Number and gender in agreement processing: are they different?

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Background. We present an experiment on Russian revealing curious differences between number and gender in predicative agreement processing. Studies on various languages compared gender and number using behavioral and electrophysiological methods. Some observed that gender mismatches are associated with a higher processing cost [1;3] and a delayed effect [2;3] as compared to number mismatches. These effects were explained by gender being a property of the lexeme and number a property of the word form [1;2;3]. However, other studies reported a higher cost of number mismatches [4;5] or no differences between the features [6;7]. Thus, the existing results are controversial. We ran two experiments to contribute to this debate.

Experiment 1: a word-by-word self-paced reading task (N = 68) comparing number (NUM, 1b) and gender (GEN, 1c) in Russian predicative agreement. They have never been directly compared in Russian before. We also included a condition with a mismatch in both NUM and GEN (NUM+GEN, 2c) to compare it to NUM alone (2b). Correct sentences had SG and PL, F and M heads, so we could also compare the cost of the error after different heads. Mean RTs for verbs across all conditions are presented in Table 1. Statistical analysis: linear regressions with mixed effects, as well as multiple comparisons (Tukey tests).

Firstly, we observed that NUM induced larger processing cost than GEN (like in [4;5], unlike in [1;3]). Moreover, the GEN effect reached significance only on the word after the verb (hence V+1) (like in [2;3]). Secondly, the GEN effects were significantly more pronounced for M heads than for F heads (like in another study of predicative gender agreement in Russian [8], in parallel with some agreement attraction results). However, no differences were found between SG and PL heads (that have not been compared outside of the attraction studies in Russian before) — NUM errors were always very salient.

This is an interesting difference with attraction phenomena and an unexpected result that cannot be readily explained in terms of feature frequency, representational feature markedness or other characteristics usually invoked for such asymmetries. A possible explanation that we are going to explore is that predicative gender agreement is much more limited than number agreement in Russian. Finally, NUM+GEN errors significantly differed from NUM errors, but only for M.PL heads, which stresses the asymmetry between different values of the gender feature again.

Experiment 2: an ERP study (N = 48) with analogous stimuli. Procedure: rapid serial visual presentation (word by word) + grammaticality judgment for 25% of stimuli. ERPs were averaged across 9 ROIs. Statistical analysis: multi-factor GLM with multiple comparisons (with Šidak correction). According to the preliminary analysis, ERP responses to number and gender errors are also significantly different (in the LAN/N400 and P600 components).

(1) a. *Prikaz postupil iz glavnogo ofisa* (correct, M.SG head)
order$_{M.SG}$ came$_{M.SG}$ from head office
b. *Prikaz postupili iz glavnogo ofisa* (NUM mismatch)
order$_{M.SG}$ came$_{PL}$ from head office
c. *Prikaz postupila iz glavnogo ofisa* (GEN mismatch)
order$_{M.SG}$ came$_{F.SG}$ from head office
(2) a. *Plakaty viseli nad rabočim stolom* (correct, M.PL head)
poster$_{PL}$ hung$_{PL}$ above working desk
b. *Plakaty visel-Ø nad rabočim stolom* (NUM mismatch)
poster$_{PL}$ hung$_{M.SG}$ above working desk
c. *Plakaty visela nad rabočim stolom* (NUM+GEN mismatch)
poster$_{PL}$ hung$_{F.SG}$ above working desk
(3) *Pros'ba postupila ot delovogo partnjora* (correct, F.SG head)
request$_{F.SG}$ came$_{F.SG}$ from business partner

Cond.	SG head	M.SG head	F.SG head	Cond.	PL head	M.PL head	F.PL head
Corr.	493	484	502	Corr.	494	494	490
Gen.	516	521	511	Num.	565	565	583
Num.	562	547	578	Num.+Gen.	587	587	585

Table 1. Mean RTs for verbs (in ms) in different conditions.

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