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Bulgarian clitics are sensitive to number attraction

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Previous research has shown that the computation of subject-verb number agreement can be derailed by the presence of syntactically illicit nouns, a phenomenon called *agreement attraction*. By contrast, the incidence of agreement attraction with anaphoric dependencies is less clear: Previous work has mostly focused on reflexives and strong pronouns, which sometimes show attraction and other times do not. Meanwhile, research on *clitics* – a different class of pronominal anaphora – is scarcer. To expand the empirical record, we examined clitic pronouns in an under-researched language, Bulgarian. The results of a large sample eye-tracking study showed clear agreement attraction effects in fixation durations and regressive eye-movements to the clitic pronoun and following words. These findings provide further evidence that the variable attraction profile of anaphoric dependencies might depend on the features of an anaphoric element, including its placement and the role of syntactic constraints in establishing the antecedent-pronoun dependency.

1. Introduction

Previous research has shown that a processing effect called *agreement attraction* does not uniformly impact all types of grammatical dependencies. For example, subject-verb agreement typically shows number attraction effects across languages, which consist of the facilitated processing of an ungrammatical verb in the presence of a preceding plural modifier – called an *attractor* – as in the sentence *The key to the cabinets ARE on the table* (Dillon et al., 2013; Hammerly et al., 2019; Jäger et al., 2020; but see Chromý et al., 2023a, 2023b). By contrast, anaphoric dependencies have a more variable behavior. Comprehension studies have mostly focused on reflexive anaphors like *himself* or *herself*, which sometimes show number attraction during reading (Jäger et al., 2020; Parker & Phillips, 2017; Patil et al., 2016), but other times do not (Dillon et al., 2013; Parker & Phillips, 2017; Sturt, 2003). A similarly variable attraction profile has been documented with object pronouns like *him* or *her* during reading comprehension (Badecker & Straub, 2002; Chow et al., 2014). The source of these variable attraction profiles is unclear, but they have sometimes been attributed to a differential use of syntactic constraints (Chow et al., 2014; Han et al., 2021) or to interpretation-related factors in production (Eberhard et al., 2005; Kandel & Phillips, 2022).

The variability observed with reflexives and pronouns motivates research into other types of anaphoric dependencies, as well as into less-studied languages. This brief report pursues this goal by investigating the processing of clitic pronouns in Bulgarian. To date, it is unknown whether Bulgarian object clitics show agreement attraction. Previous studies have only considered Greek and Spanish and employed different experimental methods. Particularly, Paspali and Marinis (2020) showed that Greek clitics are prone to gender attraction in several measures (self-paced listening times, speeded and offline judgments), in contrast to Santesteban et al. (2017), who found evidence of attraction with Spanish clitics in offline judgments and event-related brain responses, but not in self-paced reading times.

The contrast above could point to a cross-linguistic difference between Greek and Spanish clitics, an asymmetry in the processing of gender vs. number, and/or methodological factors. For example, the lack of attraction effects during reading in Santesteban et al. (2017) might have resulted from the properties of their materials (non-canonical configurations, such as clitic left-dislocated structures) and/or design. As acknowledged by the authors, the design of the experimental sentences did not allow controlling for spillover effects of the plural attractor, which can affect attraction during reading (Wagers et al., 2009). Finally, participants were required to provide grammaticality judgments after reading the sentences. This differs from most previous reading studies using self-paced and eye-tracking, which typically include comprehension questions to avoid focusing participants' attention on grammaticality (Dillon et al., 2013; Lago et al., 2021; Paspali & Marinis, 2020; Wagers et al., 2009).

Our study addressed these potential issues and additionally tested a less-studied language: Bulgarian. Bulgarian clitics are syntactically, semantically, and prosodically deficient pronominal

elements that are specified for gender (masculine, feminine, or neuter) in the third person singular, in addition to number and case (Franks, 2017, 2021). In contrast to other Slavic languages, case inflection in Bulgarian and Macedonian has been lost on nouns, but it is retained on clitics and tonic (strong) pronouns, with object clitics in the Accusative case and oblique clitics in the Dative case. In Bulgarian, clitic and tonic pronouns are in complementary distribution: clitics are the default option in antecedent-pronoun dependencies, while pronouns are used in marked contexts, such as clefts, contrastive configurations and as objects of prepositions. **Table 1** presents the properties of Bulgarian object clitics (note that clitics are not specified for animacy).

Table 1: Object clitics and tonic pronouns in Bulgarian.

Person/Number	Object clitics	Tonic pronouns	Translation
1Sg	me	mene	'me'
2Sg	te	tebe	'you'
3Sg	go (masc./neut.)	nego (masc./neut.)	'him/it'
	ja (fem.)	neja (fem.)	'her'
1Pl	ni	nas	'us'
2Pl	vi	vas	'you'
3Pl	gi	tjah	'them'

Bulgarian clitics are licensed after any prosodically non-deficient elements, e.g., conjunctions (1), the future marker *šte* ('will'), and the negative particle *ne*. Further, clitics are verb-adjacent and their canonical position is pre-verbal, unless post-syntactic (e.g., phonological) constraints reposition them post-verbally (Franks, 2017; Harizanov, 2014a; Pancheva, 2005). This distribution differs from the placement of clitics in Greek and Spanish, where the proclisis-enclisis alternation is governed by the finiteness of the verbal host of the clitic (Mavrogiorgos, 2013). The properties of Bulgarian clitics also show differences with those of the clitics in West Slavic and the rest of the South Slavic languages (there are no pronominal clitics in East Slavic).

(1) *Kupix knigata i ja pročetoh.*
bought.1SG the book and it.CL.F.SG.ACC read
'I bought the book and read it.'

Given the differences in the characteristics of Bulgarian object clitics compared to clitics in Slavic and non-Slavic languages, as well as the issues surrounding the testing of clitics in previous work, our research question was whether Bulgarian clitics would show number attraction effects in comprehension. To our knowledge, our study is the first to test attraction with pronominal dependencies in Slavic and as such, it provides an important addition to existing attraction studies on subject-verb agreement in Russian (Slioussar et al., 2022) and Czech (Chromý et al., 2023a, 2023b).

2. Eye-tracking reading experiment

We conducted an eye-tracking-while-reading experiment to examine whether number attraction effects occurred with clitic object pronouns in Bulgarian. Based on previous findings with Spanish clitics (Santesteban et al., 2017), we might expect a lack of attraction effects with Bulgarian clitics. However, as pointed out above, our materials and method differed in several aspects from Santesteban et al. (2017), including the use of clitics in canonical positions, as well as the deployment of a reading-for-comprehension paradigm without a grammaticality judgment task. Due to these modifications, we expected to find number attraction with Bulgarian clitics.

2.1 Participants

We recruited 102 native speakers of Bulgarian with normal or corrected-to-normal vision at a large public university in Bulgaria. Three participants were excluded, due to technical issues or filler accuracy below 70%. The remaining 99 participants were entered in the analysis (mean age = 21 years, age range = 18 – 39 years, 77 female). Participants provided informed consent and were compensated for their participation. The procedures were in accordance with the Declaration of Helsinki.

2.2 Design and materials

Forty experimental stimuli featuring object clitics as agreement targets were arranged in a 2 × 2 within-subjects design, with *Grammaticality* (grammatical/ungrammatical) and *Attractor number* (singular/plural) as factors. In the grammatical conditions, the clitics were always singular, while in the ungrammatical conditions, they were always plural.[1] Each target item consists of three clauses: an initial clause or preamble that introduced the event; a second clause that included an object NP with the head noun and the attractor; and a final clause that included the clitic (example 2). The clitic always appeared in its preverbal canonical position (Harizanov, 2014a).

The head noun was always singular, but we varied the number of the attractor noun, e.g., *snimkata na kăštata/kăštite* ('the picture of the house/houses').[2] The material prior to the clitic in the pre-critical region was identical across conditions containing the conjunction *i* ('and') and an adverb of manner, for example, *s neželanie* ('reluctantly'). Given that clitics in Bulgarian are syntactically and prosodically dependent on their verbal host and cannot be separated from

[1] The fact that the form of the clitic pronoun differed between the ungrammatical and grammatical conditions (*gi* vs. *ja/go*, respectively) means that the effect of grammaticality in the statistical analysis might have been influenced by the different frequency of the clitic forms. While this is a methodological limitation of our study, we think that clitic frequency is unlikely to have had a large influence on reading times, because all forms of pronouns are typically very frequent across languages.

[2] 9 out of 40 items had an antecedent noun with plural notional number (e.g., 'team'). Due to this small number, we did not analyze these items separately.

it (Franks et al., 2004; Pancheva, 2005), we analyzed the clitic and the verb jointly as one critical region. The spillover region consisted of 2–3 adverbial phrases. The gender of the clitic was counterbalanced across trials (half feminine and half masculine) and the antecedent and attractor noun always matched in gender. The plural form of the clitics was the same in all trials, because there is no gender distinction in the plural. A sample item followed by a comprehension question is shown in (2), with bolded critical and spillover regions.

(2) Sample experimental item set

Preamble

Dokato Maria roveše sred veštite na tavana,
While Maria roamed through the things in the attic,

a. *Grammatical condition, singular attractor*
*nameri snimkata na kăštata | i s neželanie | **ja** **skri** |*
(she) found the picture.F.SG of the house.F.SG and reluctantly it.CL.F.SG hid

b. *Grammatical condition, plural attractor*
*nameri snimkata na kăštite | i s neželanie | **ja** **skri** |*
(she) found the picture.F.SG of the houses.PL and reluctantly it.CL.F.SG hid

c. *Ungrammatical condition, singular attractor*
*nameri snimkata na kăštata | i s neželanie | **gi** **skri** |*
(she) found the picture.F.SG of the house.F.SG and reluctantly them.CL.PL hid

d. *Ungrammatical condition, plural attractor*
*nameri snimkata na kăštite | i s neželanie | **gi** **skri** |*
(she) found the picture.F.SG of the houses.PL and reluctantly them.CL.PL hid

Spillover
***v prašnoto čekmedže** | săs stari vešti.*
in the dusty drawer with old things
'While Maria was roaming through the things in the attic, (she) found the picture of the house(s) and reluctantly hid it/them in the dusty drawer with old things.'

Comprehension question: *Imaše li vešti v čekmedžeto?* 'Were there things in the drawer?'

Response options: *Da / Ne* 'yes / no'.

The experimental sets were combined with 100 grammatical filler sentences and distributed across four lists in a Latin Square design.[3] The fillers were of similar length as the experimental

[3] Due to experimenter error, the distribution of comprehension questions across experimental items was not balanced for each Latin Square list. Because of this, each participant saw an uneven number of questions per condition. Note that the distribution of questions p/condition was balanced across participants, but not for a single participant. We believe that this is unlikely to have affected the results, since the comprehension questions were unrelated to the experimental manipulation.

items. Eight of the fillers had plural clitics, to discourage participants from associating clitic plurality with ungrammaticality.

2.3 Procedure

Participants were tested individually, with their heads placed on a portable chinrest. Their eye movements were recorded by an Eyelink 1000 Plus eye-tracker sampling at 1000 Hz (SR Research). Viewing was binocular, but only the right eye was recorded. Sentences were presented in lower case on a monitor that displayed up to 90 characters per line. When necessary, line breaks occurred after the critical region. The resolution of the visual display was 1920 $\times$ 1080 pixels. Participants were seated 105 cm away from the monitor, and 4 characters per degree of visual angle.

Each session began with a calibration on a nine-point grid. Recalibration was conducted between the trials, as necessary. Participants were instructed to read at a natural pace and to answer comprehension questions after 16 experimental items and 34 fillers. They were allowed to take breaks at their discretion. Two practice items were presented. The order of experimental and filler items was randomized for each participant. Participants initiated each trial by fixating on a marker at the beginning of the sentence. An experimental session lasted 45 – 60 minutes.

3. Analysis

The data pre-processing steps were identical to those reported in Lago et al. (2021). The statistical analysis also closely followed Lago et al. (2021): Due to the brief report format, we only summarize the main aspects and any points of departure. We only analyzed reading measures that have consistently shown attraction in previous studies: first-pass regressions, regression-path, and total reading time (Acuña-Fariña et al., 2014; Dillon et al., 2013; Jäger et al., 2020; Parker & Phillips, 2017; Pearlmutter et al., 1999). *The probability of first-pass regressions* is an early processing measure denoting the likelihood of initiating a regression when first encountering a region. *Total time* is a global measure that denotes the amount of time spent in a region, including re-reading. Finally, *regression-path time* describes the amount of time spent since first entering a region from the left until leaving it to the right, including regressions to preceding regions.

Reading times were log-transformed. The analysis focused on the critical region – the clitic plus verb – and the spillover region – the following adverbial phrase(s) – because attraction effects in reading typically emerge after an agreement target has been encountered. We analyzed the critical and spillover regions jointly, using *Region* as a fixed effect (Cunnings & Sturt, 2018; Lago et al., 2021). Reading data were analyzed with frequentist mixed-effects logistic regression (first-pass regressions) and linear regression (regression-path and total times) in R (R Development Core Team, 2023). To control for the impact of testing three dependent measures on the Type 1

error rate (von der Malsburg & Angele, 2017), we applied the Bonferroni correction by dividing the .05 alpha level by three, which yielded an adjusted alpha level of 0.017.

Two statistical analyses were conducted for each measure. The first analysis – reported in **Table 2** and in the text – used a model with the sum-coded factors Grammaticality (-0.5 grammatical / $+0.5$ ungrammatical), Attractor Number (-0.5 singular / $+0.5$ plural), and Region (-0.5 critical / $+0.5$ spillover), as well as their interactions. The second analysis – reported in the text – quantified the nested effect of attraction within grammatical and ungrammatical sentences separately, using the *emmeans* package (Lenth, 2024). This analysis was performed because previous research has shown that attraction mainly occurs as processing facilitation in ungrammatical sentences (Hammerly et al., 2019). Thus, the attraction effect in ungrammatical sentences was our critical diagnostic of attraction in Bulgarian clitics.

The random structure of the models included intercepts and slopes for the two theoretically relevant fixed effects – Grammaticality and Attractor Number – and their interaction. We also included a random intercept for trial, because there were two non-independent data points from each trial (e.g., one observation from the critical region and one from the spillover region).

4. Results

Mean accuracy in the comprehension questions was 80% ($SD = 21\%$) in the experimental sentences and 90% ($SD = 6\%$) in the filler sentences. Skipping rates were 3.29% and 3.06% in the critical and spillover regions, respectively. We focus the discussion of the reading data on the two effects of interest, grammaticality and attraction, but include the full output of the statistical models in **Table 2**. A figure with the reading times of the regions preceding and following the critical region is available in the Appendix.

The results of the full models in the combined critical-spillover region showed a main effect of grammaticality in regression-path and total times, with longer reading times in ungrammatical than in grammatical sentences in both measures. In total times, the grammaticality effect interacted with attractor number and region. This reflected the fact that the Grammaticality $\times$ Attraction interaction – the statistical marker of a larger attraction effect in ungrammatical sentences – was larger in the clitic region than in the spillover region.

The results of the nested models showed that plural attractors facilitated the reading of ungrammatical sentences through fewer first-pass regressions and faster regression-path and total reading times (**Figure 1**). Specifically, there was a significant attraction effect in the probability of first-pass regressions in ungrammatical sentences (estimate = –0.31, SE = 0.13, $z = -2.37$, $p = .018$), but not in grammatical sentences (estimate = –0.06, SE = 0.15, $z = -0.39$, $p = .696$). Similarly, the attraction effect was significant in the regression-path times of ungrammatical

Table 2: Full model estimates in the combined clitic and spillover region.

	Estimate	SE	z/t value	p-value
First-pass regression				
Intercept (grand mean)	**–2.26**	**0.08**	**–26.90**	**<.001**
Region	**–0.93**	**0.08**	**–12.34**	**<.001**
Grammaticality	0.14	0.10	1.33	.184
Attractor number	–0.18	0.10	–1.88	.060
Region × Grammaticality	0.09	0.15	0.60	.552
Region × Attraction	–0.17	0.15	–1.10	.271
Grammaticality × Attraction	–0.25	0.20	–1.30	.193
Region × Grammaticality × Attraction	–0.35	0.30	–1.15	.249
Regression-path time				
Intercept (grand mean)	**6.34**	**0.04**	**169.93**	**<.001**
Region	**0.68**	**0.01**	**49.58**	**<.001**
Grammaticality	**0.07**	**0.02**	**3.91**	**<.001**
Attractor number	–0.03	0.02	–1.66	.101
Region × Grammaticality	–0.05	0.03	–2.00	.046
Region × Attraction	0.00	0.03	–0.09	.931
Grammaticality × Attraction	–0.07	0.03	–2.01	.049
Region × Grammaticality × Attraction	0.03	0.05	0.54	.590
Total time				
Intercept (grand mean)	6.50	0.04	157.93	**<.001**
Region	0.69	0.01	66.99	**<.001**
Grammaticality	0.07	0.02	3.73	**<.001**
Attractor number	–0.02	0.01	–1.64	.108
Region × Grammaticality	**–0.07**	**0.02**	**–3.20**	**.001**
Region × Attraction	0.02	0.02	0.85	.397
Grammaticality × Attraction	**–0.09**	**0.03**	**–3.02**	**.004**
Region × Grammaticality × Attraction	**0.11**	**0.04**	**2.58**	**.010**

Note. Model estimates are expressed in log odds for the first-pass regression probability measure and in log milliseconds for the regression-path and total time measures. For the factor Grammaticality, a positive coefficient reflects a slowdown in ungrammatical sentences – i.e., processing disruption. For the factor Attractor Number (or Attraction), a negative coefficient reflects a speedup (or fewer regressions) for sentences with a plural attractor – i.e., processing facilitation. For the Grammaticality × Attraction interaction, a negative coefficient shows a stronger attraction effect in ungrammatical sentences than in grammatical sentences. Effects are bolded if they were significant at an alpha level adjusted for multiple comparisons (.017). The estimates from the nested models quantifying the effect of attraction within grammatical and ungrammatical sentences are reported in the text.

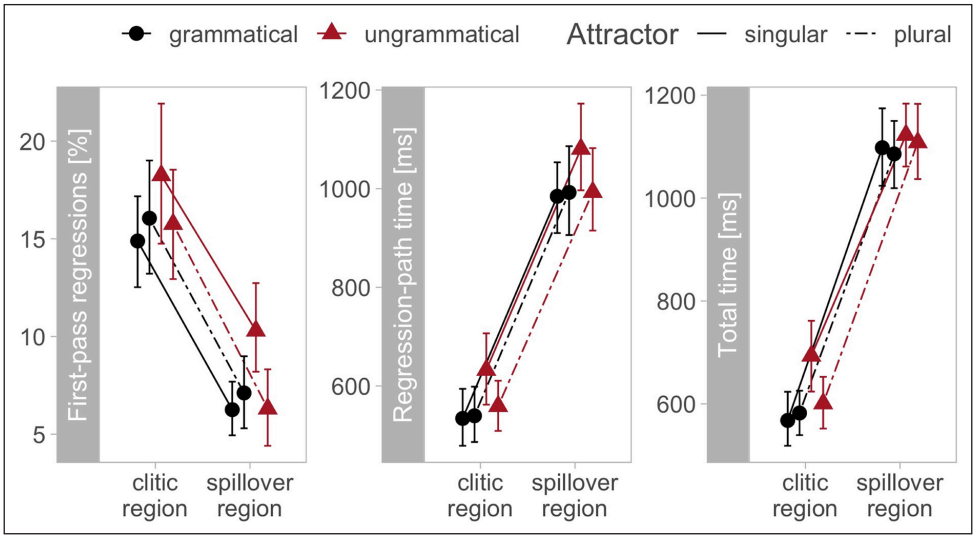

Figure 1: Descriptive summary of reading measures for the critical (clitic + V) and spillover region.

Note. Points show by-condition means and error bars show 95% confidence intervals calculated for each condition across participants and items.

sentences (estimate = –0.06, SE = 0.02, t = –2.73, p = .006), but not of grammatical sentences (estimate = 0.00, SE = 0.02, t = 0.31, p = .750). The same pattern was observed in the total reading times (ungrammatical sentences: estimate = –0.07, SE = 0.02, t = –3.37, p < .001; grammatical sentences: estimate = 0.02, SE = 0.02, t = 0.89, p = .376). Taken together, these results show that Bulgarian participants successfully detected number agreement violations with clitics, but also that they experienced attraction in the presence of a plural attractor in ungrammatical sentences.

5. Discussion

This brief report described an eye-tracking-while-reading experiment designed to test the existence of number attraction with object clitic pronouns in Bulgarian. Our goal was to provide evidence to broaden the empirical record regarding the processing of clitics, using a reading paradigm with fine-grained temporal resolution. Our findings showed attraction effects in ungrammatical sentences in all three measures of interest: first-pass regression probability, regression-path and total reading time. The time course (in terms of reading measures) and location (in terms of sentence regions) of attraction effects were similar to those reported for subject-verb agreement (Dillon et al., 2013; Lago et al., 2021; Wagers et al., 2009). In addition, there was evidence of Bulgarian participants detecting antecedent-clitic number violations, leading to grammaticality effects in regression-path and total times. Below we discuss our findings in the context of the variable attraction profiles of pronominal dependencies and the use of attraction effects as a diagnostic of the grammatical status of clitics.

5.1 Variable attraction profiles with pronominal dependencies: potential factors

With regard to pronominal dependencies as a class – i.e., taking clitics together with reflexive and non-clitic object pronouns, – an ongoing debate is what causes their variable attraction profiles across studies. Our findings cannot settle this debate, but they argue against a hypothesis sometimes advanced in the production literature: that the resilience of reflexives to attraction might be due to the operations involved in establishing a referential relationship, as opposed to the more grammaticalized relationship involved in subject-verb agreement (Eberhard et al., 2005; Kandel & Phillips, 2022). The idea is that attraction errors with verbs result from computations driven primarily by morphosyntactic information, which lack much semantic import. By contrast, agreement with pronominal elements might be driven more by the interpretative features of the pronoun's referent, potentially reducing interference due to morphological overlap. However, this hypothesis would not predict attraction with Bulgarian clitics in our materials, given that Bulgarian clitics instantiated clear referential relationships with their antecedents. Therefore, the interpretative status of antecedent-pronoun relationships is unlikely to account for their reduced attraction profile in comprehension. It is an open question whether this occurs in production, the modality in which this hypothesis has been more commonly considered.

5.2 Attraction with clitic pronouns across languages

Our finding of number attraction is consistent with results of gender attraction with Greek clitics (Paspali & Marinis, 2020) and number attraction with Spanish clitics in two out of three measures in Santesteban et al. (2017). We believe that differences in the experimental design and/or the linguistic materials might have contributed to the contrast in reading measures observed between our study and the self-paced reading study of Santesteban et al. (2017). First, we differed from Santesteban and colleagues in our use of a different method (eye-tracking vs. self-paced reading), the control of potential spillover effects of the plural attractor, and the avoidance of post-sentence acceptability judgments to deflect participants' attention from grammaticality. An additional difference was the analysis of the clitic together with the verb as one region, similarly to Paspali and Marinis (2020). In contrast, the analysis of Santesteban et al. (2017) separated them, potentially resulting in clitics' decreased sensitivity to agreement in the self-paced reading task.

Second, there are differences in the phonological and morphosyntactic properties of clitics across languages. For example, Bulgarian shares more typological commonalities in clitic doubling with Greek than with Spanish (Harizanov, 2014b), but it diverges from both languages in its phonological constraints on non-initiality (Pancheva, 2005). We cannot rule out the possible impact of these differences because we did not control for them. Future studies will have to determine whether they play a role.

Third, we tested clitics in a canonical preverbal position, which differs from the Spanish non-canonical dislocated clitic construction used by Santesteban et al. (2017). Dislocated clitics are strong anaphors with locality conditions on their antecedents that restrict them to the most

accessible elements in the discourse (López, 2009). These restrictions are similar – but not identical – to the locality constraints on antecedent-reflexive dependencies, which have been proposed to account for the resilience of reflexives to attraction (Dillon et al., 2013). By contrast, the Bulgarian clitics tested in our study are not dislocated or subject to strict binding (Principle A) or to locality constraints. Instead, they establish an antecedent-pronoun dependency via coreference that relies on morphological cues like number. A reliance on these cues by the parser could account for the attested attraction effects (Dillon et al., 2013; Parker & Phillips, 2017).

An interesting direction for future research would be to compare the behavior of Bulgarian clitics in different structural configurations (e.g., canonical vs. dislocated constructions). While previous research has discussed variability mostly in terms of contrasts between pronominal classes (reflexives vs. pronouns), we believe that keeping an anaphor's class constant but manipulating its syntactic environment provides a promising avenue to understanding the factors affecting the incidence of attraction.

A final difference between the study of Santesteban et al. (2017) and our study concerns the gender marking of plural clitics: while Spanish plural clitics have different forms for masculine and feminine (e.g., "los" vs. "las"), Bulgarian clitics have a single form ("gi"). This cross-linguistic difference could be relevant because gender features are likely cues for retrieval. However, this factor is unlikely to have played a role in our design, since the target and attractor noun always matched in gender, and thus gender was a non-diagnostic cue for retrieval.

5.3 Attraction as a diagnostic of the grammatical status of clitic pronouns

Earlier work proposed that attraction effects were useful for diagnosing the status of clitics, which have been argued to be either pronouns or agreement morphemes. The claim was that sensitivity to attraction supported proposals of clitics as agreement morphemes, while a lack of attraction would support proposals that they were pronouns. Indeed, the lack of attraction with Spanish clitics in reading measures – as well as their atypical brain responses – was taken as evidence that they were pronouns (Santesteban et al., 2017).

We think that this mapping between attraction and grammatical status is unlikely to hold for our data. The structural properties of Bulgarian clitics as functional heads –rather than as the realization of agreement features – as well as their behavior in terms of adjacency restrictions, doubling, and dislocation provide strong arguments for their status as pronouns (Franks, 2021; Harizanov, 2014b). This suggests that agreement attraction is not a reliable cross-linguistic diagnostic for determining the grammatical status of clitics. Future studies investigating the sensitivity of clitics to attraction should also take into consideration their structural properties, the triggers of their placement (syntactic, prosodic, semantic and pragmatic) and the constraints on establishing antecedent-clitic dependencies across languages.

Appendix. Reading times in the regions adjacent to the critical region

Figure S2 shows the reading times of the two regions preceding and following the critical region, in order to provide a more integral picture of the reading profiles in the experimental sentences. Sample sentence (regions indicated between parentheses):

> 'While Maria roamed through the things in the attic |, (she) found the picture of the house | and reluctantly | hid it | in the dusty drawer | with old things.'

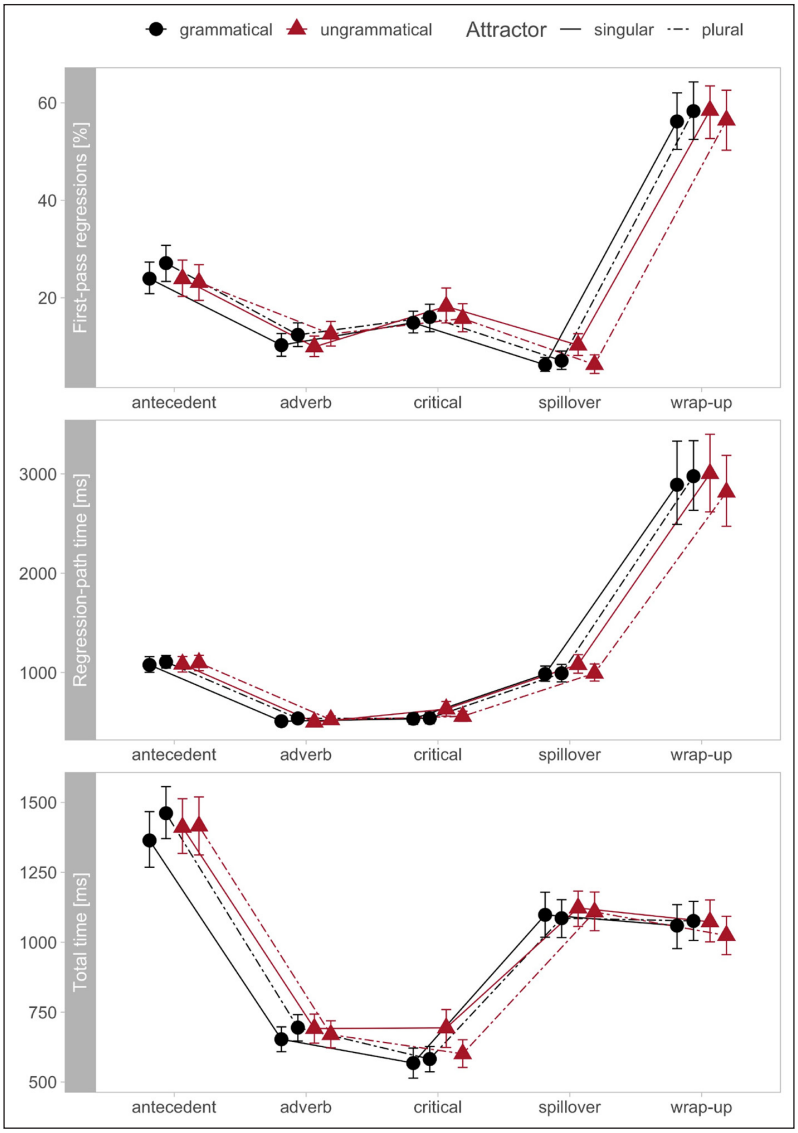

Figure S2: Empirical reading times of the two regions before and after the critical region.

Note. Points show condition means and error bars show 95% confidence intervals calculated for each condition across participants and items. The x-axis shows the different sentence regions, starting from the second sentence region: *(she) found the picture of the house*.

Abbreviations

ACC – Accusative

CL – Clitic

F – Feminine

M – Masculine

SG – Singular

PL – Plural

Data accessibility statement

Materials, data, and analysis code are publicly available at the Open Science Framework: https://osf.io/n5fv7/.

Ethics and consent

The study with human participants was performed in accordance with the Declaration of Helsinki. Informed consent was obtained in writing from all participants prior to testing.

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Competing interests

The authors have no competing interests to declare.

Author contributions

Conceptualization: T.I.S. and S.L.; methodology: T.I.S. and S.L.; formal analysis: S.L.; investigation**:** T.I.S.; resources: T.I.S. and I.A.S.; data curation: T.I.S. and S.L.; writing – original draft preparation: T.I.S.; writing – review and editing: T.I.S., I.A.S. and S.L.; visualization: S.L.; project administration: T.I.S.; funding acquisition: T.I.S. and I.A.S. All authors have read and agreed to the published version of the manuscript.

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