

Gender and declension in gender agreement processing: evidence from Russian

In Russian, nouns come in three genders (M, F and N), and adjectives, participles and verbs (in some forms) exhibit gender agreement. Depending on the set of their inflections, nouns are divided into several declensions. We will rely on the most widely accepted system presented in Table 1 (e.g. Aronoff, 1994; Halle, 1994; Shvedova, ed., 1980). As Table 1 shows, inflections differ depending on how typical they are for a particular gender. We present three self-paced reading experiments studying how this typicality (known as gender-to-ending consistency in the psycholinguistic literature) and the gender of the noun influence gender agreement processing.

Exp. 1. Materials included 36 target sentence sets and 80 filler sentences. Sentences in one set contained the same six words except for the first one, the subject noun (M nouns with typical endings, F nouns with typical and non-typical endings, balanced in frequency and length) and the second one, the verb form (M or F). An example is given in (1). This yielded six experimental conditions, three of them with a gender agreement error. The design is schematized in Table 2. Sentences from each set in different conditions were distributed across six experimental lists. 33 native speakers participated in the experiment.

Average RTs are shown on Fig.1. RTs were analyzed using RM ANOVA (by subject and by item analyses). Firstly, the influence of the two factors of interest can be detected only in the sentences with agreement errors, i.e. no gender or declension is intrinsically more difficult to process (at least, in the sentence context). Secondly, the typicality of the ending plays a role at a very early stage and its effect is very short-lived, while the role of gender becomes visible later and its effect is more pronounced. Namely, agreement errors were noticed significantly later with non-typical F nouns than with typical F or M ones. But error-related delay on subsequent words was significantly more pronounced for M subjects than for F ones (of any type). The latter result suggests that predictions we make about predicate gender are stronger for M subjects (see also Slioussar & Malko, 2016). The former result can be explained by assuming that the gender of the nouns with non-typical endings is more difficult to retrieve.

Exp. 2. The design and analysis were very similar, but instead of F nouns with non-prototypical endings, we used M nouns with non-prototypical endings (see Table 2). All such nouns are animate, so we also used animate nouns in all other groups, while in Exp. 1, all subject nouns were inanimate. Although the gender feature is not semantically empty on animate nouns, the results for non-typical M nouns were very similar to those of Exp. 2 (see Fig. 2). Readers notice agreement errors with them significantly later. Interestingly, on subsequent words, error-related delay is significantly larger in the sentences with typical M subjects than with typical F and non-typical M ones. I.e. only in the former case, the expectation about the gender on the predicate is stronger. We had 48 participants and 36 target sentence sets.

Exp. 3. The design and analysis were very similar, but we introduced N nouns (see Table 2). All nouns had prototypical endings and were inanimate in this experiment, we wanted to assess the role of gender. As Fig. 3 illustrates, we found the difference between M vs. F and N subjects. The former generate much stronger predictions about the gender of the predicate. We had 48 participants and 36 target sentence sets.

Discussion. Many experimental studies found differences between nouns with more and less typical inflections in a variety of languages. However, these studies usually looked at the processing of isolated nouns. Among the few sentence-processing studies, Caffarra et al. (2015) looked at Italian nouns with more and less typical endings presented in the same sentences in an EEG study. Franck et al. (2008) and Vigliocco and Zilli (1999) demonstrated for Italian, Spanish, and French that heads with regular inflections are more resistant to gender agreement attraction. Our experiments contribute to this picture. There was one paper (Taraban and Kempe, 1999) that addressed this problem in Russian before. No differences between M and F nouns ending in a consonant were found for native speakers, but Taraban and Kempe used a method allowing for less direct reading measures (predicate form selection).

Turning to the second factor, a major problem discussed in agreement processing literature is associated with asymmetric effects of different features. Russian gender is interesting in this respect because markedness relations in the system are not entirely obvious (see e.g. Slioussar and Malko 2016). Several experimental studies of agreement in comprehension demonstrated that M (the most frequent gender) is different from F and N (e.g. Akhutina et al., 1999, 2001; Romanova & Gor 2017; Slioussar and Malko 2016). Our study confirms this pattern.

- (1) *Xalat / kurtka / šinel' + byl / byla potrepannym / potrepannoj + ot mnogoletnej noski. robe_{2D-M} / jacket_{1D-F} / overcoat_{3D-F} + was_{M/F} shabby_{M/F} + from years-long wear*

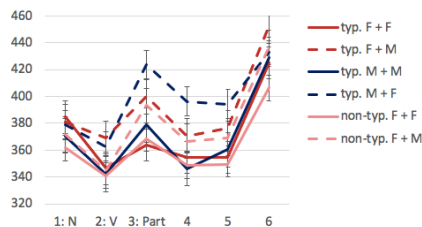


Fig. 1. Average word-by-word reading times (in ms) in Exp. 1

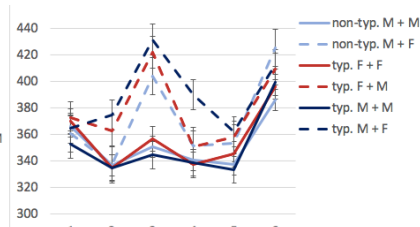


Fig. 2. Average word-by-word reading times (in ms) in Exp. 2

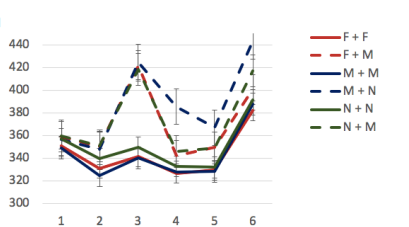


Fig. 3. Average word-by-word reading times (in ms) in Exp. 3

Declension and gender	% in the RNC	Ending in Nom.Sg	Examples
1 st decl. F	29% nouns	end in <i>-a/ja</i>	<i>žena</i> ‘wife’
1 st decl. M	1% nouns	end in <i>-a/ja</i>	<i>djadja</i> ‘uncle’
2 nd decl. M	46% nouns	end in a consonant (any type)	<i>syn</i> ‘son’, <i>gel’</i> ‘gel’
2 nd decl. N	18% nouns	end in <i>-o/e</i>	<i>pole</i> ‘field’
3 rd decl. F	5% nouns	end in a consonant (palatalized or /ž/, /š/, /č’/, /š’č’/)	<i>mel’</i> ‘shallow’
irregular & indeclinable	1% nouns		

Table 1. The distribution of nouns among genders and declensions in the grammatically disambiguated subcorpus of the Russian National Corpus (<http://www.ruscorpora.ru>).¹

	Exp 1			Exp 2			Exp 3		
Subject: gender and ending	M + -C	F + <i>-a/ja</i>	F + -C	M + -C	F + <i>-a/ja</i>	M + <i>-a/ja</i>	M + -C	F + <i>-a/ja</i>	N + <i>-o/e</i>
Predicate	typ.	typ.	non-typ.	typ.	typ.	non-typ.	typ.	typ.	typ.
	M / F	F / M	F / M	M / F	F / M	M / F	M / N	F / M	N / M

Table 2. Experimental designs

Aronoff, M. 1994. *Morphology by itself*. Cambridge, MA: MIT press. ◇ Akhutina, T., et al. 1999. Processing of grammatical gender in a three-gender system: Experimental evidence from Russian. *J. Psycholing. Res.* 28: 695–713. ◇ Akhutina, T., et al. 2001. Processing of grammatical gender in normal and aphasic speakers of Russian. *Cortex* 37: 295–326. ◇ Caffarra, S., et al. 2015. Is the noun ending a cue to grammatical gender processing? *Psychophysiology* 52: 1019–1030. ◇ Franck, J., et al. 2008. The interplay of syntax and form in sentence production: a cross-linguistic study of form effects on agreement. *Lang. Cogn. Process.* 23: 329–374. ◇ Halle, M. 1994. The Russian declension. In: *Perspectives in phonology*. Stanford: CSLI Publications. Pp. 29–60. ◇ Romanova, N., and K. Gor. 2017. Processing of gender and number agreement in Russian as a second language. *Stud. Second Lang. Acquis.* 39: 97–128. ◇ Shvedova, N (ed.). 1980. *Russkaja grammatika* (‘Russian grammar’). Moscow: Nauka. ◇ Slioussar, N., and A. Malko. 2016. Gender agreement attraction in Russian: production and comprehension evidence. *Front. Psychol.* 7: article 1651. ◇ Slioussar, N., and M. Samoiloa. 2015. Častotnosti različnyx grammatičeskix xarakteristik i okončanij u suščestvitel’nyx russkogo jazyka [Frequencies of different grammatical features and inflectional affixes in Russian nouns]. In: *Proceedings of the conference ‘Dialogue’*. www.dialog-21.ru/digests/dialog2015/materials/pdf/SlioussarNASamoiloaMV.pdf ◇ Taraban, R., and V. Kempe. 1999. Gender processing in native and nonnative Russian speakers. *Appl. Psycholinguist.* 20: 119–148. ◇ Vigliocco, G., and T. Zilli. 1999. Syntactic accuracy in sentence production: gender disagreement in Italian language-impaired and unimpaired speakers. *J. Psycholing. Res.* 28: 623–648.

¹ The counts are from Slioussar and Samoiloa (2015). Substantivized adjectives were not counted.