BOĞAZİÇİ UNIVERSITY
The Department of Linguistics

The Role of Shallow Processing in Agreement Attraction

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Understanding Agreement

◇ Agreement is susceptible to certain illusions as in (1).

(1) [The sheer **weight** [of all these figures]] **make** them harder to understand.

—Ronald Reagan

$\diamond$ Not just wild mistakes but characteristic errors.[1]

$\diamond$ Experimentally first elicited by Bock and Miller (1991) in production.
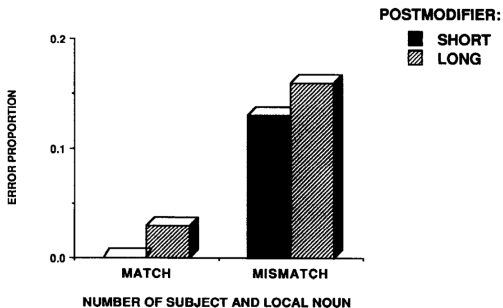
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[1] Jespersen (1913); Francis (1986); Quirk (1985)

Bock and Miller (1991): In Production

🔊 **SPEAKER:** The **key** to the cabinets ...
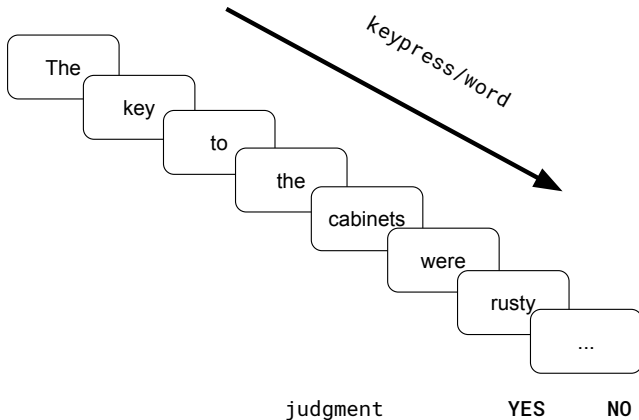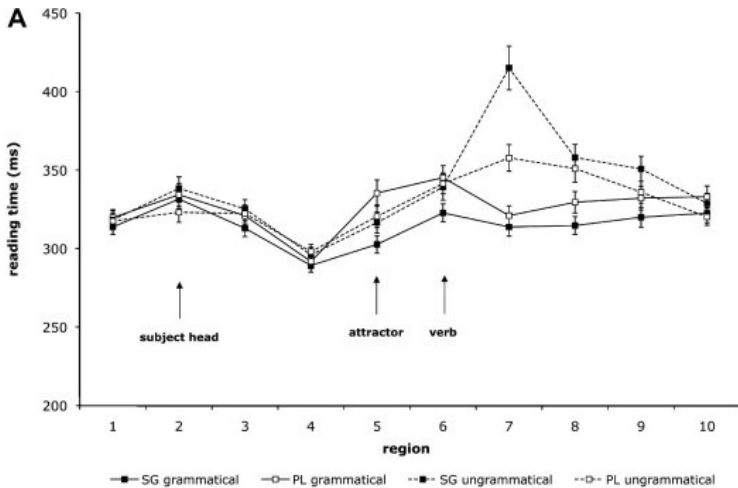
🗣 **PARTICIPANT:**　　　　　... **are** rusty.

(2) [The **key** [to the cabinets]] **were** rusty from many years of disuse.

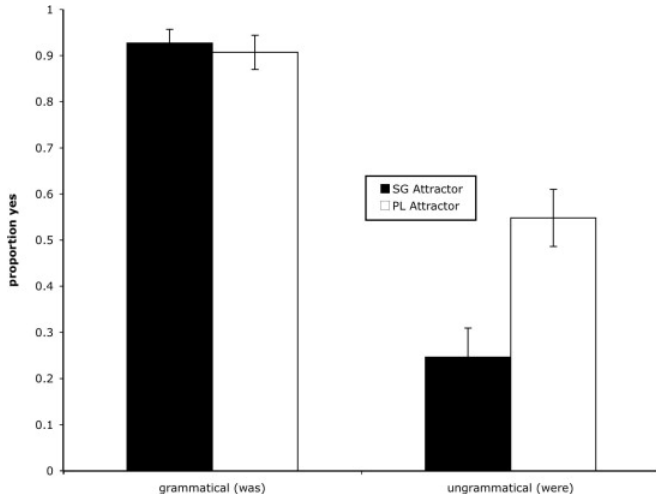(3) [The **key** [to the cabinet]] **were** rusty from many years of disuse.

(Wagers et al., 2009)

$\rightarrow$ as a facilitation of reading times

Wagers et al. (2009)

$\rightarrow$ as a higher acceptability

In Sentence Processing

Not special to the attractors within PPs or English.

Different Constructions

ORC: Wagers et al. (2009), Lago et al. (2015), Franck et al. (2015)

SRC: Tucker et al. (2015), Parker et al. (2015), Dillon et al. (2013)

POSSESSIVE RC: Häussler and Bader (2009)

GENITIVE-POSSESSIVE: Lago et al. (2018)

Different Languages

ARABIC: Tucker et al. (2015)

SPANISH: Lago et al. (2015)

FRENCH: Franck et al. (2015)

GERMAN: Häussler and Bader (2009)

ARMENIAN: Avetisyan et al.

TURKISH: Lago et al. (2018)

KOREAN: Kwon and Sturt (2016)

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$\diamond$ Are there agreement attraction effects in Turkish?

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   $\rightarrow$ With genitive attractors?

(5)   * [*Öğrenci-ler-in* [***danışman-ı***]] *sınıf-ta*   *birden*   ***bayıl-dı-lar***.
      student-PL-GEN advisor-POSS   class-LOC suddenly faint-PST-PL

      'The students' advisor suddenly fainted$_{pl}$ in the classroom.'

◇ In English, Nicol et al. (2016) found genitive attractors did not work.

    (6)   a.   The elf's **house** with the tiny window ...

                  b.   The elves' **house** with the tiny window ...

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(6)   a.   The elf's **house** with tiny window ...

      b.   The elves' **house** with tiny window ...

◇ Unlike English, Turkish can have genitive marked subjects, thus no inhibition.

(7)   [*Şarkıcı-lar-**ın** zıpla-dığ-ın-ı*]   *bil-iyor-du-n.*
      singer-PL-**GEN** jump-NMLZ-POSS-ACC know-PROG-PST-2SG

      'You knew that singers jumped.'

The Status of Turkish: *Lago et al. (2018)* (*n*=44)

Number of the Attractor *x* Number of the Verb

(8)   a. PLURAL ATTRACTOR, UNGRAMMATICAL (PLURAL VERB)

*[*Öğrenci-ler-in* [***danışman-ı***]] *sınıf-ta   birden   **bayıl-dı-lar***.
student-PL-GEN advisor-POSS   class-LOC suddenly faint-PST-PL

'The students' advisor suddenly fainted*pl* in the classroom.'

   b. PLURAL ATTRACTOR, GRAMMATICAL (SINGULAR VERB)

[Öğrenci-ler-in [**danışman-ı**]] sınıf-ta birden **bayıl-dı**.
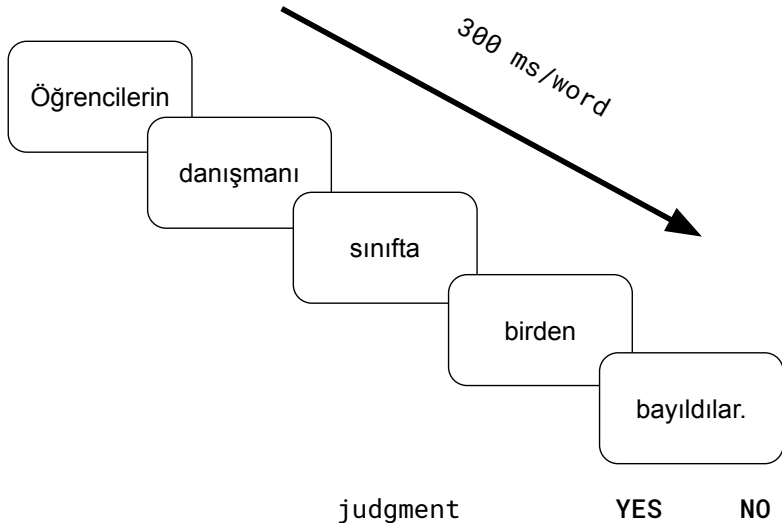
   c. SINGULAR ATTRACTOR, UNGRAMMATICAL (PLURAL VERB)

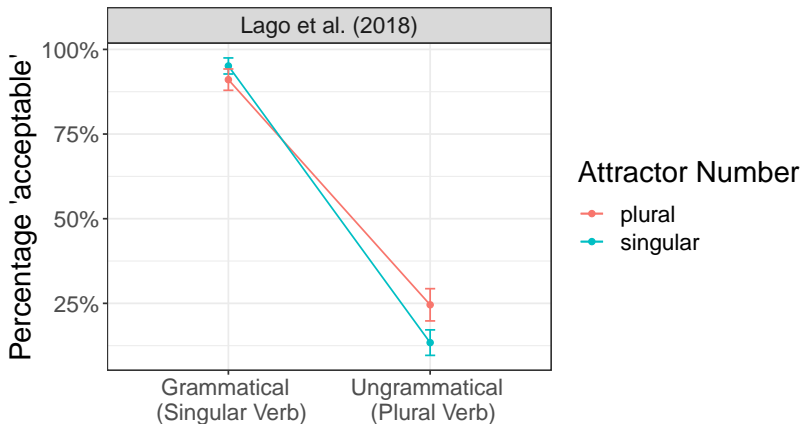*[Öğrenci-nin [**danışman-ı**]] sınıf-ta birden **bayıl-dı-lar**.

   d. SINGULAR ATTRACTOR, GRAMMATICAL (SINGULAR VERB)

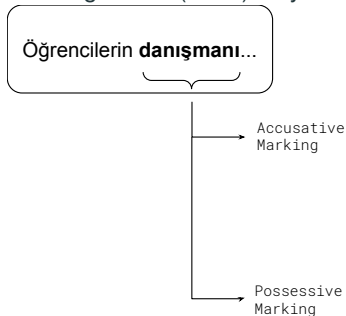[Öğrenci-nin [**danışman-ı**]] sınıf-ta birden **bayıl-dı**.

The Status of Turkish: *Lago et al. (2018)* (*n*=44)

◇ Agreement attraction occurs following certain conditions:

→ Violated subject-verb agreement.

↳ Comprehenders go back and check for missed plural NP.

→ Genitive marking (No Inhibition) on the attractor.

→ Attractor matches with number.
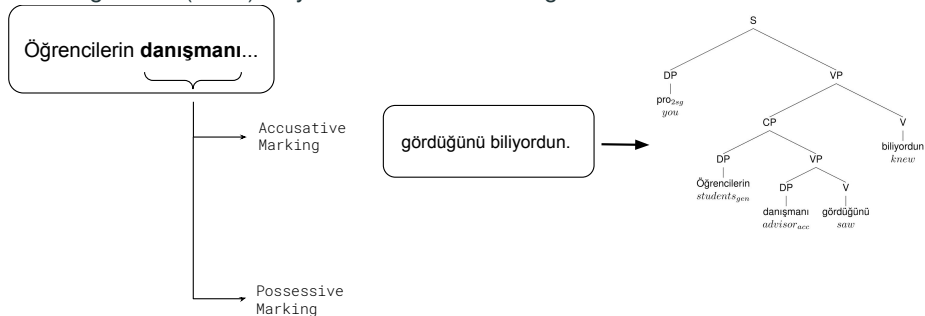
⇒ Attractor is erroneously retrieved as the controller.

An Issue with Lago et al. (2018): Case Ambiguity

◇ -I marking on consonant-ending words are ambiguous between accusative and possessive.

◇ Lago et al. (2018) only use consonant-endings words.

Öğrencilerin **danışmanı**...

Accusative
Marking

Possessive
Marking

An Issue with Lago et al. (2018): Case Ambiguity

◇ -I marking on consonant-ending words are ambiguous between accusative and possessive.
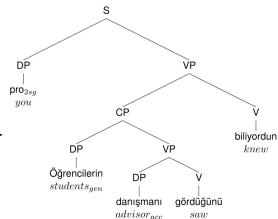
◇ Lago et al. (2018) only use consonant-endings words.

An Issue with Lago et al. (2018): Case Ambiguity

◇ -I marking on consonant-ending words are ambiguous between accusative and possessive.

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A Possible Explanation

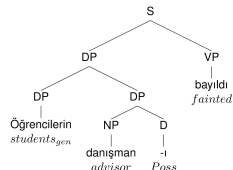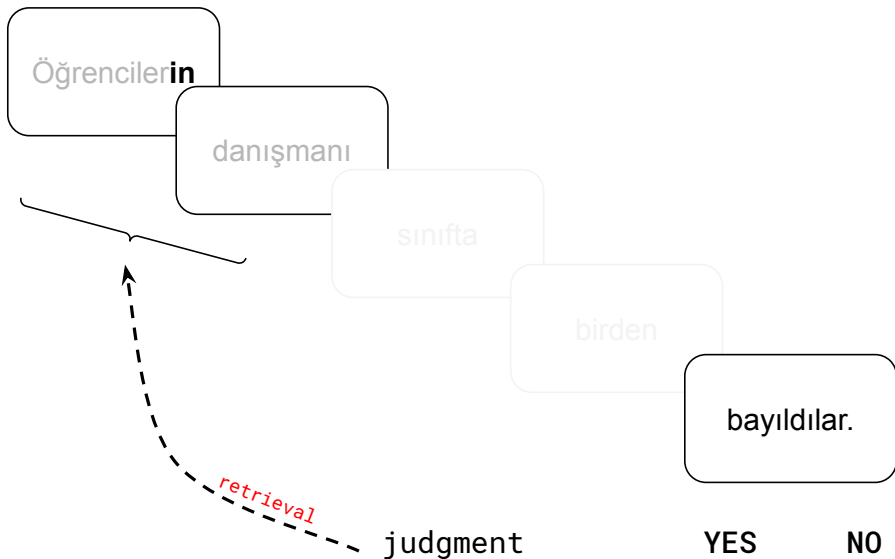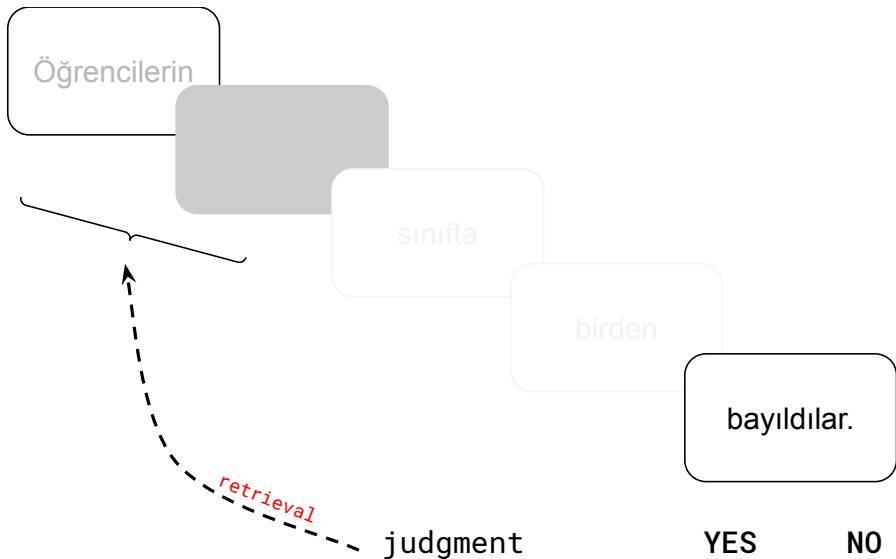◇ Agreement attraction occurs following certain conditions:

→ Violated subject-verb agreement.

↳ Comprehenders go back and check for missed plural NP.

→ ~~Genitive marking on the attractor.~~

→ **Maybe Inhibition for Accusative?**

→ Attractor matches with number.

⇒ Attractor is erroneously retrieved as the controller.

An Issue with Lago et al. (2018): Case Ambiguity

Öğrenciler**in**

danışmanı

sınıfta

birden

bayıldılar.

retrieval

judgment   YES   NO

An Issue with Lago et al. (2018): Case Ambiguity

Öğrencilerin

sınıfta

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retrieval

judgment   YES   NO

Different Modes, Same Result

An Issue with Lago et al. (2018)
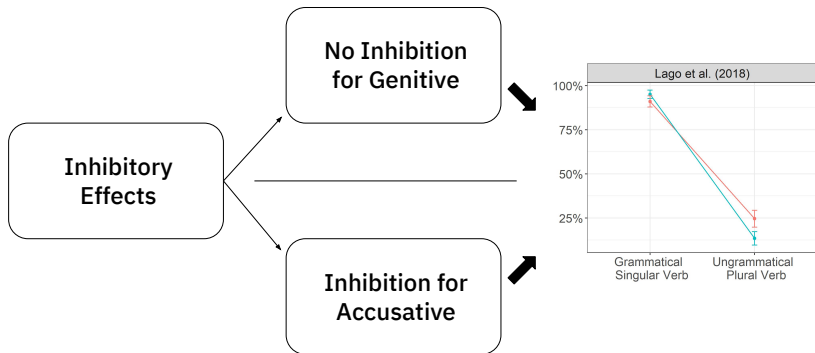
SOLUTION: Disambiguation of case.

→ Consonant-ending words: ambiguous.

→ Vowel-ending words: not ambiguous.

(9) danışman-**ı**
advisor-POSS/ACC

(10) aşçı-**sı**
cook-POSS

(11) aşçı-**yı**
cook-ACC

(12) a. PLURAL ATTRACTOR, UNGRAMMATICAL (PLURAL VERB)

*[*Öğrenci-ler-in* [**aşçı-sı**]] *mutfak-ta   birden   **bayıl-dı-lar**.*
student-PL-GEN cook-POSS kitchen-LOC suddenly faint-PST-PL

'The students' sister suddenly fainted*pl* in the kitchen.'

b. PLURAL ATTRACTOR, GRAMMATICAL (SINGULAR VERB)

[Öğrenci-ler-in [**aşçı-sı**]] mutfak-ta birden **bayıl-dı**.

c. SINGULAR ATTRACTOR, UNGRAMMATICAL (PLURAL VERB)

*[Öğrenci-nin [**aşçı-sı**]] mutfak-ta birden **bayıl-dı-lar**.
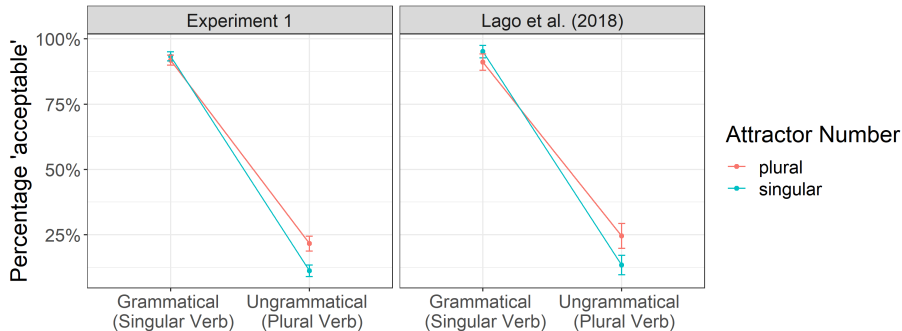
d. SINGULAR ATTRACTOR, GRAMMATICAL (SINGULAR VERB)

[Öğrenci-nin [**aşçı-sı**]] mutfak-ta birden **bayıl-dı**.

- Method: An acceptability judgment study (*n*=118) on IbexFarm.

- Data: https://github.com/utkuturk/replication_lagoetal2018

PREDICTORS:
(i) Ungrammaticality,
(ii) Attractor Number,
(iii) Their interactions.

DEPENDENT VARIABLE: 'Yes' responses

INCLUDED: by-participants & by-item intercepts and slopes for all predictors.

Experiment 1: Ungrammaticality	`[> .999]`
Experiment 1: Plural Attractor	`[  .008]`
Experiment 1: Ungrammaticality * Plural Attractor	`[< .001]`

Estimate (probit)
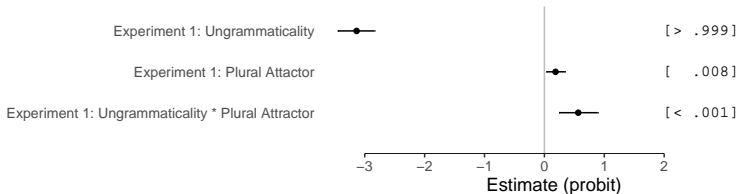
Estimates and 95% credible intervals for the regression coefficients   Contrasts & Code

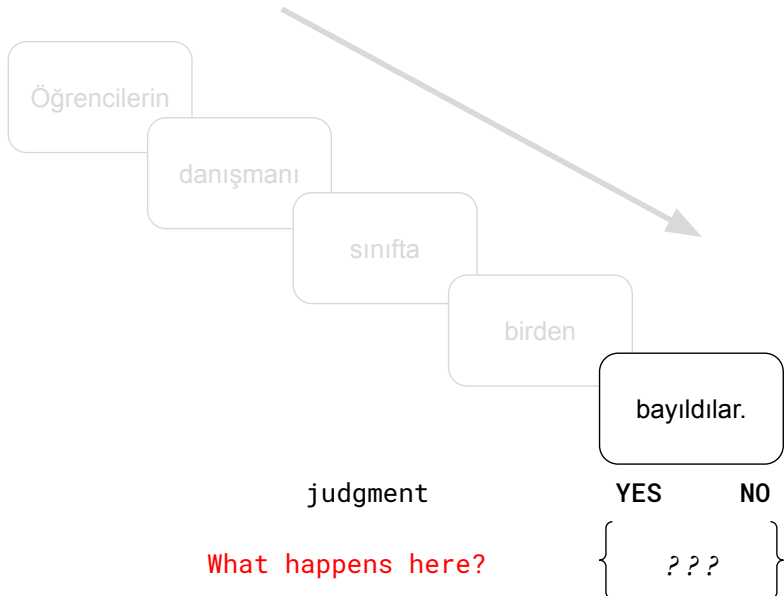# Experiment 1: Implications

☑ Genitive Inhibition in English

🚫 Genitive Inhibition in Turkish

🚫 Accusative Inhibition in Turkish, assuming shallow processing

↳ Lago et al. (2018) findings are not due to Accusative Inhibition.

One Other Corner to Check

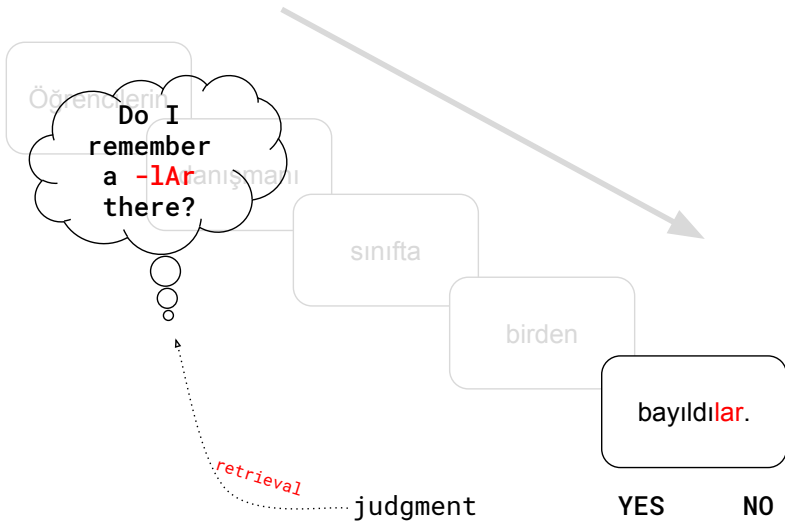Assuming shallow processing, agreement attraction may be due to

→ Lapse in attention,

→ Task-specific strategies.

Öğrencilerin

danışmanı

sınıfta

birden

bayıldılar.

`judgment`   **YES**   **NO**

What happens here? $\{$ *? ? ?* $\}$

◇ With insufficient information, comprehenders may match two *-lAr*s and call the sentence acceptable.

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   and call the sentence acceptable.

◇ How to test this: Introduce a -lAr morpheme without an NP.

◇ Used verbal _-lAr_ as an attracting plural morpheme.

(13) *[Tanı-dık-lar-ı   **aşçı**] mutfak-ta   birden   **bayıl-dı-lar**.
       know-NMLZ-PL-POSS cook kitchen-LOC suddenly faint-PST-PL.
       'The cook that they knew suddenly fainted$_{pl}$ _in the kitchen.'_

Experiment 2: *Form-driven Processing Strategy*

(14)   a.   PLURAL ATTRACTOR, UNGRAMMATICAL (PLURAL VERB)

*[Tanı-dık-lar-ı   **aşçı**] mutfak-ta   birden   **bayıl-dı-lar**.*
know-NMLZ-PL-POSS cook kitchen-LOC suddenly faint-PST-PL.

'The cook that they knew suddenly fainted in the kitchen.'

b.   PLURAL ATTRACTOR, GRAMMATICAL (SINGULAR VERB)

Tanı-dık-lar-ı **aşçı** mutfak-ta birden **bayıl-dı**.

c.   SINGULAR ATTRACTOR, UNGRAMMATICAL (PLURAL VERB)

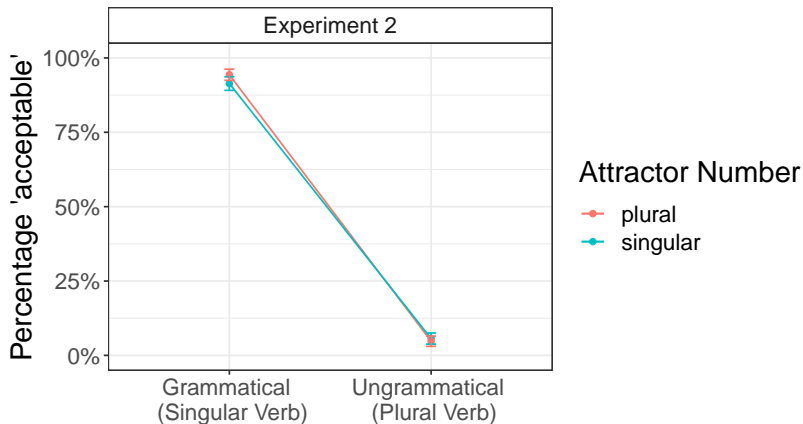*[Tanı-dığ-ı **aşçı**] mutfak-ta birden **bayıl-dı-lar**.

d.   SINGULAR ATTRACTOR, GRAMMATICAL (SINGULAR VERB)

Tanı-dığ-ı **aşçı** mutfak-ta birden **bayıl-dı**.

- Method: An acceptability judgment study (*n*=79) on IbexFarm.

- Data: https://github.com/utkuturk/orc-attractor_numberattraction

Experiment 2: Bayesian Model Results
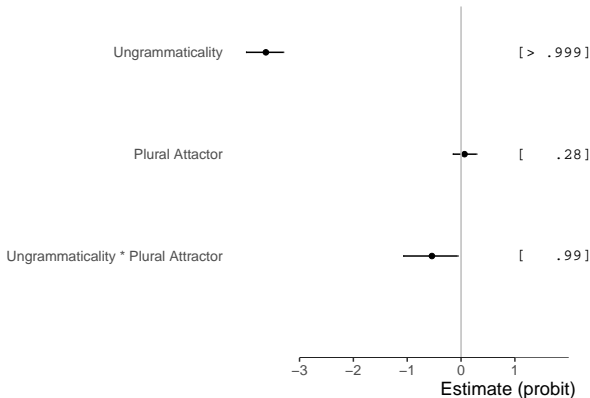
PREDICTORS:
 (i) Ungrammaticality,
(iii) Attractor Number,
(ii) Their interactions.

DEPENDENT VARIABLE: 'Yes' responses

INCLUDED: by-participants & by-item
intercepts and slopes for all predictors.

Estimates and 95% credible intervals for the regression coefficients

Contrasts & Code

◇ Form-driven processing strategy predicted agreement attraction effects to occur.

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◇ Form-driven processing strategy predicted agreement attraction effects to occur.

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

◇ Agreement attraction happens at the abstract feature level.

Conclusions

◇ There is genuine agreement attraction in unambiguous Turkish sentences.

◇ It is not modulated by case ambiguity or form advantage.

◇ Instead, certain linguistic features in retrieval are in use.

References

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Matthew W Wagers, Ellen F Lau, and Colin Phillips. Agreement attraction in comprehension: Representations and processes. *Journal of Memory and Language*, 61(2):206–237, 2009.

```r
df_merged %<>% within(., {
  cGrammatical <- ifelse(grammatical == "grammatical", .5, -.5)
  cUngrammatical <- ifelse(grammatical == "ungrammatical", .5, -.5)
  cAttractorPlural <- ifelse(attractor_num == "plural", .5, -.5)
  cEndsInConsonant <- ifelse(experiment != "Experiment 1", .5, -.5)
})
df_merged_nofillers <- df_merged %>% subset(is.na(source) | source != "filler")

m_responses <- brm(ResponseYes ~ cEndsInConsonant * cUngrammatical * cAttractorPlural +
                               (cUngrammatical * cAttractorPlural + 1| subject) +
                               (cUngrammatical * cAttractorPlural + 1| item),
                   data = df_merged_nofillers,
                   family = bernoulli("probit"),
                   chains = 4, cores = 4, iter = 2000)
```

```
df_merged2 %<>% within(., {
  cGrammatical <- ifelse(grammatical == "grammatical", .5, -.5)
  cUngrammatical <- ifelse(grammatical == "ungrammatical", .5, -.5)
  cAttractorPlural <- ifelse(attractor_num == "plural", .5, -.5)
  cVerbalAttractor <- ifelse(experiment == "Experiment 2", .5, -.5)
})
df_merged_nofillers2 <- df_merged2 %>% subset(is.na(source) | source != "filler")
m_responses2 <- brm(ResponseYes ~ cVerbalAttractor * cUngrammatical * cAttractorPlural +
                                  (cUngrammatical * cAttractorPlural + 1| subject) +
                                  (cUngrammatical * cAttractorPlural + 1| item),
                  data = df_merged_nofillers2 %>% subset(!is.na(ResponseYes)),
                  family = bernoulli("probit"),
                  chains = 4, cores = 4, iter = 2000)
```
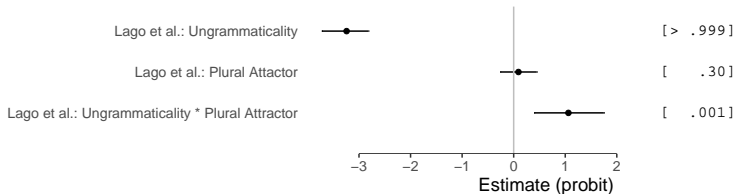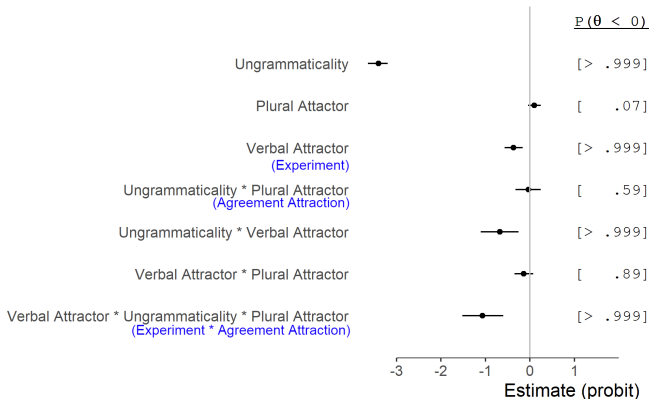
Back to Model Results.
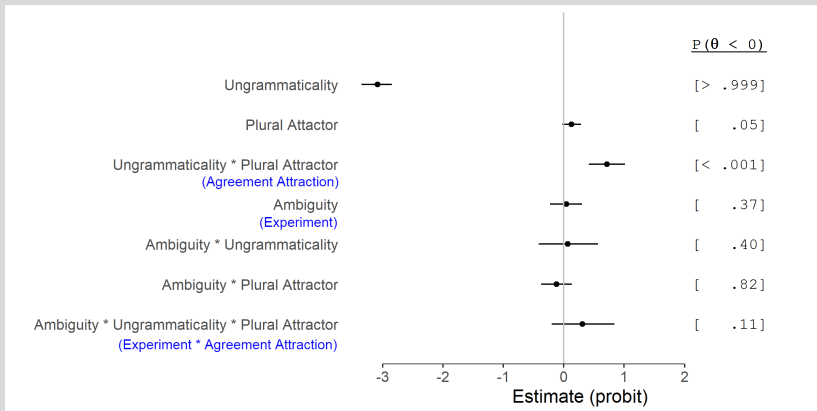
Experiment 1 and Lago et al. (2018) included model: Estimates and 95% credible intervals for the regression coefficients
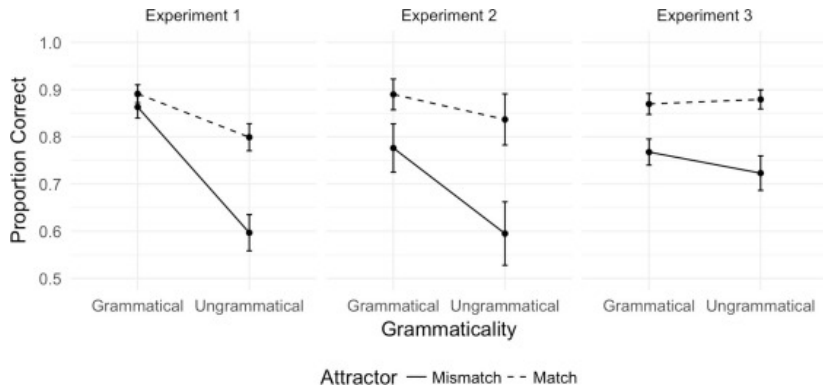
	Estimate (probit)	
Lago et al.: Ungrammaticality	●———	[> .999]
Lago et al.: Plural Attactor	—●—	[.30]
Lago et al.: Ungrammaticality * Plural Attractor	—●—	[.001]

Lago et al. (2018) estimates and 95% credible intervals for the regression coefficients

Experiment 1 and Experiment 2 included model: Estimates and 95% credible intervals for the regression coefficients

Hammerly et al. (2019) Data