

Comparing number and gender agreement processing in Russian: an experimental study

Anastasiia Ivanova¹, Natalia Slioussar^{1, 2, 3}

¹School of Linguistics, Higher School of Economics, Russian Federation

²Faculty of Liberal Arts and Sciences, St Petersburg University, Russian Federation

³Institute for Cognitive Studies, St Petersburg University, Russian Federation

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Abstract

We conducted a self-paced reading experiment comparing attraction effects in number and gender agreement in Russian. Only one previous comprehension study (Tucker et al., 2021) compared them in Standard Arabic, getting distinct profiles. In Russian, larger reading time delays were associated with gender errors compared to number errors, but attraction effects with both features were similar.

Keywords: Russian, language comprehension, agreement attraction, grammatical gender, grammatical number

Introduction

Agreement attraction, as in the sentence “The key to the cabinets were rusty”, in which the verb erroneously agrees not with the subject, but with a dependent noun, *an attractor*, has been extensively studied in many languages. Attraction effects were observed both in gender and in number agreement, both in production and in comprehension. However, very few studies tried to compare gender and number attraction effects, especially in comprehension: this was done only by Tucker et al. (2021) on Standard Arabic. We conducted a comprehension experiment on Russian, getting partially different results.

Russian language has three genders (masculine, feminine, neuter) and two numbers (singular, plural), as well as six cases. Adjectives and participles agree with nouns in case, number and gender (in singular). Verbs agree with subjects in person and number in the present and future tense and in number and gender (in singular) in the past tense.

Previous comprehension studies on Russian found attraction effects both in number and in gender agreement (Slioussar, Malko 2016; Slioussar 2018; Slioussar et al., 2022), but never compared them. In production, Lorimor et al. (2008) studied both features in one experiment, eliciting some number errors, but no gender errors (such errors were observed by Slioussar and Malko (2016), but their study did not include number agreement). Lorimor et al. concluded that gender agreement is more resistant to attraction, and experiments on Romance languages (e.g. Vigliocco et al., 1995) point to the same conclusion.

Experiment

Method

130 Russian native speakers (18-70 years old, mean age 22,4) took part in the experiment. We constructed 28 target sentence sets, as in (1). In all sentences, the head of the subject noun phrase was a feminine or neuter noun in nominative singular¹. The number and gender of the accusative dependent noun and the predicate varied across seven experimental conditions shown in Table 1. All heads and dependent nouns were inanimate and syncretic (their accusative forms coincided with their nominative forms) to maximize attraction effects (see Slioussar 2018; Slioussar et al. 2022 for the role of syncretism in agreement processing in Russian).

- (1) Zapis' pro povest' / povesti / rasskaz
 entry_{F.NOM.SG} about novel_{F.ACC.SG} / novels_{F.ACC.PL} / story_{M.ACC.SG}
 byla/*byl/*byli najdena/*najden/*najdeny v dneknike pisatelja.
 wa_{F.SG/M.SG/PL} found_{F.SG/M.SG/PL} in writer's diary

	i.	ii.	iii.	iv.	v.	vi.	vii.
Dependent noun	N/F.Sg	N/F.Sg	N/F.Pl	N/F.Pl	N/F.Sg	M.Sg	M.Sg
Predicate	N/F.Sg	N/F.Pl	N/F.Sg	N/F.Pl	M.Sg	N/F.Sg	M.Sg

Table 1. Seven experimental conditions.

Three conditions were grammatically correct (i, iii, vi in Table 1), four contained number (ii, iv) and gender (v, vii) agreement errors. In the conditions in which the ungrammatical features of the predicate matched the relevant features of the dependent noun (iv, vii) attraction effects could be expected. Target sentences in different conditions were distributed across 7 experimental lists. There were also 66 grammatical filler sentences.

The word-by-word self-paced reading methodology on the IbeXFarm platform was used in the experiment. After one third of the sentences participants were asked a comprehension question with a choice of two answers to ensure that they were paying attention. No participants were excluded based on low accuracy, and below, only RTs are discussed.

Results

Firstly, we excluded all RTs that exceeded a threshold of 2.5 standard deviations, by region and condition, from further analysis. This led to the exclusion of 0.8% of the data. Mean reading times in different conditions are shown in Figure 1 (we checked that the picture was very similar for the sentences with feminine and neuter subject nouns and analyzed them together).

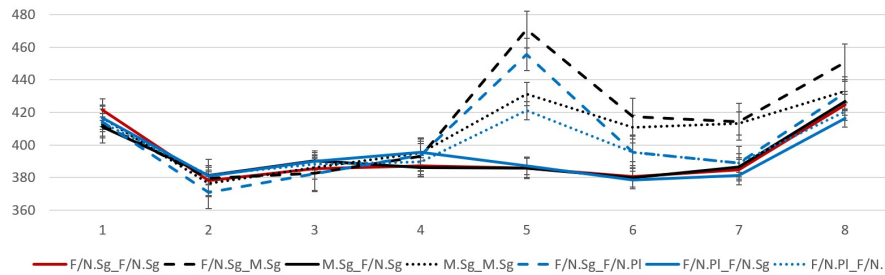


Figure 1. Average RTs per region (in ms) in the seven experimental conditions. Regions: N1 (head)—preposition—N2 (dependent)—copula (*byt'* 'to be')—adjective/participle—three words modifying the predicate.

The data were modelled with a mixed-effects regression in the R software. Random intercepts and random slopes by participant and by item were included in the model. Three factors were considered: *number* (number agreement error: yes/no), *gender* (gender agreement error: yes/no), *match* (the features of the subject match the features of the dependent noun: yes/no).

Statistically significant differences between conditions were found only on the fifth word (a participle, like 'found' in (1)). The number factor ($\beta = -29,29$, $SE = 6,88$, $z = 4,25$, $p < 0,01$) and the gender factor ($\beta = -45,05$, $SE = 6,83$, $z = 6,59$, $p < 0,01$) were significant, showing that readers slowed down on agreement errors. As we can see from the β -values, the effect of gender errors was more noticeable. The interaction between number and match ($\beta = -43,44$, $SE = 10,42$, $z = 4,17$, $p < 0,01$) and gender and match ($\beta = -40,77$, $SE = 10,47$, $z = 3,89$, $p < 0,01$) also reached significance, i.e. similar attraction effects were detected for number and gender agreement. Other comparisons were not significant.

Discussion

Tucker et al.'s (2021) study on Standard Arabic was the only comprehension study comparing number and gender agreement attraction. They found that number attraction effects were smaller in comparison to gender agreement, but reached significance earlier (on the verb, not on the following word). At the same time, Tucker et al. noted that number attraction in Arabic appeared to differ from what was observed in other languages. Therefore, it was important to look at other languages to see if the comparison would yield similar results.

Our experiment demonstrated that in Russian, number and gender agreement attraction profiles are very similar in comprehension, both in terms of the effect size and timing. However, the delay provoked by gender agreement errors (both with and without attraction) was more pronounced in comparison to number errors. How to explain these findings and to reconcile them with the results of production studies (Lorimor et al., 2008) showing that number attraction errors are more frequent?

Stronger reaction to gender errors may have the following explanation. Gender is a property of the lexeme, while number is a property of a particular form, most nouns have both singular and plural, but only one gender. Maybe, this also explains why number attraction errors are more frequent in production — gender agreement may be in general more resistant to errors. However, if an error is present — and in comprehension studies, they are purposefully introduced in the stimuli — the same retrieval mechanisms are activated to check number and gender features, so attraction profiles are similar.

Further experiments are necessary to check whether these results would generalize to other constructions in which attraction is observed, most importantly, to relative clauses that were studied by Tucker et al. (2021), and to other languages with number and gender agreement. Our results are also interesting in the light of recent findings on Russian showing that in some other tasks that invoke memory, the number feature is more salient than the gender feature (Antropova et al., 2022). We can conclude that different properties of features become relevant depending on the nature of the task.

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Notes

1. In their comprehension study on Russian, Slioussar and Malko (2016) observed no attraction effects for masculine heads, and crosslinguistically, no attraction effects were found for plural heads (on Russian, see Slioussar (2018)).

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