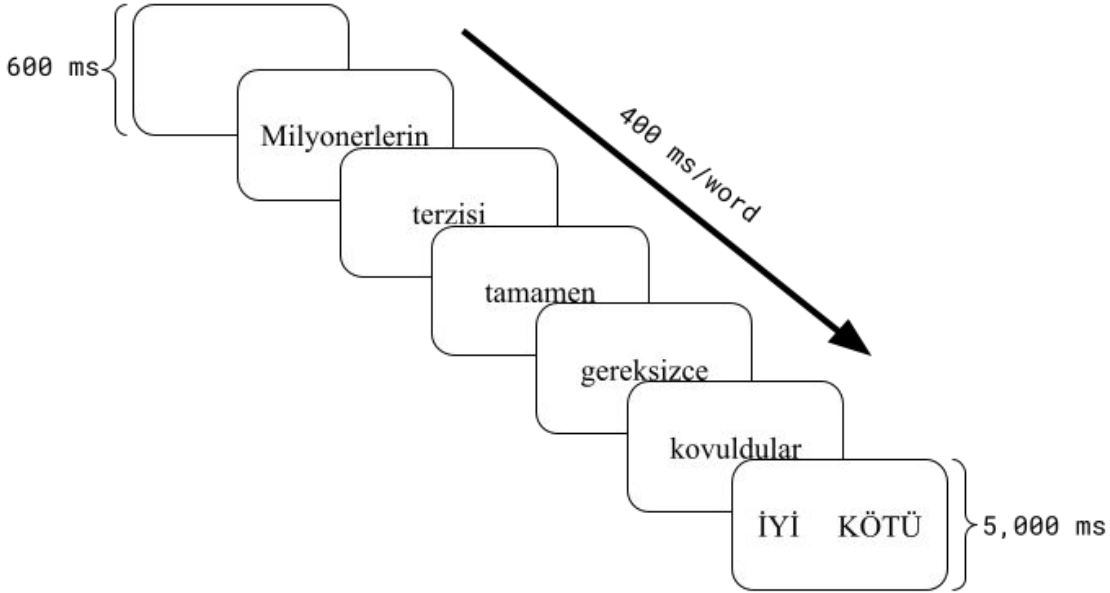
c. *Milyonerlerin* terzisi tamamen gereksizce kovuldu.

d. *Milyonerin* terzisi tamamen gereksizce kovuldu.

Experiment 1: Case Syncretism

[Method]

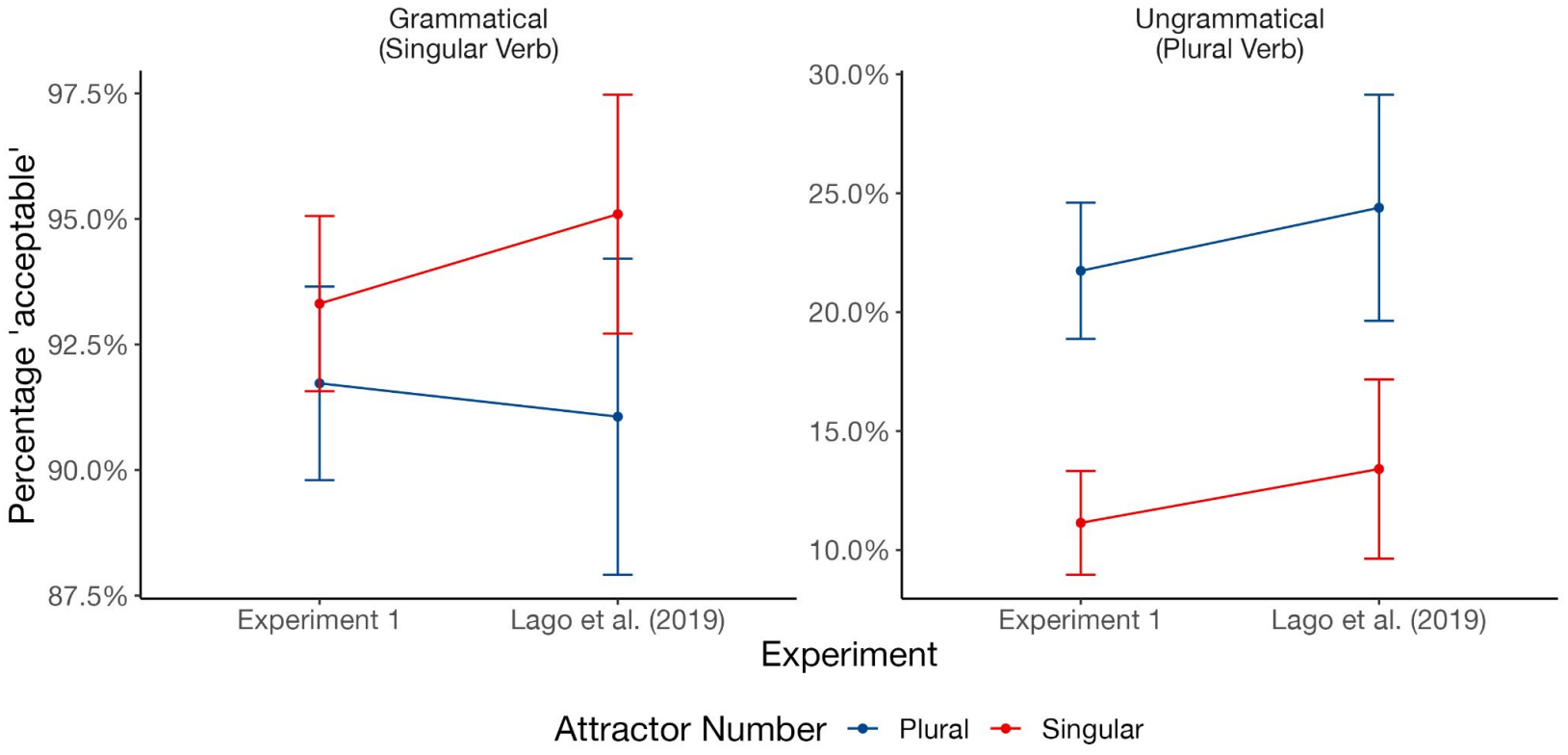
Our Goal: Replicate Lago et al.'s findings with disambiguated (vowel-ending) head nouns.



- Speeded Acceptability Judgment, N = 118
- Within-subject factors: *Verb x Attractor number*

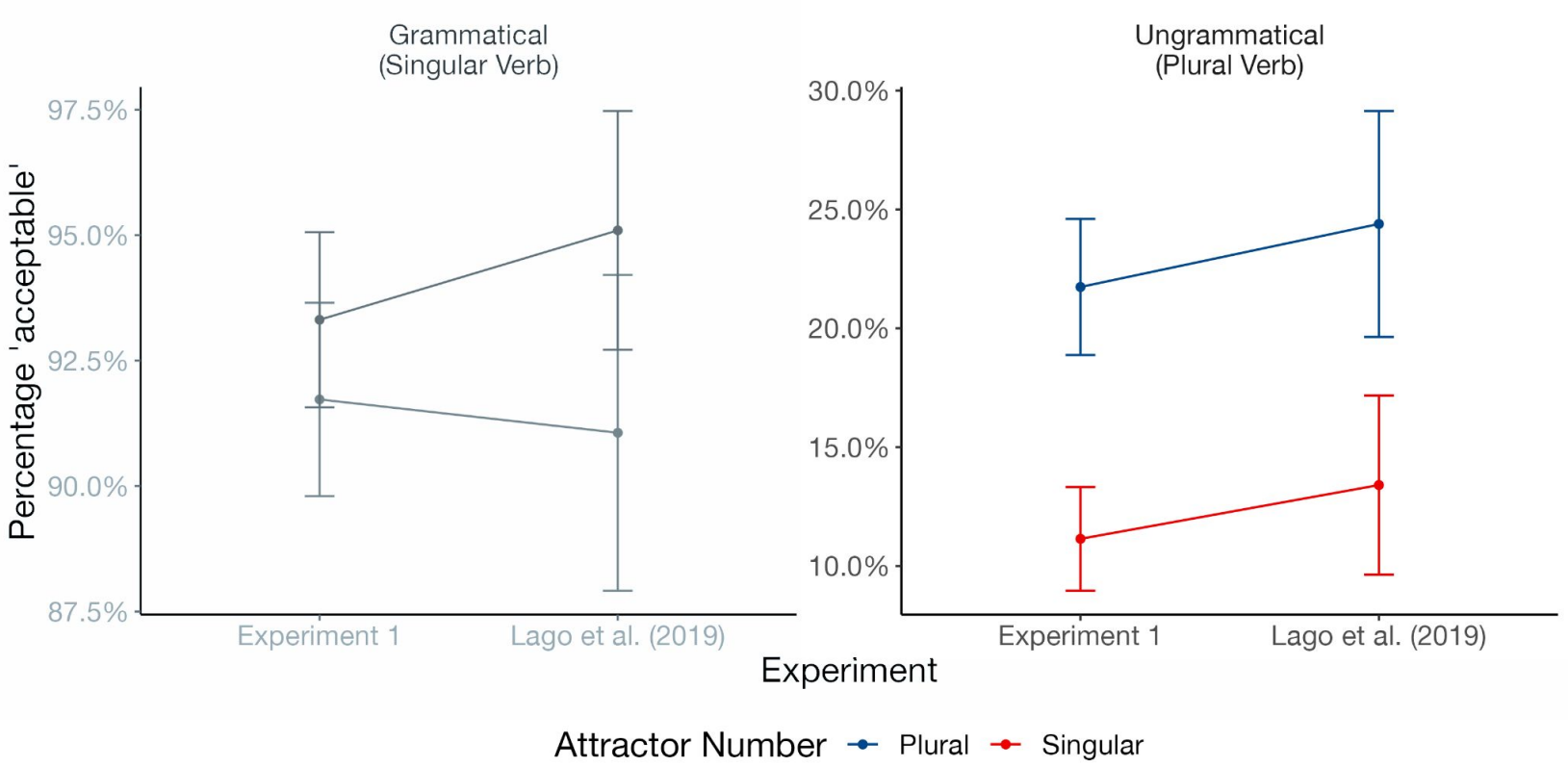
Experiment 1: Case Syncretism

[Results]



(Cousineau, 2005; Morey, 2008)

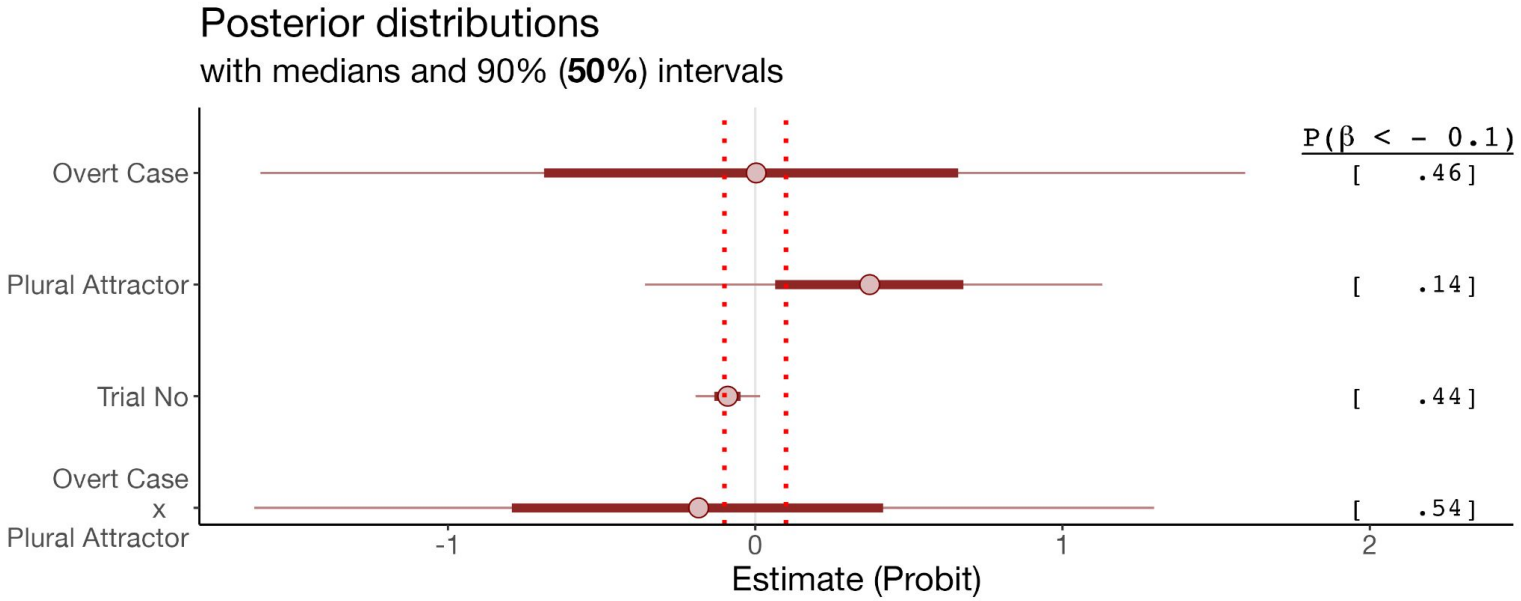
Experiment 1: Case Syncretism **[Results]**



(Cousineau, 2005; Morey, 2008)

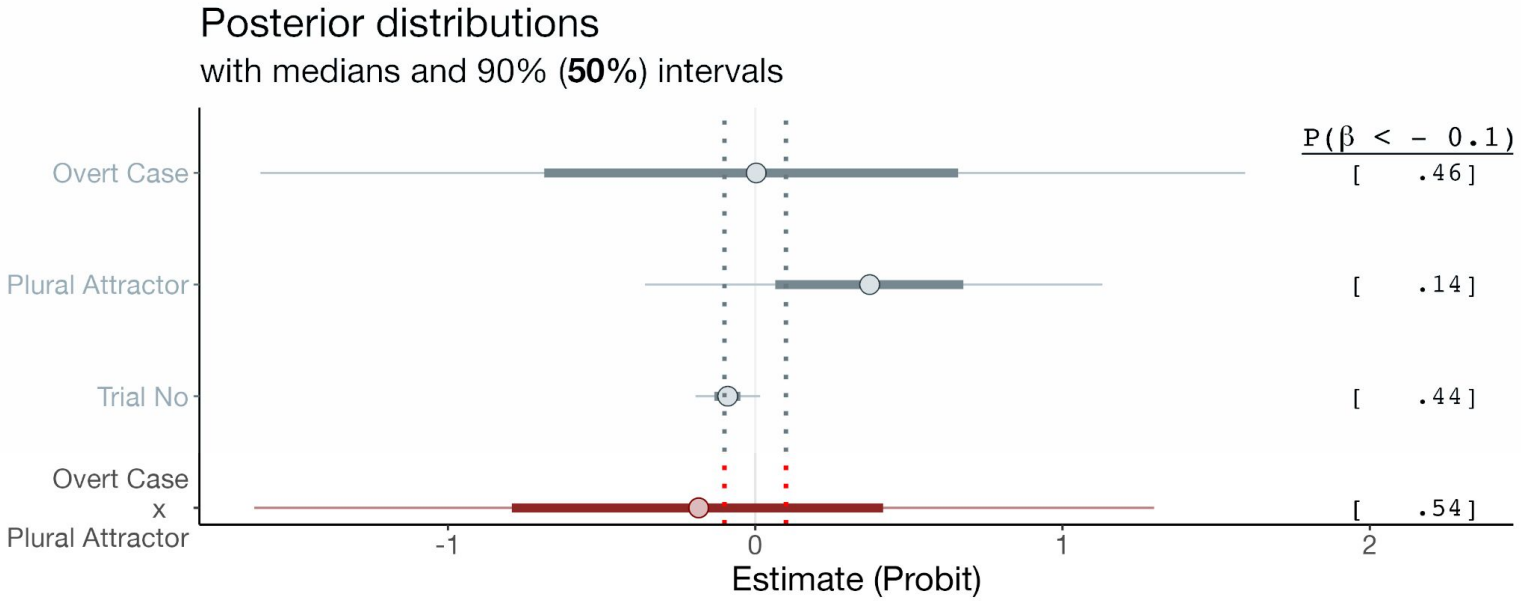
Experiment 1: Case Syncretism **[Modeling]**

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



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

Experiment 1: Case Syncretism **[Modeling]**



➔ Disambiguating case did not impact responses in ungrammatical sentences

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

Experiment 1: Case Syncretism **[Take-away]**

∴ Lingering parses do not affect agreement attraction

∴ Case cues do not play a role in agreement attraction

∴ Turkish agreement attraction is not due to case syncretism

Experiment 2A: Form Heuristics

Experiment 2A: Form Heuristics

! Unlike other languages, Turkish has matching **plural** markings

(7) * [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.

Experiment 2A: Form Heuristics **[Hypothesis]**

Participants use heuristics to make informed guesses

(Copeland & Radvansky, 2001; Ferreria, 2003)

Experiment 2A: Form Heuristics

[Hypothesis]

Participants use heuristics to make informed guesses

Task-specific response strategy based on form

(Copeland & Radvansky, 2001; Ferreria, 2003)

Experiment 2A: Form Heuristics

[Method]

Our Goal: Rule out form-driven processing strategy with phi-unrelated plural marking as an attractor

- Speeded Acceptability Judgment, N = 80
- Within-subject factors: *Verb x Attractor number*

(6) a. * [*Tut-tuk-lar-ı* aşçı] mutfak-ta sürekli zıpla-dı-lar.
hire-NMLZ-PL-POSS cook kitchen-LOC non_stop jump-PST-PL
*The cook *that (they) hired*$_{PL}$ jumped$_{PL}$ in the kitchen non-stop.

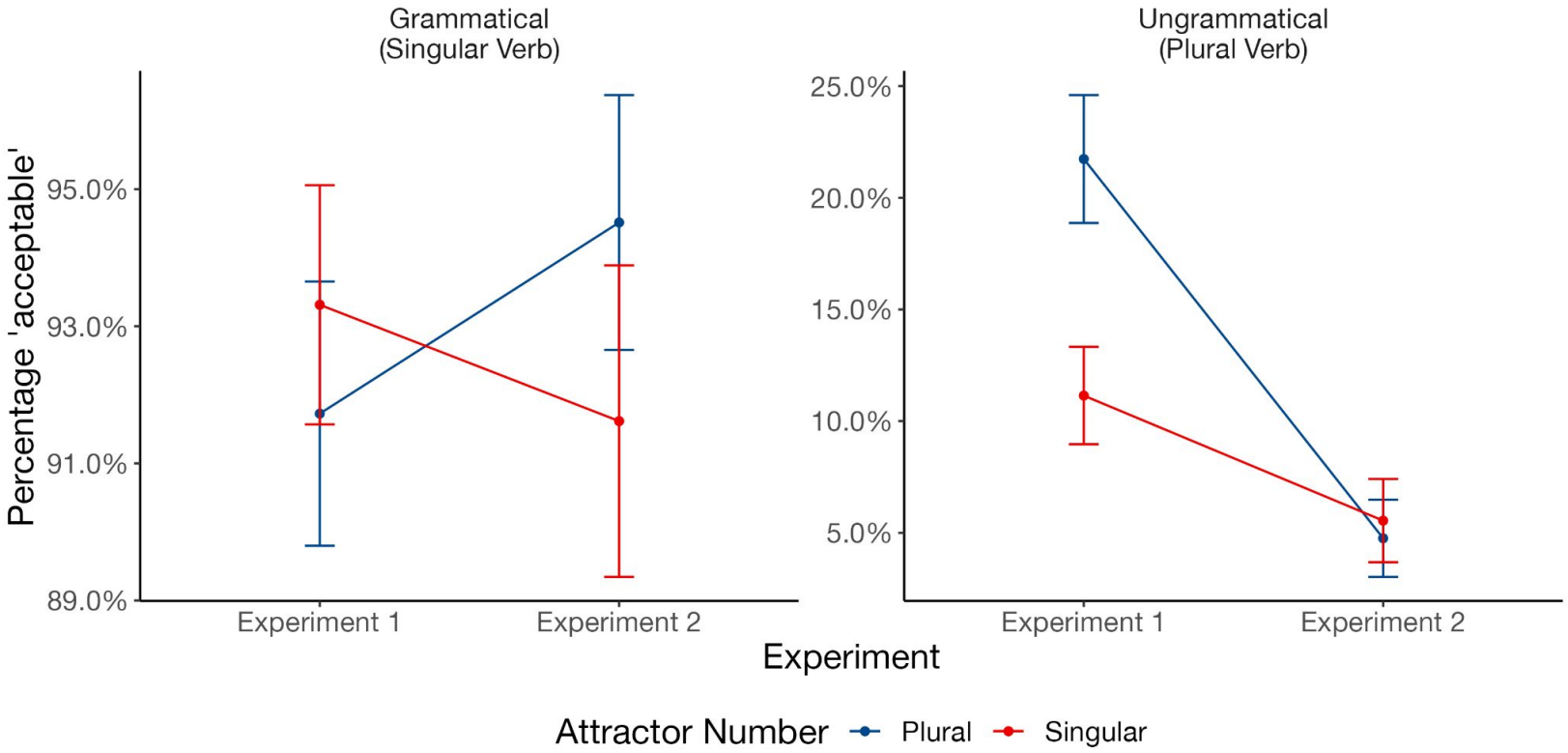
b. * *Tuttuğu* aşçı mutfakta sürekli zıpladılar.

c. *Tuttukları* aşçı mutfakta sürekli zıpladı.

d. *Tuttuğu* aşçı mutfakta sürekli zıpladı.

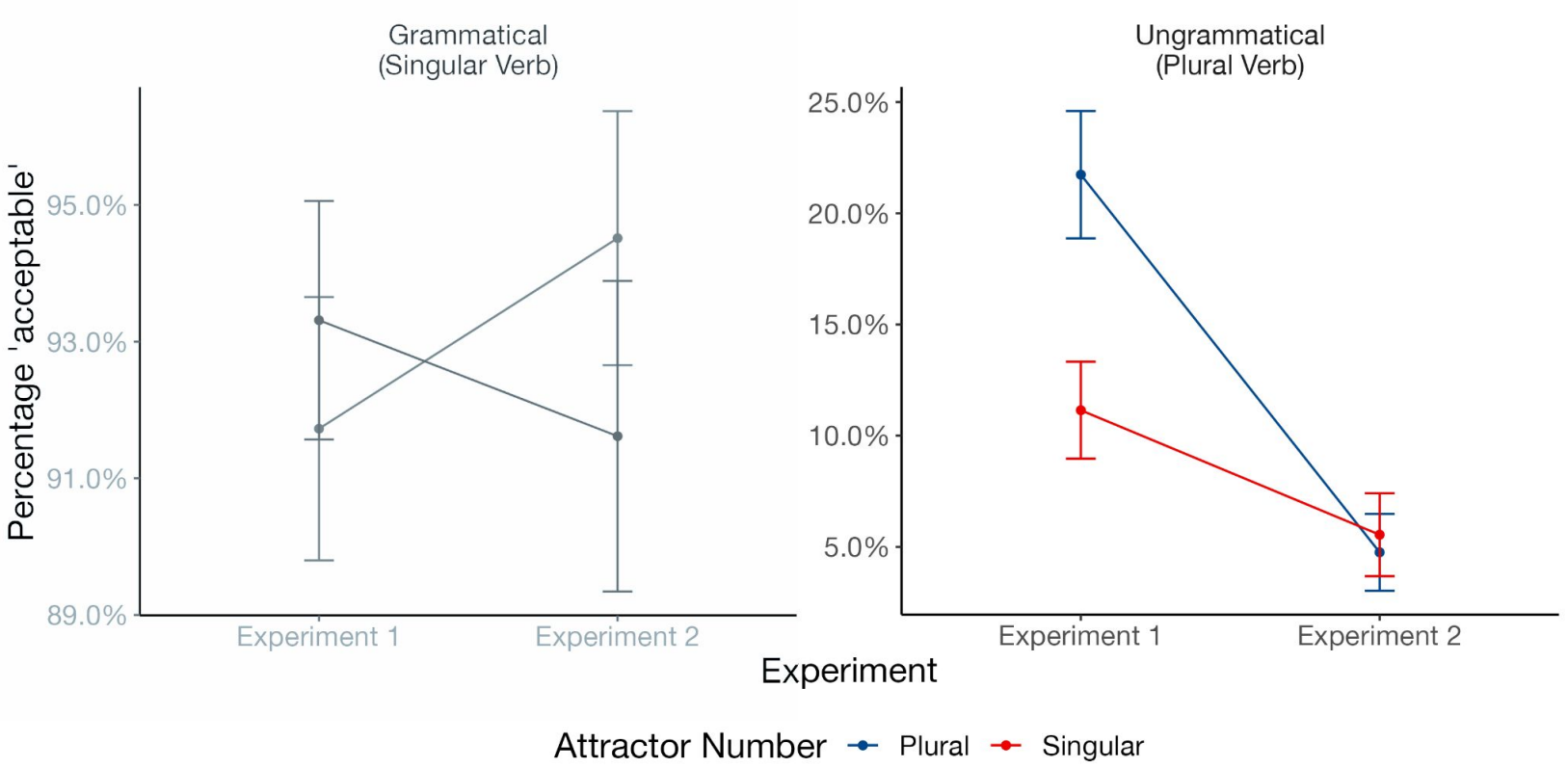
Experiment 2A: Form Heuristics

[Results]



(Cousineau, 2005; Morey, 2008)

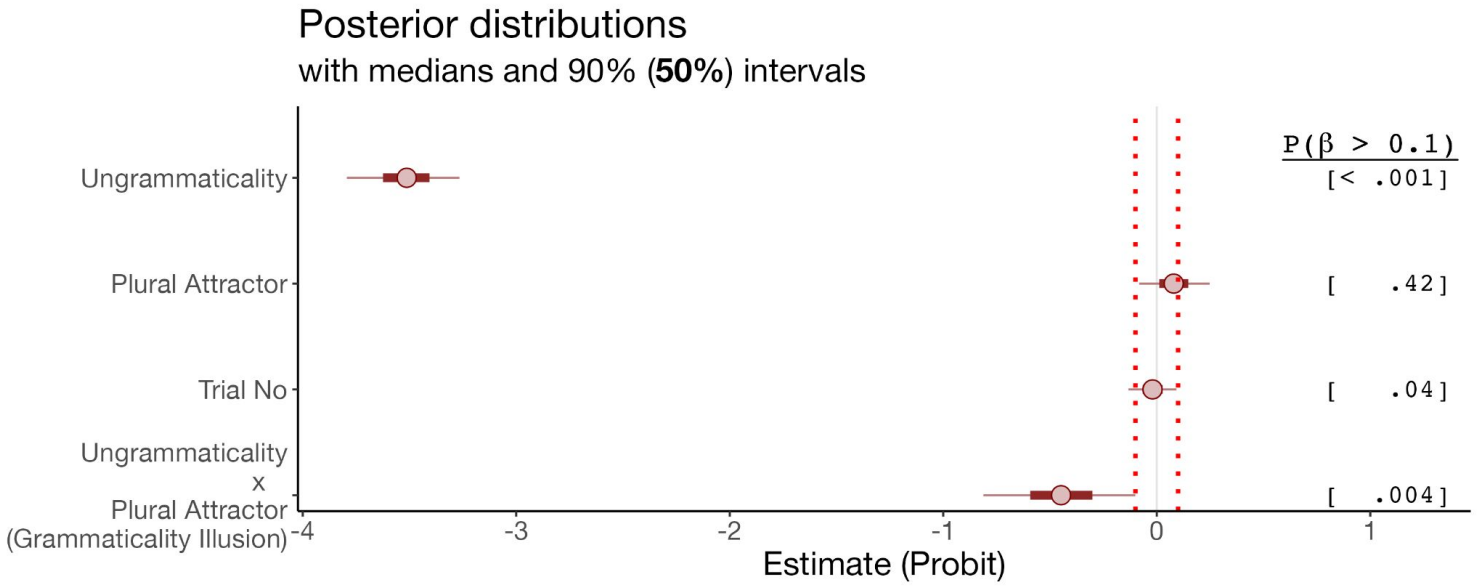
Experiment 2A: Form Heuristics **[Results]**



(Cousineau, 2005; Morey, 2008)

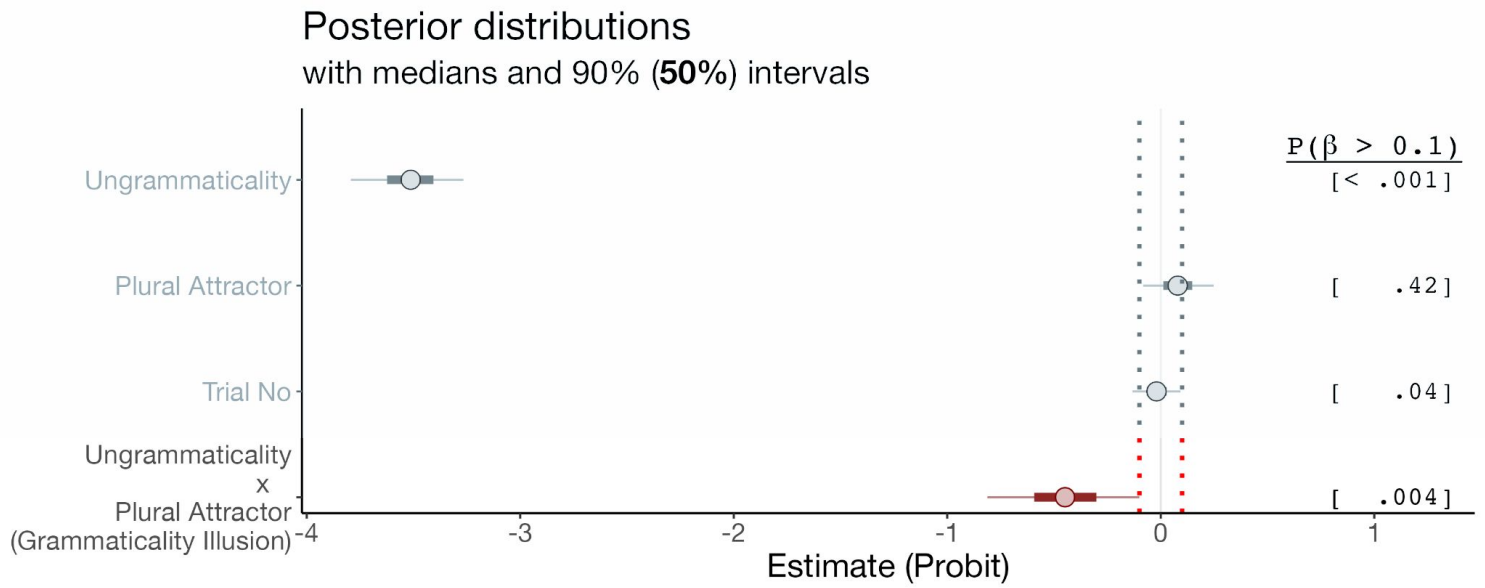
Experiment 2A: Form Heuristics **[Modelling]**

- Fit a maximal Bayesian GLM to ‘yes’ responses to all experimental sentences



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

Experiment 2A: Form Heuristics **[Modelling]**



➔ Verbal attractors did not increase ‘yes’ responses in ungrammatical sentences

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

Experiment 2A: Form Heuristics **[Take-away]**

∴ It is not surface strings that comprehenders use looking for.

∴ Attraction occurs at the abstract feature level.

Experiment 2B: Form Heuristics

! Experiment 2A Assumption:
Participants correlate prior **plural** marking with grammaticality

! Not enough plural agreement to prime this bias.

Experiment 2B: Form Heuristics **[Method]**

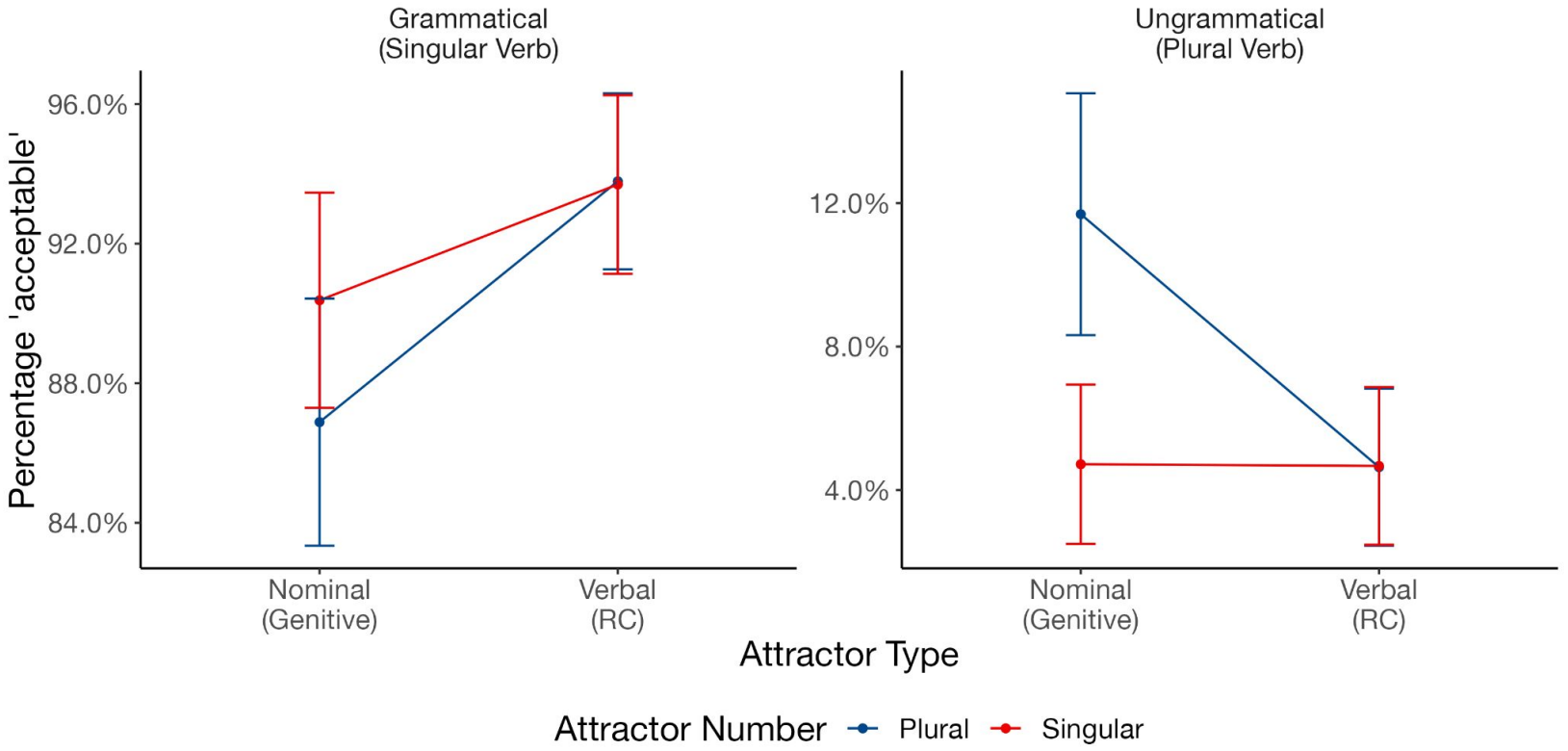
Our Goal: Replicate Experiment 2A with additional nominal attractor conditions

- Speeded Acceptability Judgment, N = 95
- Within-subject factors: *Verb x Attractor number x Attractor Type*

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

b. [*Tut-tuk-lar/∅-ı* aşçı] mutfak-ta sürekli zıpla-dı-lar/∅.
hire-NMLZ-PL/SG-POSS cook kitchen-LOC non_stop jump-PST-PL/SG
The cook *that (they) hired*$_{PL/SG}$ jumped$_{PL/SG}$ in the kitchen non-stop.

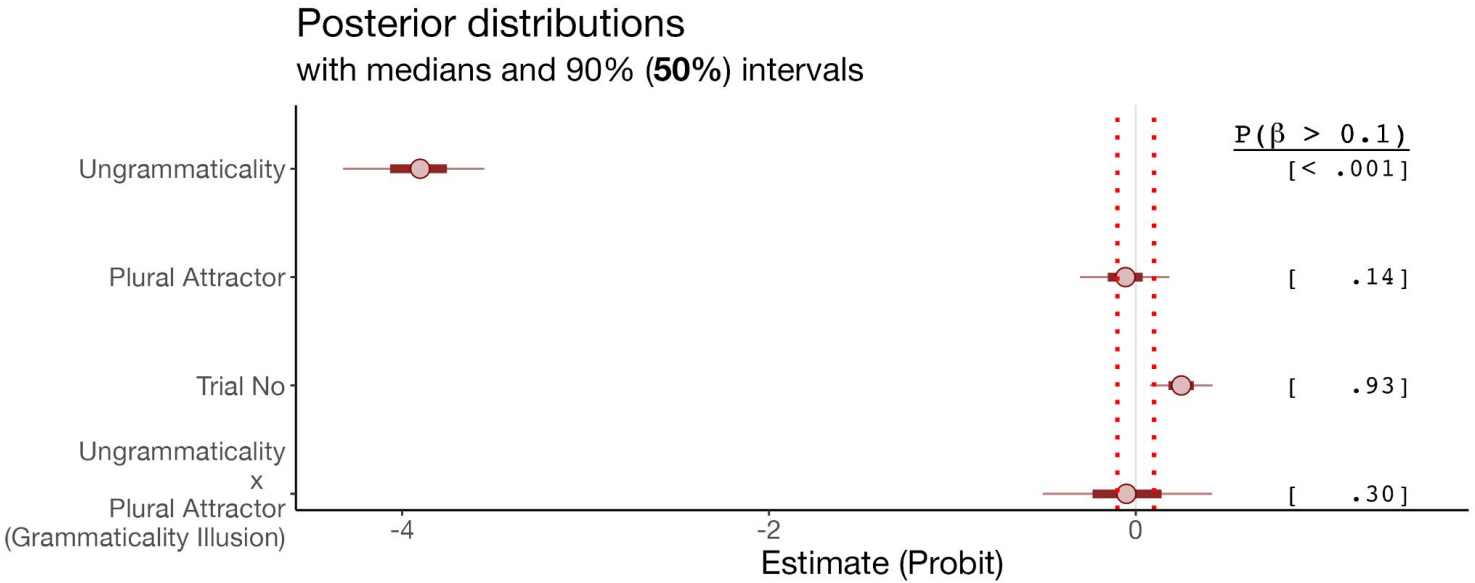
Experiment 2B: Form Heuristics **[Results]**



(Cousineau, 2005; Morey, 2008)

Experiment 2B: Form Heuristics **[Modeling]**

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



➔ Verbal attractors did not increase ‘yes’ responses in ungrammatical sentences

➔ We verified Experiment 2A results

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

Experiment 3: Grammaticality Asymmetry

Experiment 3: Grammaticality Asymmetry

*The key to the *cabinets* were rusty.

The key to the *cabinets* was rusty.

(Wagers et al., 2009)

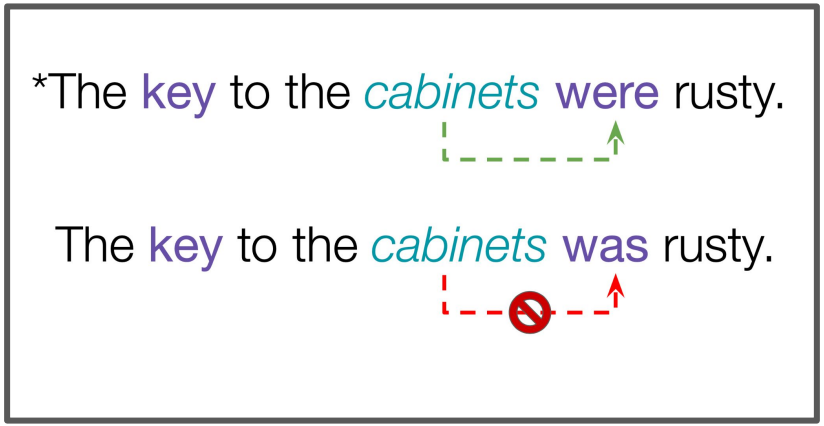
Experiment 3: Grammaticality Asymmetry

*The key to the *cabinets* were rusty.

The key to the *cabinets* was rusty.

(Wagers et al., 2009)

Experiment 3: Grammaticality Asymmetry



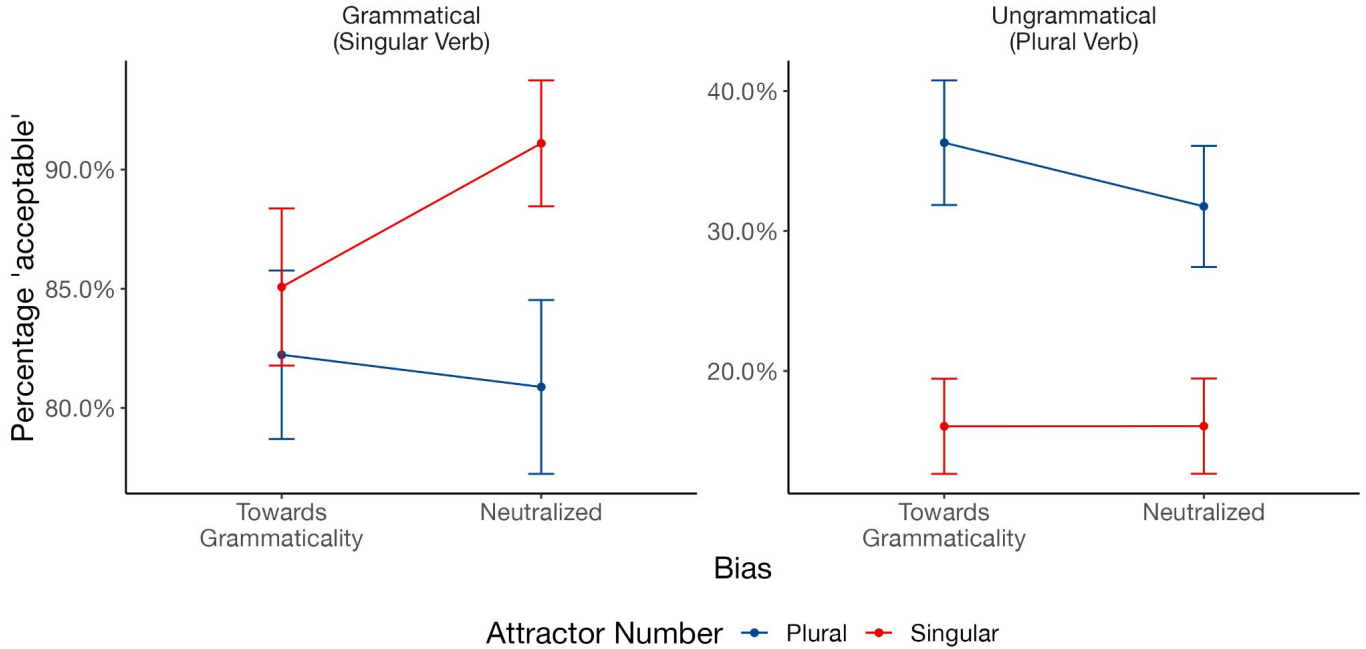
Retrieval accounts ✅

Representational accounts ❌

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

Experiment 3: Grammaticality Asymmetry **[Bias]**

- Hammerly et al.: Grammaticality asymmetry due to response bias
- Hammerly et al.: People have *a priori* grammaticality bias

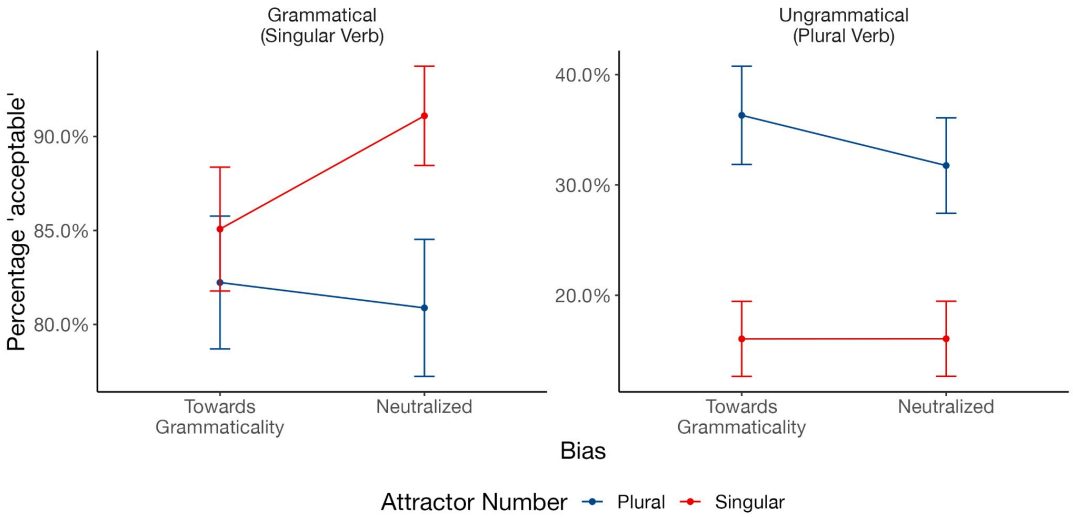


(Cousineau, 2005; Macmillan & Creelman, 2005; Morey, 2008)

Experiment 3: Grammaticality Asymmetry **[Bias]**

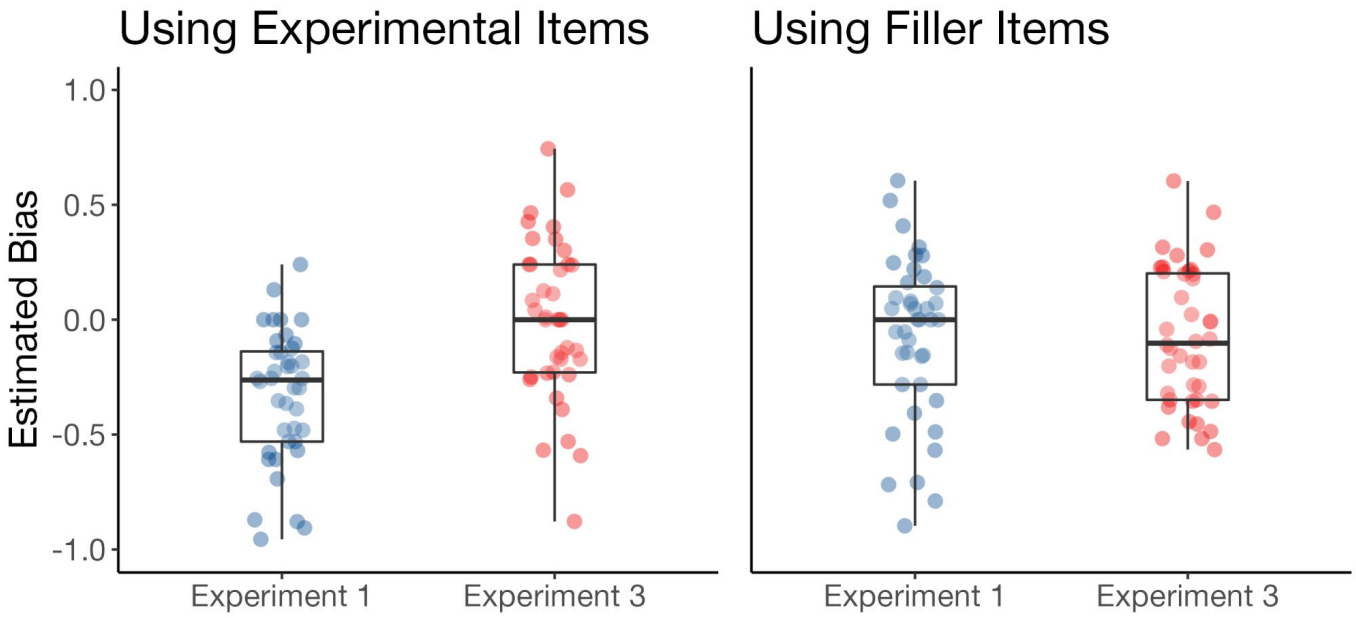
- Equation:

$$-\frac{Z(\textit{Hit Rate}) + Z(\textit{False Alarms})}{2}$$



Experiment 3: Grammaticality Asymmetry **[Bias]**

- Bias Estimates of the participants:



Experiment 3: Grammaticality Asymmetry **[Method]**

Our Goal: Replicate Hammerly et al.'s findings in another language with another construction

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

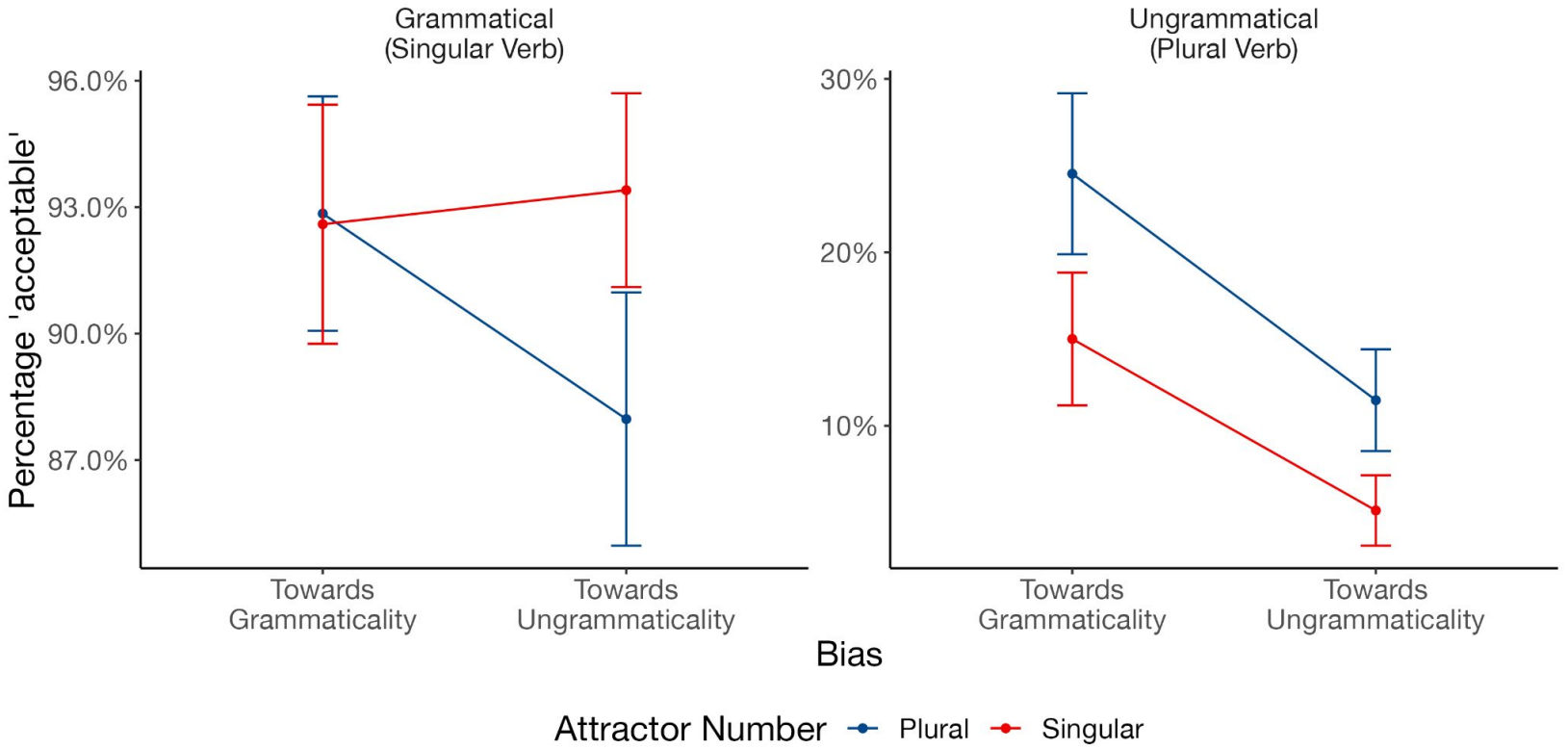
(10) a. * [*Milyoner-ler-in* terzi-si] tamamen gereksizce kov-ul-du-lar.
millionaire-PL-GEN tailor-POSS completely without_reason fire-PASS-PST-PL
*The tailor of *the millionaires* were fired for no reason at all.

b. * *Milyonerin* terzisi tamamen gereksizce kovuldular.

c. *Milyonerlerin* terzisi tamamen gereksizce kovuldu.

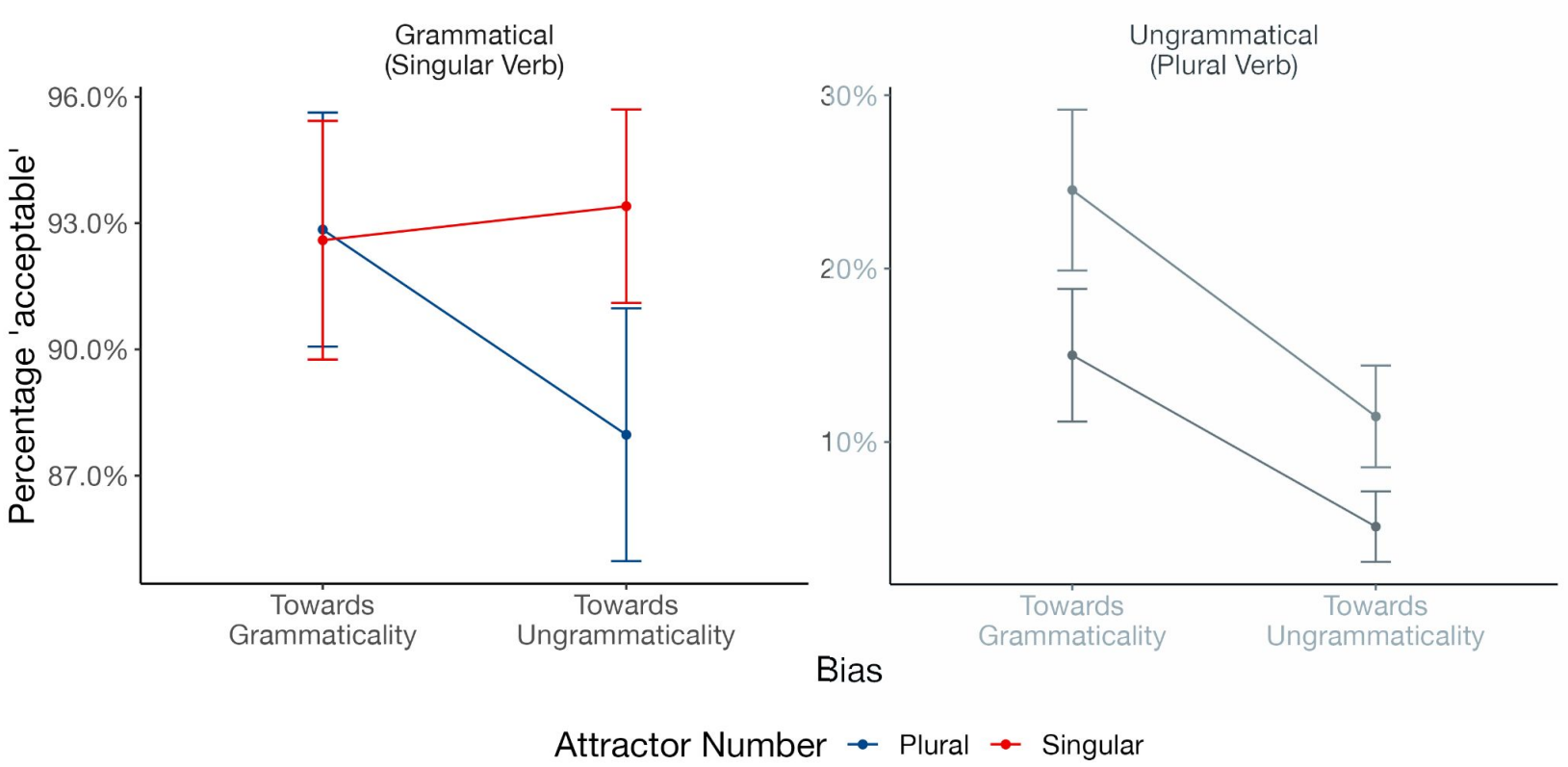
d. *Milyonerin* terzisi tamamen gereksizce kovuldu.

Experiment 3: Grammaticality Asymmetry **[Results]**



(Cousineau, 2005; Macmillan & Creelman, 2005; Morey, 2008)

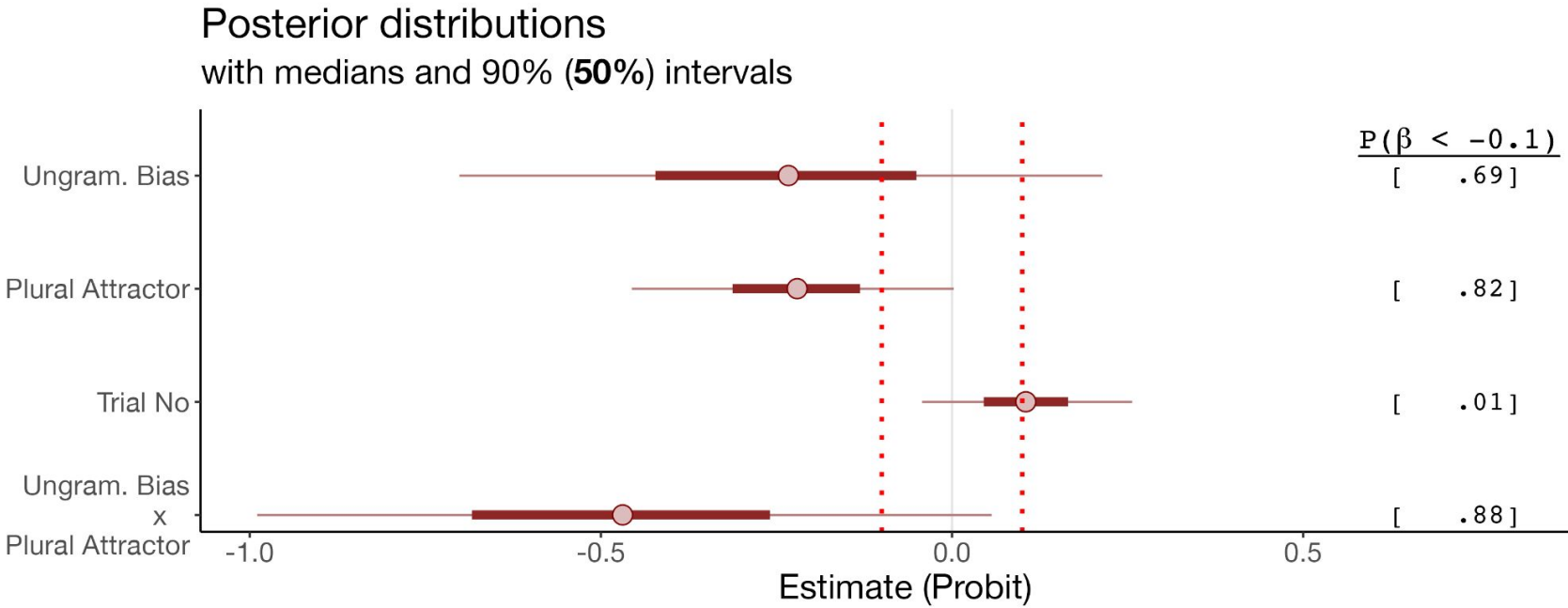
Experiment 3: Grammaticality Asymmetry **[Results]**



(Cousineau, 2005; Macmillan & Creelman, 2005; Morey, 2008)

Experiment 3: Grammaticality Asymmetry **[Modeling]**

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



➔ The effect of plural attractor is more pronounced in people with ungrammaticality bias in grammatical sentences

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

Experiment 3: Grammaticality Asymmetry **[Take-away]**

∴ We were able to replicate theoretically significant findings of Hammerly et al. (2019).

∴ Grammaticality asymmetry is due to response bias

Conclusion

➔ Case ambiguity does not play a role in attraction

➔ The attraction process is not driven by form

➔ Non-linguistics phenomenon, like bias, may impact attraction

Conclusion

	Predictions		
Phenomenon	Retrieval	Representational	Our Findings
Overt Case	✅	❌	❌
Form-Advantage	✅	❌	❌
Response Bias	❌	✅	✅

Thank you!

Selected References

Barr, D. J., Levy, R., Scheepers, C., & Tily, H. J. (2013). Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of memory and language*, *68*(3), 255-278.

Bock, K., & Miller, C. A. (1991). Broken agreement. *Cognitive Psychology*, *23*(1), 45–93.

Cousineau, D., et al. (2005). Confidence intervals in within-subject designs: A simpler solution to loftus and massons method. *Tutorials in quantitative methods for psychology*, *1*(1), 42–45.

Eberhard, K. M., Cutting, J. C., & Bock, K. (2005). Making syntax of sense: number agreement in sentence production. *Psychological review*, *112*(3), 531.

Ferreira, F. (2003). The misinterpretation of noncanonical sentences. *Cognitive psychology*, *47*(2), 164-203.

Hammerly, C., Staub, A., & Dillon, B. (2019). The grammaticality asymmetry in agreement attraction reflects response bias: Experimental and modeling evidence. *Cognitive psychology*, *110*, 70-104.

Kruschke, J. K. (2018). Rejecting or accepting parameter values in Bayesian estimation. *Advances in methods and practices in psychological science*, *1*(2), 270-280.

Lago, S., Gracanin-Yuksek, M., Şafak, D. F., Demir, O., Kırkıcı, B., & Felser, C. (2019). Straight from the horse's mouth: Agreement attraction effects with Turkish possessors [Journal Article]. *Linguistic Approaches to Bilingualism*, *9*(3), 398–426. doi: https://doi.org/ 10.1075/lab.17019.lag

Macmillan, N. A., & Creelman, C. D. (2004). *Detection theory: A user's guide*. Psychology press.

Morey, R. D., et al. (2008). Confidence intervals from normalized data: A correction to cousineau (2005). *Reason*, *4*(2), 61–64.

Nicenboim, B., & Vasishth, S. (2016). Statistical methods for linguistic research: Foundational Ideas—Part II. *Language and Linguistics Compass*, *10*(11), 591-613.

Staub, A. (2007). The return of the repressed: Abandoned parses facilitate syntactic reanalysis. *Journal of memory and language*, *57*(2), 299-323.

Wagers, M. W., Lau, E. F., & Phillips, C. (2009). Agreement attraction in comprehension: Representations and processes. *Journal of Memory and Language*, *61*(2), 206-237.

Appendix A: Experiment 4

Experiment 4: Register

[Hypothesis]

Participants create a formal context due to NP1-NP2 relation

Possible formal readings license spurious *-lars*

(Copeland & Radvansky, 2001; Ferreria, 2003)

Experiment 4: Register

[Method]

Our Goal: Rule out a possible formal reading with the use of a post-verbal slang

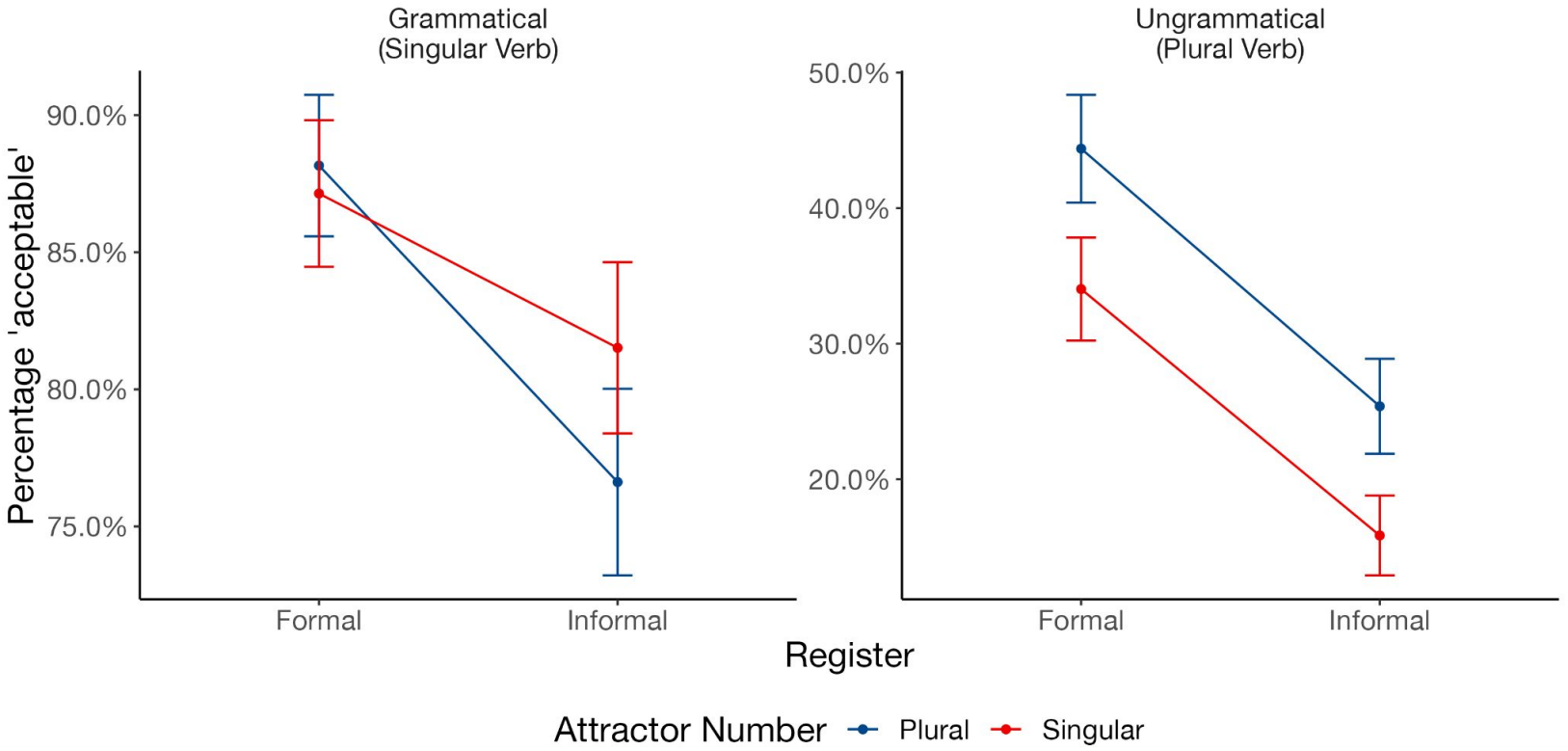
- Speeded Acceptability Judgment, N = 174
- Within-subject factors: *Verb x Attractor number x Register*

(11) a. [*Milyoner-ler/∅-in* terzi-si] tamamen gereksizce kov-ul-du-lar/∅, efendim.
millionaire-PL/SG-GEN tailor-POSS completely without_reason fire-PASS-PST-PL/SG sir
Sir, the tailor of *the millionaire(s)* was/were fired for no reason at all.

b. [*Milyoner-ler/∅-in* terzi-si] tamamen gereksizce kov-ul-du-lar/∅ lan.
millionaire-PL/SG-GEN tailor-POSS completely without_reason fire-PASS-PST-PL/SG yo
Yo, the tailor of *the millionaire(s)* was/were fired for no reason at all.

Experiment 4: Register

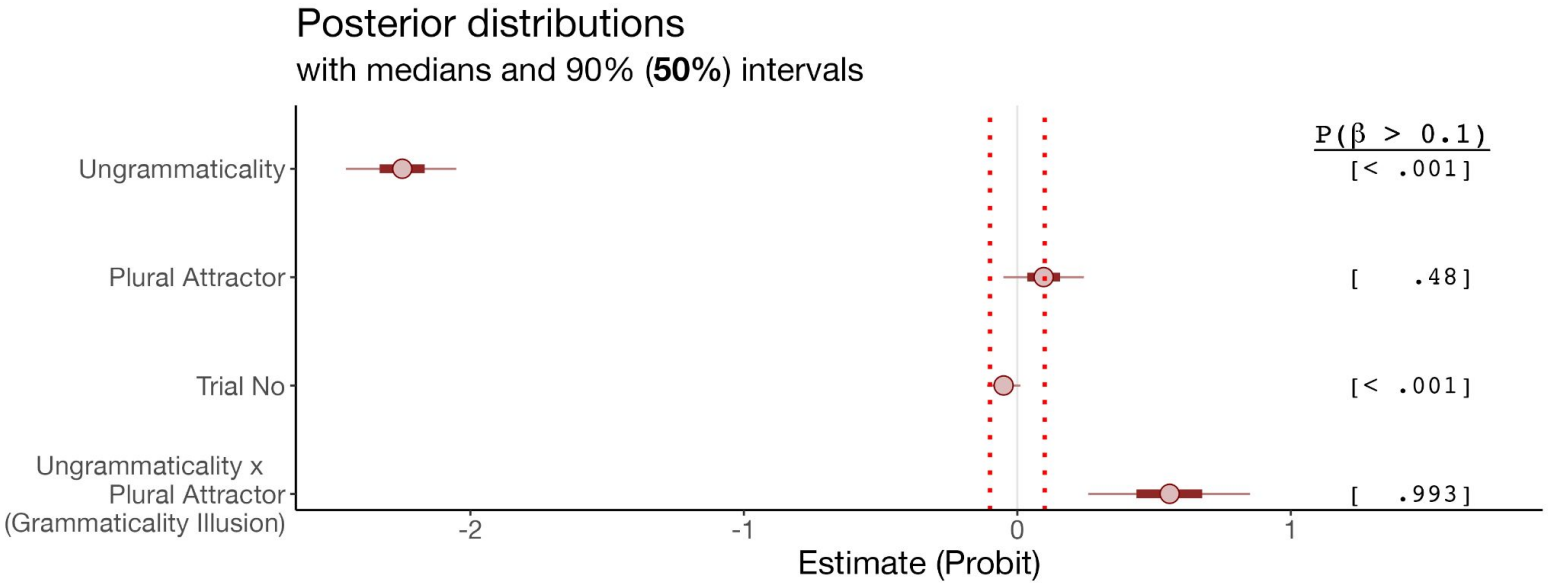
[Results]



(Cousineau, 2005; Morey, 2008)

Experiment 4: Register **[Modeling]**

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

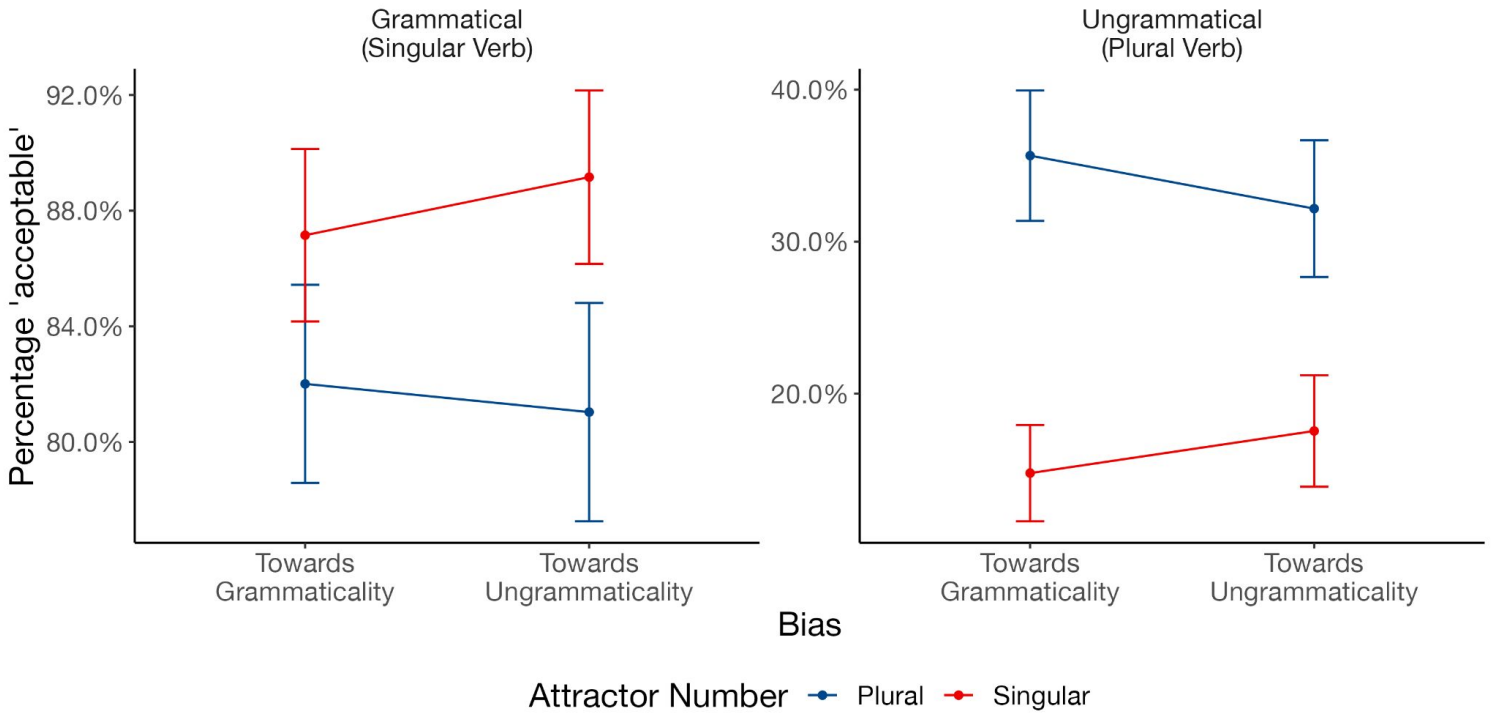


➔ A clear interaction between ungrammaticality and attractor number.

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

Appendix B: Bias Meta-Analysis

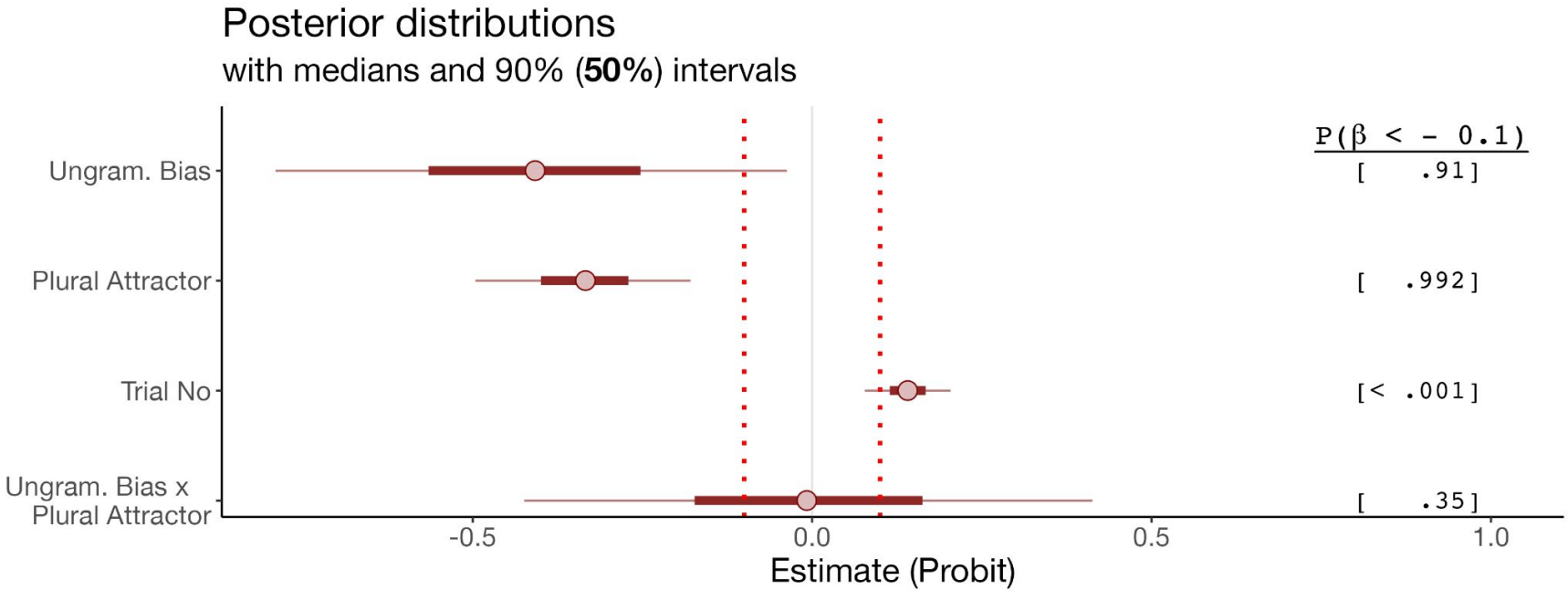
Hammerly et al. (2019) **[Modeling]**



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

Hammerly et al. (2019) **[Modeling]**

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



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