



## SHORT ARTICLE

# Agreement Attraction in Turkish: The Case of Genitive Attractors

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### ARTICLE HISTORY

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### ABSTRACT

Speakers have been shown to find sentences with erroneous agreement acceptable under certain conditions. This so-called agreement attraction effect has also been found in genitive-possessive structures such as “*the teacher’s brother*” in Turkish (Lago et al., 2019), which is in contrast to its absence in similar constructions in English (Nicol et al., 2016). It has been hypothesized that this discrepancy is a result of the association between genitive case marking and being a controller in Turkish. We test an alternative explanation according to which Lago et al.’s findings are due to a potential confound in their experiment, as the morphology on all agreement controllers were locally ambiguous between possessive and accusative case. The results of our speeded acceptability judgment experiment suggest that the presence of case ambiguity does not affect agreement attraction contrary to previous findings in the literature.

### KEYWORDS

Agreement attraction; syncretism; Turkish; sentence processing; number

## 1. Introduction

Speakers often fail to accurately process grammatical dependencies between different parts of a sentence (e.g., Gibson & Thomas, 1999; Phillips, Wagers, & Lau, 2011). For example, in (1), the auxiliary verb *were* erroneously agrees with the agreement-wise

irrelevant attractor noun phrase headed by *cabinets* instead of the agreement controller headed by *key*. A number of previous studies in comprehension (J. L. Nicol, Forster, & Veres, 1997; Pearlmutter, Garnsey, & Bock, 1999; Wagers, Lau, & Phillips, 2009) showed that participants found sentences like (1) acceptable more often and read them faster compared to their counterparts with a singular attractor. This phenomenon, known as *agreement attraction* (Bock & Miller, 1991) has been attested in a number of languages, such as in Arabic (Tucker, Idrissi, & Almeida, 2015), Eastern Armenian (Avetisyan, Lago, & Vasishth, 2020), German (Lago & Felser, 2018), Hindi (Bhatia & Dillon, 2020), Serbian (Ristic, Molinaro, & Mancini, 2016), Slovak (Badecker & Kuminiak, 2007), Spanish (Lago, Shalom, Sigman, Lau, & Phillips, 2015), and recently in Turkish (Lago et al., 2019).

- (1) \* The key to the cabinets were rusty from many years of disuse.

Lago et al. (2019) demonstrated that genitive possessors (such as *painters in the painters' rival*) effect agreement attraction effects in Turkish. However, this finding appears to be at odds with J. L. Nicol, Barss, and Barker's (2016) results, who failed to find a similar effect in English. Lago et al. (2019) hypothesize that Turkish possessor noun phrases, unlike their English counterparts, may function as agreement attractors because Turkish genitive NPs may function as agreement controllers of non-finite clauses in Turkish (Göksel & Kerslake, 2005; Kornfilt, 2011). As a result, Turkish genitive-marked NPs may match the controller feature used in the cue-based retrieval of an agreement controller (Arnett & Wagers, 2017; Lewis & Vasishth, 2005; Wagers et al., 2009).

We tested an alternative explanation of Lago et al.'s (2019) findings which is related to an instance of local ambiguity in their experimental sentences, as a result of which all subject head nouns, agreement controllers, were ambiguous between possessive and accusative case.

Our hypothesis is also consistent with most previous studies which showed that unambiguous case marking reduced attraction effects in Dutch (Hartsuiker, Antón-Méndez, & Van Zee, 2001), English (J. Nicol & Antón-Méndez, 2009), German (Hartsuiker, Schriefers, Bock, & Kikstra, 2003), Russian (Cherepovskaia, Reutova, & Slious-

sar, 2021; Slioussar, 2018), and Slovak (Badecker & Kuminiak, 2007). However, recently a study on Eastern Armenian showed that unambiguous case marking does not affect attraction patterns (Avetisyan et al., 2020). Moreover, two studies on French showed that unambiguous case marking induced more attraction errors (Franck, Lassi, Frauenfelder, & Rizzi, 2006; Franck, Soare, Frauenfelder, & Rizzi, 2010). Different from these studies, the case syncretism in our study is only instantiated on the controller, and it introduces an additional parse of the sentence in which the attractor is interpreted as a controller.<sup>1</sup> We believe that a clear manipulation of case syncretism on the controller might provide a more comprehensive picture of the interaction between case marking and attraction.

## 2. Agreement Attraction in Turkish

Lago et al. (2019) demonstrated an agreement attraction effect in Turkish genitive-possessive constructions in a speeded acceptability judgment study with sentences like (2), in which the number of the attractor and the verb was manipulated. The resulting 2x2 design, indicated by curly braces and slashes in (2), consisted of two grammatical conditions, in which the verb agreed in number with the singular controller, and two ungrammatical conditions, in which the verb carried plural agreement, and thus did not agree with the controller. In ungrammatical sentences, they found a higher percentage of *acceptable* responses when the genitive attractor was plural than when it was singular, indicating agreement attraction. No such effect was found in grammatical sentences.

- (2)      Teknisyen-{ler/Ø}-in              eğitmen-i              olağanüstü              hızlı  
           technician-{PL/SG}-GEN      instructor-POSS      extraordinarily      fast  
           koş-tu-{lar/Ø}.  
           run-PST-{PL/SG}  
           “The technician’s/technicians’ instructor ran{PL/SG} extraordinarily fast.”

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<sup>1</sup>We are aware that Badecker and Kuminiak (2007) also manipulated the case syncretism on the controller. However, their focus was on gender agreement attraction and only the set of conditions with feminine heads can be used to investigate the effect of syncretism on the controller. Their experimental results showed that feminine heads behaved as if they were more marked than the masculine heads, thus deeming feminine heads similar to plural heads in number agreement attraction.

Lago et al. (2019) hypothesized that these effects originated from how case and number information are encoded and retrieved: According to Lewis and Vasishth’s (2005) cue-based retrieval model, phrases are encoded in a content-addressable memory as bundles of features called *chunks* which include information like number, gender, case, and syntactic function (e.g., Smith & Vasishth, 2020). Under Lago et al.’s (2019) proposal, participants predict the number of the verb based on the noun phrases they process while reading the controller. In grammatical sentences with singular verb agreement, the number prediction and the verb number match, which causes no processing difficulty. In contrast, when participants fail to find the predicted number morphology on the verb, a memory-retrieval process is initiated. This process activates the search for a chunk matching two cues: the subjecthood, or the controller, feature ([+CONTROLLER]) and the plural feature ([+PL]). While neither of the available noun phrases matches this specification in ungrammatical agreement attraction sentences, each of the NPs headed by *technician* and *instructor* matches one of these cues. While this partial match mostly results in participants finding the sentence ungrammatical, they may retrieve the attractor *technicians* on some trials. Lago et al. (2019) argue that this erroneous retrieval may be facilitated by the genitive case marking on the attractor, because genitive NPs can function as agreement controllers of embedded clauses in Turkish. Due to the ubiquity of genitive-marked subjects, attractors marked with genitive case are a priori likely to be agreement controllers.

However, a potential problem with the stimuli in the Lago et al. (2019) study is that the stems of all head nouns such as *eğitmen-i* (‘*instructor*’) in (2) were consonant-ending, making their possessive forms ambiguous between possessive and accusative case due to case syncretism between them in consonant-ending stems (Göksel & Kerslake, 2005, pp. 66–67). As a result, the head noun (‘*instructor*’) in (3) can be disambiguated towards possessive case as in (3a), or towards accusative case as in (3b), where the genitive-marked noun functions as an embedded subject, and the matrix subject is omitted due to pro-drop. Notice that the forms of the possessive and the accusative case with vowel-ending words is not syncretic in vowel-ending words such as *öğrenci* (‘*student*’). Moreover, data from annotated treebanks (Çöltekin, 2015; Kuzgun et al., 2020; Sulubacak et al., 2016; Türk et al., 2021, 2019) showed that the relative

probability of encountering accusative marking after the genitive-marked noun is 0.22, indicating the accusative interpretation is a fairly possible parse even though it is less likely than the possessive interpretation.

(3) a. POSSESSIVE INTERPRETATION

Teknisyen-in {eğitmen-i / öğrenci-si} koş-tu.  
 technician-GEN instructor-POSS / student-POSS run-PST  
 “The technician’s instructor/student ran.”

b. ACCUSATIVE INTERPRETATION

Teknisyen-in {eğitmen-i / öğrenci-yi} kov-duğ-un-u  
 technician-GEN instructor-ACC / student-ACC fire-NMLZ-POSS-ACC  
 gör-dü-m.  
 see-PST-1SG  
 “I saw the technician firing the instructor/student.”

Because accusative NPs cannot function as agreement controllers in Turkish, it is possible that Lago et al.’s finding of agreement attraction effects in sentences like (2) are not due to the genitive attractors’ association with subjecthood or being a controller, but rather due to the head nouns’ *reduced association with [+CONTROLLER]* due to its ambiguity.

Because sentences like (2) are locally ambiguous, participants may initially adopt an incorrect analysis of the genitive-possessive structure on some trials, and encode the genitive-marked first noun as the agreement controller of an embedded verb and the ambiguous second noun as an accusative object. Under the assumption that remnants of an incorrect analysis affect the parsing process even after a successful reanalysis (Staub, 2007), the initial association between the genitive noun phrase and subjecthood may lead an agreement attraction effect. In contrast, this account predicts that the agreement attraction effect should be either significantly reduced or entirely absent when the head noun is unambiguous, as the function of the genitive noun phrase is disambiguated early, thus preventing potential digging-in effects (Tabor & Hutchins, 2004). We tested this hypothesis in a speeded-acceptability experiment with sentences similar to Lago et al.’s (2019), but with unambiguously marked vowel-ending agreement controllers.

### 3. The Present Study

The present study tested the predictions of the case syncretism account as an alternative explanation of the previously found agreement attraction effect in Turkish. To avoid the ambiguity present in Lago et al. (2019), we used vowel-ending head nouns nouns such as *terzi* (‘tailor’), for which the possessive marker surfaces as *-si* and is distinct from the accusative (*-yi*). We hypothesized that if the morpho-phonological ambiguity was a key factor in agreement attraction in Turkish, unambiguous sentences like ours in (4) should not elicit attraction effects.

- (4) a. \*PLURAL ATTRACTOR, UNGRAMMATICAL (PLURAL VERB)
- |                       |                  |            |                |  |
|-----------------------|------------------|------------|----------------|--|
| [Milyoner-ler-in      | <b>terzi-si]</b> | tamamen    | gereksizce     |  |
| millionaire-PL-GEN    | tailor-POSS      | completely | without.reason |  |
| <b>kov-ul-du-lar.</b> |                  |            |                |  |
| fire-PASS-PST-PL      |                  |            |                |  |
- “The millionaires’ tailor were fired for no reason at all.”
- b. PLURAL ATTRACTOR, GRAMMATICAL (SINGULAR VERB)
- |                    |                  |            |                |                   |
|--------------------|------------------|------------|----------------|-------------------|
| [Milyoner-ler-in   | <b>terzi-si]</b> | tamamen    | gereksizce     | <b>kov-ul-du.</b> |
| millionaire-PL-GEN | tailor-POSS      | completely | without.reason | fire-PASS-PST     |
- “The millionaires’ tailor was fired for no reason at all.”
- c. \*SINGULAR ATTRACTOR, UNGRAMMATICAL (PLURAL VERB)
- |                 |                  |            |                |                       |
|-----------------|------------------|------------|----------------|-----------------------|
| [Milyoner-in    | <b>terzi-si]</b> | tamamen    | gereksizce     | <b>kov-ul-du-lar.</b> |
| millionaire-GEN | tailor-POSS      | completely | without.reason | fire-PASS-PST-PL      |
- “The millionaire’s tailor were fired for no reason at all.”
- d. SINGULAR ATTRACTOR GRAMMATICAL (SINGULAR VERB)
- |                 |                  |            |                |                   |
|-----------------|------------------|------------|----------------|-------------------|
| [Milyoner-in    | <b>terzi-si]</b> | tamamen    | gereksizce     | <b>kov-ul-du.</b> |
| millionaire-GEN | tailor-POSS      | completely | without.reason | fire-PASS-PST     |
- “The millionaire’s tailor was fired for no reason at all.”

#### 3.1. Participants

We recruited 118 undergraduate students to participate in the experiment in exchange for course credit. All participants were native Turkish speakers, with an average age of 20 (range: 18 – 32). The experiment was carried out following the principles of the Declaration of Helsinki and the regulations concerning research ethics at **hidden** University. All participants provided informed consent before their participation and

their identities were completely anonymised.

### 3.2. Materials

We used 40 sets of sentences like (4), in which we manipulated (i) the number of the attractor noun and (ii) the number agreement on the verb. Plural number and plural agreement were both marked with the suffix *-ler/-lar*, while the singular number and singular agreement were marked by its absence. We used the experimental items from Lago et al. (2019) as a starting point for all items. We substituted ambiguous nouns for unambiguous alternatives, and in some cases, modified other parts of the sentence for plausibility reasons.

All sentences started with a complex subject NP like *milyonerlerin terzisi* “the millionaires’ tailor,” in which the genitive possessor functioned as the attractor, and the head noun carried an unambiguous possessive case marker. Because the plural marking on nominals is not optional and the head noun was singular, absent of *-lar*, in all conditions, sentences with plural verb agreement were ungrammatical. Moreover, the semantic relationship between the possessor and the head noun was kept as it is in Lago et al.’s (2019) original study and genitive-possessive structures can be paraphrased using *’s* or *of* in English.

One example set of experimental items is in (4). The subject phrase is marked with square brackets, and the dependency between the subject head and the matrix verb is signaled using bold-face.

To preclude participants from equating singular verbs with grammaticality, 40 fillers were added featuring 20 with grammatical plural verbs and 20 with ungrammatical singular verbs.

### 3.3. Procedure

The experiment was run online, using the web-based platform Ibex Farm (Drummond, 2013). Each experimental session took approximately 25 minutes to complete. Participants provided demographic information and gave informed consent to participate in the experiment. They then proceeded to read the instructions and were given nine

practice trials before the experiment began.

Each trial began with a blank screen for 600 ms, followed by a word-by-word RSVP presentation of the sentence in the center of the screen, followed by a prompt to indicate their acceptability judgment. Sentences were presented word-by-word in the center of the screen in 30 pt font size, at a rate of 400 ms per word. Participants saw a blank screen for 100 ms between each word, and to see the next item, they needed to press the `space` key. Participants were asked to press the key `P` to indicate that a sentence is acceptable and `Q` to indicate that the sentence is unacceptable. They were instructed to provide judgments as quickly as possible. During the experiment, a warning message in red font appeared if they did not respond within 5,000 ms.

Participants saw 40 experimental and 40 filler sentences. Experimental sentences were distributed among four different lists according to a Latin-square design. Every participant saw one version of the experiment with a specific list and one item per condition.

### ***3.4. Analysis***

In order to test whether the morphological ambiguity present in the Lago et al. (2019) sentences affected the presence or magnitude of the agreement attraction effect, we analyzed the data from the present experiment and compared our results to Lago et al.'s (2019) results, by including Lago et al.'s (2019) data in our Bayesian GLM and using the experiment as an additional factor in the analysis.

Prior to the analysis, we removed all participants for whom the difference in the percentage of *yes* responses between conditions with singular attractors (4d) and (4c) fell below the threshold of 0.1 percentage points. We also excluded trials in which the participants missed the response deadline. As a result, we excluded 3.39% of the trials from our experiment and 2.27% of the Lago et al.'s (2019) trials.

We analyzed responses using two Bayesian GLMs assuming a Bernoulli-distributed response with a probit link function. We used the R packages `brms` (Bürkner, 2018) and `rstan` (Stan Development Team, 2019) to fit Bayesian hierarchical models (e.g., Gelman & Hill, 2007; Nicenboim & Vasishth, 2016). We analyzed only experimental sentences and used (i) grammaticality of the sentence, (ii) attrac-



tor number, and (iii) presence of morphological ambiguity (i.e., experiment), as well as all their interactions as predictors. We used by-participant and by-item intercepts and slopes for all predictors and their interaction. All factors were sum-coded. We used a *Student's t*(3,0,2.5) prior for the intercept, a *Normal*(0,1) prior for all slopes, a *Cauchy*<sup>+</sup>(0,1) prior for the standard deviations of random effects, and a *LKJ*(2) prior for correlation matrix for the random effects.

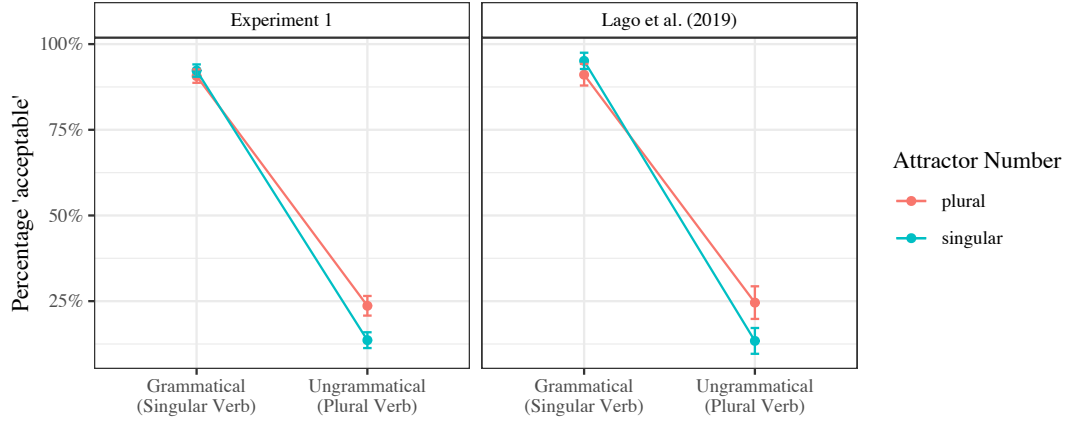
Because the magnitude of the agreement attraction effect can be operationalised either as the interaction between grammaticality and the presence of a plural attractor, or as the effect of a plural attractor in ungrammatical sentences, we used a second model with predictors (ii) and (iii) and their interaction to analyze responses to ungrammatical conditions only.

In the results section, we provide summaries of the coefficient posterior distributions. For our model, we ran 4 chains with 1000 warm-up iterations and 1000 sampling iterations. The data for our study, along with our analysis scripts can be found at <https://osf.io/hegmd/>.

### 3.5. Results

Figure 1 shows the average proportions of “acceptable” responses by experimental condition in our experiment with unambiguous possessive marking, side by side with Lago et al.’s findings. It shows that ungrammatical sentences with plural attractors are rated as acceptable more often ( $M = 0.24$ ,  $SE = 0.01$ ) than their counterparts with singular attractors ( $M = 0.14$ ,  $SE=0.01$ ). The magnitude of the effect (0.10) was in line with the findings reported in Lago et al. (2019), where the difference was also 0.11. Accuracy rates for grammatical conditions were nearly equal ( $M = 0.92$  and  $0.91$ ,  $SE = 0.01$  and  $0.01$ , for singular and plural attractors respectively).

Figure 2 shows estimates and 95% credible intervals of a Bayesian GLM with a probit link function. The main effect of grammaticality ( $\hat{\beta} = 3.01$ ;  $CI = [2.76; 3.27]$ ;  $P(\beta < 0) < .001$ ) indicates that, on average, participants were quite good at distinguishing between grammatical and ungrammatical sentences. Meanwhile, the negative interaction between grammaticality and attractor number ( $\hat{\beta} = -0.71$ ;  $CI = [-1.00; -0.44]$ ;  $P(\beta < 0) > .999$ ) indicated a larger difference (positive) ef-

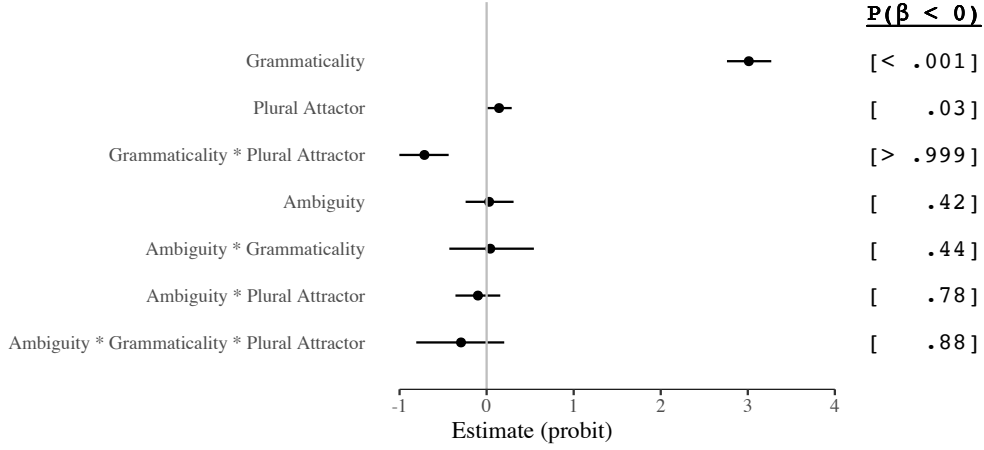


**Figure 1.** The average percentage of acceptable responses according to the experimental conditions in our study and Lago et al. (2019). Error bars signal standard errors calculated following Morey (2008).

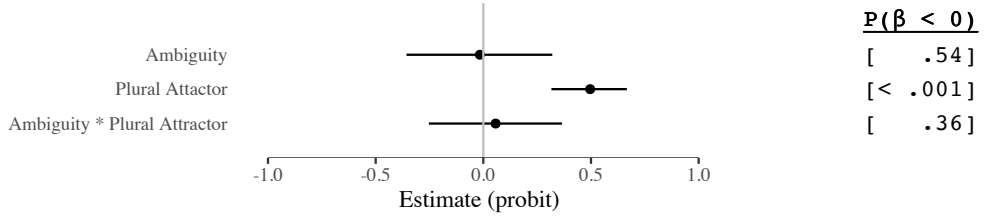
fect of plural attractors in ungrammatical conditions, and thus a number agreement attraction effect. There was weak evidence for a negative three-way interaction between the presence of ambiguity, ungrammaticality, and attractor number ( $\hat{\beta} = -0.29$ ;  $CI = [-0.81; 0.20]$ ;  $P(\beta < 0) = .88$ ), which was largely driven by differences in the effect of attractor number in *grammatical conditions*, as the magnitude of the effect in the ungrammatical conditions was identical in both experiments (0.11). This is consistent with the estimates of the model based on ungrammatical sentences in Figure 3, which show no indication of an interaction between ambiguity and the presence of a plural attractor ( $\hat{\beta} = 0.06$ ;  $CI = [-0.25; 0.37]$ ;  $P(\beta < 0) = .36$ ). It also showed a main effect of plural attractor ( $\hat{\beta} = 0.50$ ;  $CI = [0.32; 0.67]$ ;  $P(\beta < 0) < .001$ ). Taken together, the coefficients indicated a substantial agreement attraction effect regardless of the presence of local ambiguity.

#### 4. Discussion & Conclusion

We re-examined the findings of Lago et al. (2019) and investigated the contribution of a possible confound to their finding of an agreement attraction effect in genitive-possessive constructions in Turkish. Our main question was whether Lago et al.’s (2019) findings can be explained by an alternative hypothesis: Because in their experimental sentences, all head nouns were locally ambiguous between the possessive



**Figure 2.** Estimates and 95% credible intervals for the probit regression coefficients for the model of responses in our experiment and Lago et al. (2019).



**Figure 3.** Estimates and 95% credible intervals for the probit regression coefficients for the model of responses to **ungrammatical sentences** in our experiment and Lago et al. (2019).

and the accusative case (a case that cannot occur with agreement controller NPs), we hypothesized that this may have weakened the strength of association between the actual agreement controller and the [+CONTROLLER] feature. If Turkish agreement attraction effects in genitive-possessive structures resulted from this ambiguity, we expected the absence of agreement attraction effects when the case of the head noun was unambiguous.

Our experimental findings were comparable to Lago et al. (2019): We observed that the presence of a plural attractor increased the rate of erroneous “acceptable” responses in ungrammatical sentences. Importantly, we did not find an effect of case ambiguity: While our model based on all experimental conditions indicated a weak three-way interaction between ambiguity, grammaticality, and attractor number, a model based on ungrammatical sentences only demonstrated that this is due to a difference in acceptability rates in grammatical conditions. This model showed no evidence of an interaction between attractor number and ambiguity, indicating no evidence of

a modulation of the effect size of the agreement attraction effect by the presence of a local case ambiguity. Although the 95% credible interval for the interaction term was relatively wide, our findings indicate the presence of a substantial agreement attraction effect regardless of the presence of local ambiguity. Thus, we successfully replicated the findings of Lago et al. (2019) with disambiguated head nouns.

Taken together, our results suggest (i) that agreement attraction effects in Turkish are not due to a reduced association between case-ambiguous nouns and the abstract features related to being an agreement controller, and (ii) that local ambiguities, such as case syncretism, do not appear to play a role in Turkish agreement attraction. Our results contradicted previous research on the interaction between overt case-marking and agreement attraction except for a recent study on Eastern Armenian (Avetisyan et al., 2020), which also showed no effect of overt case marking on attraction patterns. Drawing parallelism from the effect of the notional number on agreement attraction—which shown to affect attraction patterns when the manipulation was introduced on the agreement controller (Haskell & MacDonald, 2003) and not on the attractor (Bock & Eberhard, 1993)—we believe that our results that contrasts with the previous syncretism findings in agreement attraction might be because our manipulation targeted the case syncretism on the agreement controller. Since both parses are fairly available, we believe that the structural frequency discrepancy cannot explain our findings. The fact that previous experiments on case syncretism do not introduce any additional parses and still induce attraction effects supports our belief as well.

## **Abbreviations**

DAT = dative, GEN = genitive, NMLZ = nominaliser, PASS = passive, PL = plural, POSS = possessive, PST = past, SG = singular, WHEN = when.

## **Authors' Contributions**

Utku Türk conceived the initial version of the presented idea. Both authors designed the experiment together. Utku Türk wrote the stimuli and conducted the experiment.

The statistical analysis was carried out by Pavel Logačev; Utku Türk prepared all summaries and plots. Utku Türk wrote the first draft of the manuscript and both authors edited it subsequently.

## Data Availability Statement

All data and R code used in the data analysis is available at <https://osf.io/hegmd/>.

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