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BRIEF REPORT



Agreement attraction in Turkish: the case of genitive attractors

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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). Straight from the horse’s mouth: Agreement attraction effects with Turkish possessors. *Linguistic Approaches to Bilingualism*, 9(3), 398–426. <https://doi.org/10.1075/lab.17019.lag>], which is in contrast to its absence in similar constructions in English [Nicol et al. (2016). Minimal interference from possessor phrases in the production of subject-verb agreement. *Frontiers in Psychology*, 7, 548. <https://doi.org/10.3389/fpsyg.2016.00548>]. It has been hypothesised 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 syncretism does not affect agreement attraction contrary to previous findings in the literature.

Abbreviations: ACC, accusative; DAT, dative; GEN, genitive; NMLZ, nominaliser; PASS, passive; PL, plural; POSS, possessive; PST, past; SG, singular; WHEN, when.

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1. Introduction

Speakers often fail to accurately process grammatical dependencies between different parts of a sentence (e.g. Gibson & Thomas, 1999; Phillips et al., 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 et al., 1997; Pearl-mutter et al., 1999; Wagers et al., 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 et al., 2015), Eastern Armenian (Avetisyan et al., 2020), German (Lago & Felser, 2018), Hindi (Bhatia & Dillon, 2022), Serbian (Ristic et al., 2016), Slovak (Badecker & Kuminiak, 2007), Spanish (Lago et al., 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 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 (“technician”) and the verb (“run”) was manipulated. Lago et al. (2019) demonstrated that genitive possessors (such as *painters* in *the painters’ rival*) cause agreement attraction effects in Turkish. Lago et al. (2019) assumed a cue-based retrieval model in which the verb cues a search for a *chunk* matching two cues: the plural feature cue [+PL] and the subjecthood, or agreement-controller cue [+CONTROLLER].¹ In the ungrammatical attraction sentences as in (2), each of the NPs headed by “technicians” and “instructor” matches one of these cues, which may lead to the erroneous retrieval of the attractor “technicians” in some trials. What made this particular attraction effect interesting is that it was thought from an earlier study in English that genitive NPs were not accessible as attractors (Nicol et al., 2016). Therefore, understanding what drives the effect in Turkish could provide broader insights into the processing mechanisms by which agreement is computed more generally.

(2) * Teknisyen-ler-in eğitimci-olağanüstü hızlı koş-tu-lar.
technician-PL-GEN instructor-POSS extraordinarily fast run-PST-PL
“The technician/s/technicians’ instructor ran_{PL} extraordinarily fast.”

One possible explanation, and the one suggested by Lago et al. (2019), is that whether an NP is a suitable attractor or not is impacted by whether its case-marking

is ever shared by agreement controllers in that language. In English, genitive-marked NPs can never serve as agreement controllers. However, in most Turkish non-finite clauses, the agreement controller (i.e. the understood “subject”) is marked genitive as in (3) (Göksel & Kerslake, 2005, p. 161). This may have the result that even in finite clauses, where the subject cannot be marked with the genitive case, like the ones Lago et al. (2019) used, a genitive-marked NP can be available as an attractor in Turkish in a way that it cannot be in English. If true, this could have interesting implications for theories of how features like [+CONTROLLER] are encoded on phrases in cue-based memory models.

- (3) Ali [hırsız-in o ev-e gir-diğ-in]-i duy-du.
 Ali [thief-GEN that house-DAT enter-NMLZ-POSS.3SG]-ACC hear-PST.3SG
 “Ali heard that the thief broke into that house.”

(“Öztürk & Taylan, 2016, Example 61, p. 106)

A different explanation, however, has to do with case syncretism. In the Lago et al. (2019) study, 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. 66–7). As a result, the head noun (“instructor”) in (4) can be disambiguated towards possessive case as in (4-a), or towards accusative case as in (4-b), where the genitive-marked noun functions as an embedded subject, and the matrix subject is omitted due to pro-drop. Note that the forms of the possessive and accusative case with vowel ending words are not syncretic in vowel ending words such as *öğrenci* (“student”). Furthermore, data from annotated treebanks (Coltekin, 2015; Kuzgun et al., 2020; Sulubacak et al., 2016; Türk et al., 2021, november, 2019) showed that the relative probability of encountering accusative marking after the genitive-marked noun is 0.22, indicating that the accusative interpretation is a fairly possible parse, although it is less likely than the possessive interpretation.²

- (4) 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 gör-dü-m.
 technician-GEN instructor-ACC / student-ACC fire-NMLZ-POSS-ACC 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 (2019) 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 the case syncretism.

If this explanation were correct, it would also have interesting implications for theories of agreement processing, because whether and how case syncretism impacts agreement computations has become a topic of lively debate. Several studies have argued that case syncretism does matter, showing that unambiguous case marking reduces attraction effects in Dutch (Hartsuiker et al., 2001), English (Nicol & Antón-Méndez, 2009), German (Hartsuiker et al., 2003), and Russian (Cherepovskaia et al., 2021; Slioussar, 2018). In Slovak, Badecker and Kuminiak (2007) found that gender attraction was only observed when the case syncretism is instantiated on the head noun. However, a recent study on Czech showed that case syncretism on the head noun did not give rise to attraction effects (Lacina & Chromý, 2022). Findings from Slovak and Czech have generated uncertainty in the literature about whether case syncretism on the controller can cause attraction in case-marking languages. Slovak seems to suggest it can, while Czech suggests that it cannot. Similarly, Avetisyan et al. (2020) showed that even unambiguous case marking on the attractor does not affect attraction patterns in Eastern Armenian. Moreover, studies on French showed that unambiguous case marking on the attractor induced more attraction errors, contrary to the aforementioned findings (Franck et al., 2006, 2010). In this paper, we contribute to this ongoing debate by testing whether or not case syncretism was a crucial factor in the Turkish genitive agreement attraction effects observed by Lago et al. (2015).

Notably, the syncretism manipulation in our study is not only instantiated on the controller, but also deals with an additional parse of the sentence in which the attractor is interpreted as a controller, which may give rise to digging-in effects (Tabor & Hutchins, 2004). 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 to 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 not marked with a syncretic form, 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.

2. 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 hypothesised that if the case syncretism, thus local ambiguity, was a key factor in agreement attraction in Turkish, unambiguous sentences like ours in (5) should not elicit attraction effects.

- (5) a. * PLURAL ATTRACTOR, UNGRAMMATICAL (PLURAL VERB)
[Milyoner- **terzi-si**] tamamen gereksizce **kov-ul-du-lar**.
ler-in
millionaire-PL-GEN tailor-POSS completely without.reason fire-PASS-
PST-PL
"The millionaires' tailor were fired for no reason at all."
- b. PLURAL ATTRACTOR, GRAMMATICAL (SINGULAR VERB)
[Milyoner- **terzi-si**] tamamen gereksizce **kov-ul-du**.
ler-in
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- **terzi-si**] tamamen gereksizce **kov-ul-du-lar**.
in
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- **terzi-si**] tamamen gereksizce **kov-ul-du**.
in
millionaire-GEN tailor-POSS completely without.reason fire-PASS-PST
"The millionaire's tailor was fired for no reason at all."

2.1. 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 Boğaziçi University. All participants provided informed consent before their participation and their identities were completely anonymised.

2.2. Materials

We used 40 sets of sentences like (5), 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 (5). The subject phrase is marked with square brackets, and the dependency between the subject head and the matrix verb is signalled 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.

2.3. 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 centre of the screen, followed by a prompt to indicate their acceptability judgment. Sentences were presented word-by-word in the centre 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.

2.4. 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 analysed 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 ? and ? 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 analysed 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 analysed only experimental sentences and used (i) grammaticality of the sentence, (ii) attractor 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*⁺(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 analyse responses to ungrammatical conditions only.

2.5. 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) effect 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.

3. 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 and the accusative case (a case that cannot occur with agreement controller NPs), we hypothesised that this may have weakened the strength of association between the actual agreement controller and the [+CONTROLLER] feature. If Turkish

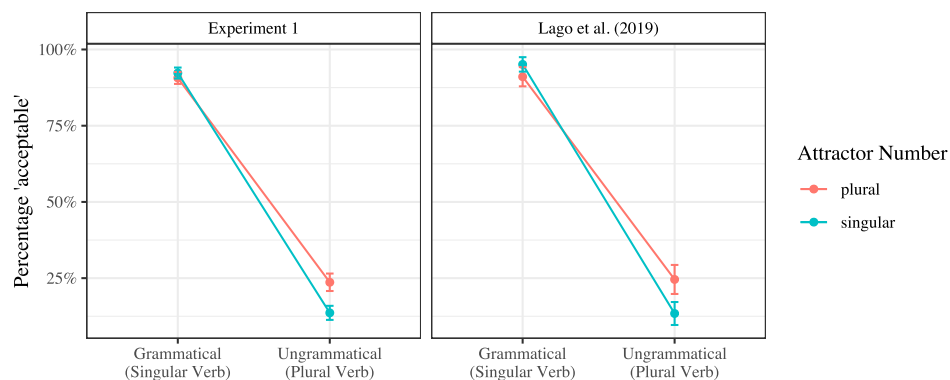


Figure 1. The average percentage of acceptable responses according to the experimental conditions in our study and Lago et al. (2019). Error bars signal standard errors calculated following Morey (2008).

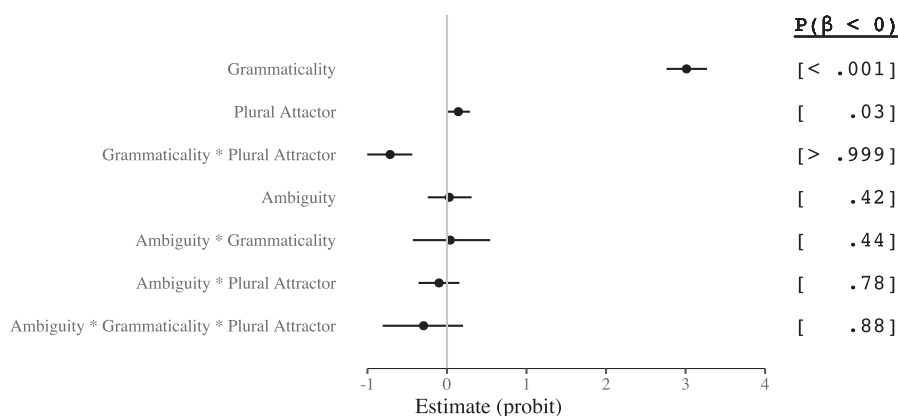


Figure 2. Estimates and 95% credible intervals for the probit regression coefficients for the model of responses in our experiment and Lago et al. (2019).

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.

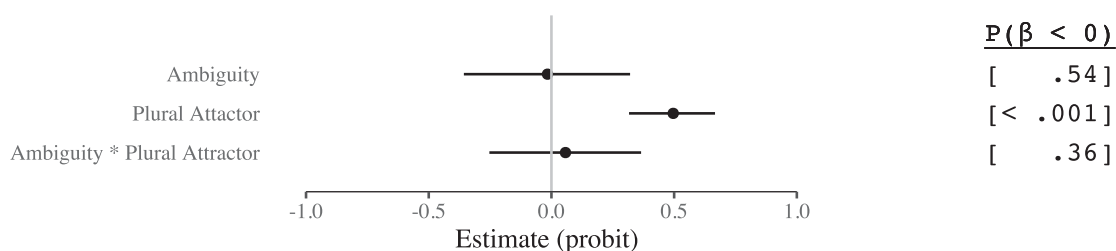


Figure 3. Estimates and 95% credible intervals for the probit regression coefficients for the model of responses to **ungrammatical sentences** in our experiment and Lago et al. (2019).

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 and Slovak (Avetisyan et al., 2020; Lacina & Chromý, 2022), 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.

Notes

1. An anonymous reviewer pointed that the feature subjecthood conflates various syntactic and morphological primitives, such as syntactic position or case (McCloskey, 1997). Even though Lago et al. (2019) use *subjecthood* and cue against subjecthood as a key element in their analysis, we chose to use a more agnostic term *controller* following Bhatia and Dillon (2022).
2. We gathered syntactically and morphologically annotated data from Turkish Universal Dependencies treebanks and divided the count of accusative marking (Case=ACC) following an instance of genitive marking (Case=GEN) by total count of genitive marking preceded by accusative and possessive marking.

$$P(\text{Acc after Gen}) = \frac{\text{Count}(\text{Acc after Gen})}{\text{Count}(\text{Acc after Gen}) + \text{Count}(\text{Poss after Gen})}$$

Disclosure statement

No potential conflict of interest was reported by the author(s).

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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