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Symmetry, postposition, and hydras

Experimental evidence against the ATB-analysis of partial
agreement in Russian

Abstract

We present the results of acceptability judgement study focused on partial predicate agreement in Russian. We test the predictions of a possible analysis of partial agreement assuming coordination on VP level with subsequent Across-the-Board movement of verbal heads to a structurally higher position. This analysis implies restrictions on partial agreement in the case of symmetrical predicates, SV word order, and coordinated subject being a head of a relative clause. Our experimental data support none of these predictions. We propose that this result argues in favor of the DP-coordination analysis of partial agreement in Russian.

Keywords: acceptability judgement, agreement, coordination, experimental syntax, Russian

1 Introduction

Languages show different strategies of number agreement of the predicate with the coordinated subject. There are a few options attested. Firstly, the coordinated DP can be treated as a single plural DP, with the agreement marker on the verb being plural. Secondly, the agreeing verb can show singular morphology. In that case, it may appear that only one conjunct controls the agreement. This strategy is hence referred to as *partial agreement* (PA), or alternatively *first conjunct / last conjunct / closest conjunct / conjunct-sensitive agreement*. PA is not restricted to number: valuation of gender or person features may be involved as well. The range of languages where PA is possible is wide and typologically diverse. Just a few examples are Arabic (Aoun et al. 1994, Munn 1999), Hindi-Urdu (Bhatt & Walkow 2011), Bosnian/Croatian/Serbian (Bošković 2009, 2010, Willer-Gold et al. 2016), Tsez (Benmamoun et al. 2009), Welsh (Borsley 2009), and Qafar (Hayward & Corbett 1988), see Johannessen (1996) and Krejci (2020) for additional examples. PA strategies in those languages differ by a number of parameters, such as optionality, positional restrictions, availability of distributive and collective readings, and others. Some examples of PA are shown in (1).

- (1) a. *Raah Kariim w Marwaan.* (Lebanese Arabic, Aoun et al. 1994: 207)
 left.3.M.SG Kareem and Marwaan
 ‘Kareem and Marwaan left.’
- b. *kid=no uži=n Ø-ik’is* (Tsez, Benmamoun et al. 2009: 71)
 girl.ABS.II=AND boy.ABS.I=AND I-went
 ‘A girl and a boy went.’

The diversity of theoretical approaches correlates with the typological differences. To name a few options, Marušič et al. (2007, 2015) suppose that PA is a linear order effect in post-syntactic agreement. Bošković (2009) claims that in the case of PA the whole ConjP and the first conjunct are equally distant from the probe, thus creating two possible agreement goals. Aoun et al. (1994) argue for clausal conjunction with subsequent Across-the-Board (ATB) movement of the verb. For a more extensive discussion of these and other approaches see Nevins & Weissner (2019).

This paper will focus on number PA in Russian. More precisely, we will examine the predictions made by one of the possible approaches to PA in Russian — Krejci’s (2020) ATB-analysis. To do so, we will be using the methods of experimental syntax. The structure of the paper is as follows: in Section 2 we summarize the Russian data after describing the relevant aspects of Russian grammar. Section 3 gives an overview of the currently available analyses of Russian PA. Section 4 is devoted to presenting our experimental study. Finally, Section 5 offers a general discussion of the results.

2 Russian data

2.1 Basic grammatical facts

In Russian, the nominative subject controls the agreement of a finite verb. The verb always agrees in number, but the presence of other features depends on the tense. In the present and future tense the verb shows person agreement in addition to number agreement (2a,b vs. 2c), which is not applicable to the past tense. Instead, the verb in the past tense agrees with the subject in gender (3a,c vs. 3b,c). In plural, the gender distinction is neutralized (3d).

- (2) a. *Masha pishet pis'mo.*
 Masha.F.SG.NOM write.PRS.3.SG letter.ACC¹
 ‘Masha is writing a letter.’
 b. *Ivan pishet pis'mo.*
 Ivan.M.SG.NOM write.PRS.3.SG letter.ACC
 ‘Ivan is writing a letter.’
 c. *Ya pishu pis'mo.*
 I.NOM write.PRS.1.SG letter.ACC
 ‘I am writing a letter.’
- (3) a. *Masha napisala pis'mo.*
 Masha.F.SG.NOM write.PST.F.SG letter.ACC
 ‘Masha wrote a letter.’
 b. *Ivan napisal pis'mo.*
 Ivan.M.SG.NOM write.PST.M.SG letter.ACC
 ‘Ivan wrote a letter.’
 c. *Ya napisala / napisal pis'mo.*
 I.NOM write.PST.F.SG / write.PST.M.SG letter.ACC
 ‘I wrote a letter.’

¹ In this paper we use a simplified glossing system, explicitly marking only the grammatical features relevant for the discussion.

- d. *Oni napisali pis'mo.*
 they.NOM write.PST.PL letter.ACC
 ‘They wrote a letter.’

Coordination occurs by means of the conjunction *i* ‘and’. It can conjoin phrases of any level of syntactic complexity: e.g. DPs² (4a), vPs (4b), CPs (4c).

- (4) a. *Masha prinesla [tort i tsvety].*
 Masha brought cake and flowers
 ‘Masha brought a cake and flowers.’
 b. *Masha [prishla i prinesla tort].*
 Masha came and brought cake
 ‘Masha came and brought a cake.’
 c. *[Masha prinesla tort, i Ivan ego s"el].*
 Masha brought cake and Ivan it ate
 ‘Masha brought a cake, and Ivan ate it.’

The basic word order in Russian is SVO. However, this order is not fixed and it is influenced by information structure and the phonological length of constituents (for discussion of the derivation of different orders see e.g. Bailyn 2003). What will be important for further discussion is that SV and VS orders in sentences like (5a) and (5b) respectively are equally acceptable with slight differences in interpretation.

- (5) a. *Kniga lezhit na stole.*
 book is.lying on table
 ‘The book is lying on the table.’
 b. *Na stole lezhit kniga.*
 on table is.lying book
 ‘A book is lying on the table.’

The other relevant grammatical fact is the structure of relative clauses in Russian. They contain the relative pronoun *kotoruj* ‘which’ in C-domain. It agrees in number and gender with the head of the relative clause (6).

- (6) *Na stole lezhit kniga, kotoruyu Masha vzyala s polki.*
 on table is.lying book.F.SG.NOM which.F.SG.ACC Masha took from shelf
 ‘The book that Masha took from the shelf is lying on the table.’

2.2 PA facts

PA of the predicate is not obligatory. Although in some contexts it is just as acceptable as full plural agreement (FA), its use is restricted by multiple factors. These factors are discussed in descriptive studies of Russian (Pekelis 2013a, Pekelis 2013b, Sannikov 2008, Shvedova 1980).

² It is an open question whether there is a DP projection in Russian, or the nominals are NPs (e.g. see Pereltsvaig 2013). However, this question is not directly connected to our topic, so we will further use DP for the sake of convenience.

For instance, Pekelis (2013a) argues that the probability of PA is defined by the following factors, which apply in hierarchical order:

1. Word order (SV < VS)
2. Animacy hierarchy status (the higher status < the lower status)
3. Tense (past < present / future)
4. Gender (different gender of conjuncts < the same gender of conjuncts)

Pekelis (2013a) shows that the data from the Russian National Corpus (RNC, <https://ruscorpora.ru/en/>) is consistent with this hierarchy: PA in the more probable configurations is attested more often. Other sources (Sannikov 2008, Shvedova 1980) agree with the fact that the above-mentioned factors influence the acceptability of PA. However, these factors are not perceived by the authors as equally strict. Importantly for our study, both Pekelis and Sannikov claim that SV word order influences the probability of PA, but does not block this option entirely, while the Russian Grammar (Shvedova 1980) advocates for the impossibility of PA in SV clauses. Example (7) illustrates the contrast between standard FA (7a) and PA (7b) in SV clauses.

- (7) a. *Kniga i zhurnal lezhat na stole.*
 book and magazine lie.PRS.3.PL on table
 Lit. ‘A book and a magazine are lying on the table.’
 b. *?/*Kniga i zhurnal lezhit na stole.*
 book and magazine lie.PRS.3.SG on table
 Lit. ‘A book and a magazine is lying on the table.’

An additional factor is the semantics of the verb, namely, whether it requires collective reading or not. One kind of predicates that do impose collective reading are called symmetrical predicates (Pekelis 2013b). They require two arguments bearing the same thematic role. An example is given in (8a). The symmetrical predicate *sovmeshchat'sya* ‘be combined’ is only possible in the sentence where the subject is semantically plural (e.g. in (8a) the subject is the coordinated DP ‘theory and practice’). When this is not the case, the sentence is ungrammatical (8b). Regarding number agreement, symmetricity is predicted either to fully block PA (Pekelis 2013b, Shvedova 1980) or just to hinder it (Sannikov 2008), (8c).

- (8) a. *V novom kurse sovmeshchayutsya teoriya i praktika.*
 in new course combine.PRS.3.PL theory and practice
 ‘In the new course, theory and practice are combined.’
 b. **V novom kurse sovmeshchaetsya teoriya.*
 in new course combine.PRS.3.SG theory
 Lit. ‘In the new course, theory is combined.’
 c. *?/*V novom kurse sovmeshchaetsya teoriya i praktika.*
 in new course combine.PRS.3.SG theory and practice
 Lit. ‘In the new course, theory and practice is combined.’

As can be seen, there is a variety of factors influencing the possibility of PA of the predicate in Russian, and there is sometimes no consensus on how strict these constraints are. Our further discussion will mainly focus on the factors of word order and symmetry. In the following section we will overview the possible explanations of the given facts.

3 Analyses of PA in Russian

The theoretical approaches to PA in Russian can be divided in two major groups depending on the level of coordination they postulate. The first possible line of research, implying DP coordination, argues that the structure of the coordinated subject is equal in sentences with FA and PA. In the second approach, the choice of the verb form is explained by the structural differences. In the case of FA, the coordination occurs on DP level, while VP coordination stands behind PA.

3.1 DP coordination

Bošković (2010) does not attribute the differences between PA and FA in Russian to the level of coordination. He proposes an account of PA in SV and VS word orders building upon the hierarchical structure of ConjP and division between Primary and Secondary Agree. Although this analysis focuses not on finite verbs, but on passive participles with a finite auxiliary, it can be easily expanded to our configuration. As Bošković's analysis was designed for participles, it has to account for the partial gender agreement as well. When the gender features of conjuncts differ, the gender agreement is controlled by the closest conjunct. Interestingly, Bošković treats PA in SV and VS clauses as equally grammatical, which contradicts the viewpoints discussed above. The examples are given in (10).

- (10) a. *Bylo razrusheno selenie i derevnya.*
 be.PST.N.SG destroyed.N.SG settlement.N and village.F
 Lit. 'A settlement and a village was destroyed.'
- b. *Derevnya i selenie bylo razrusheno.*
 village.F and settlement.N be.PST.N.SG destroyed.N.SG
 Lit. 'A village and a settlement was destroyed.'
- (Adapted from Bošković 2010: 42)

The ConjP is claimed to optionally possess the plural number feature. When the order is VS, the account is straightforward: the finite verb agrees with the whole ConjP in plural, if the number is specified, or in singular with the higher (and linearly first) conjunct, if the number is not specified. The gender agreement is controlled by the higher conjunct (10a). The subject remains in a position lower than the verbal head.³

³ In the original account (Bošković 2010) this is explained by the fact that the participial head Part can either have or not have EPP feature. This does not seem to be true for finite verbs. However, there are some separate analyses of VS word order in Russian. For instance, Bailyn (2003) and others (see Bailyn 2003 for references) argue that the EPP feature of the finite I/T head can be fulfilled by some non-canonical phrases, such as object DP or locative PP.

In the case of SV, the derivation is more complex to account for the fact that the gender agreement is controlled by the lower (and linearly second) conjunct. In this configuration, the agreement is claimed to occur in two stages. Firstly, at the Primary Agree stage ConjP's plural feature values the number feature of the predicate, and the gender feature is valued by the higher conjunct. Bošković argues that both ConjP and the higher conjunct could be moved to the Spec,TP position. The author supports this by the claim that it is possible to violate Coordinate Structure Constraint (CSC) in Russian when the first conjunct is extracted⁴. Thus the availability of two options for movement causes a conflict, and agreement fails. Further the features already used in valuation are deleted, and Secondary Agree occurs with the first conjunct in number and with the second conjunct in gender, which results in apparent last conjunct agreement.

In his paper, Bošković does not provide any analysis of agreement with ConjP with absent number features in clauses with SV word order. In this case, both number and gender features would be valued by the higher conjunct during Primary Agree, and this conjunct would be moved to Spec,TP, yielding sentences as (11). The status of (11) is not entirely clear⁵ to us, but we will leave this discussion for the sake of space.

- (11) ?*Derevnya byla razrushena i selenie.*
 village.F be.PST.F.SG destroyed.F.SG and settlement.N
 Lit. 'A village and a settlement was destroyed.'

3.2 VP coordination

The alternative approach is proposed by Krejci (2020). In this theory, the clauses with PA structurally differ from the ones with FA. The latter have standard coordinated DPs as their subjects, yielding standard plural agreement. In the former, on the contrary, coordination occurs on the VP⁶ level. Each of the conjoined VPs contains one of the two DPs and identical V heads. These heads are moved Across-the-Board (ATB) to the dominating aspectual head Asp, leaving only one instance of the predicate by the time the sentence is pronounced. The predicate features are valued by the DP in the higher conjunct as the closest. Just as Bošković (2010), Krejci has to account for the EPP feature in the finite clause. Krejci argues that the EPP feature of T is satisfied by the higher DP which values the ϕ -features of T. However, due to the CSC the DP is only covertly moved to Spec,TP. An example of derivation is given in (12).

- (12) a. *Poyavilas' luna i odna zvezda.*
 appeared.F.SG moon.F and one star.F
 'Moon and one star appeared.'

⁴ However, the sentence given as an example ?*Knigi Ivan [knigi i fil'my] kupil*, lit. 'Books Ivan [books and films] bought' (Bošković 2010: 42) seems marginal at best to us and the speakers we consulted. This question should be addressed separately in an experimental study.

⁵ It should be noted that similar examples containing double conjunction *i...i* 'and...and' seem to be acceptable and are attested in corpus (Pekelis 2013b). Moreover, it is the only grammatical option in this case: *i starost' nastupit, i bolezni* 'and old age will.come.SG and diseases' (Pekelis 2013b).

⁶ Krejci leaves the light verb projection *v* aside. As it does not seem to be important for the discussion, we will do so as well.

- b. [TP_{[AspP} poyavilas' [ConjP [VP₁ poyavilas' luna] [i [VP₂ poyavilas' odna zvezda]]]]]
 '[TP_{[AspP} appeared.f.sg [ConjP [VP₁ appeared.f.sg moon.f] [and [VP₂ appeared.f.sg
 one star.f]]]]]'
 (Adapted from Krejci 2020: 244)

This approach predicts the ungrammaticality of several configurations. We will now look more closely at some of them, as these predictions will serve as hypotheses in our experimental study.

3.2.1 PA with SV word order

Krejci, like the developers of other approaches discussed above, makes generalizations about the positional restrictions on PA. As the DPs that appear to be a coordinated subject in PA clauses do not in fact form a constituent (they are contained in different VPs), they cannot simultaneously move to the Spec,TP position. Thus, the coordinated subject cannot be found in a position higher than the verbal head, sentences like (13) are predicted to be ungrammatical.

- (13) **Luna i odna zvezda poyavilas'.*
 moon.F and one star.F appeared.F.SG
 'Moon and one star appeared.'

In other words, Krejci argues for the ungrammaticality of PA in sentences with SV word order. In this regard, Krejci's predictions correspond with the point of view found in Russian Grammar (Shvedova 1980) and differ from all other approaches, especially from Bošković's which does not predict any positional restrictions at all.

3.2.2 PA of symmetrical predicates

The next diagnostic is quite similar to the ones used by Aoun et al. (1994) for Arabic and considers collective predicates. As we discussed above, some authors claim PA to be unacceptable in clauses with symmetrical predicates. Krejci's ATB-analysis predicts ungrammaticality in this configuration as well, as the DPs that appear to be the subject do not in fact form a plural constituent. Thus, the predicate requirements are not met. See the failed derivation of example (8c) in (14). This prediction goes in line with the observations of Pekelis (2013b) and Russian Grammar (Shvedova 1980).

- (14) a. ?/**V novom kurse sovmeshchaetsya teoriya i praktika*
 in new course combine.PRS.3.SG theory and practice
 Lit. 'In the new course, theory and practice is combined.'
 b. sovmeshchaetsya [[sovmeshchaetsya teoriya] [i [sovmeshchaetsya praktika]]]
 'combines [[combines theory] [and [combines practice]]]'

3.2.3 PA with relativized subject

The last diagnostic we will take into consideration concerns relative clauses. Krejci claims that if the clause shows PA, the coordinated subject cannot be a head of a relative clause (such relative clauses with coordinated heads are called *hydras*, see e.g. Link 1984, Bobaljik 2017, Citko 2021). The grammatical sentence (15a) is opposed to the ungrammatical (15b).

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- (15) a. *V prudu utonuli sharf i varezhka, kotorye mat'*
 in pond sink.PST.PL scarf and mitten which.PL mother.F
svyazala.
 knit.PST.SG.F
 ‘In the pond sank the scarf and mitten that mother had knit.’
- b. **V prudu utonul sharf i varezhka, kotorye mat'*
 in pond sink.PST.SG scarf and mitten which.PL mother.F
svyazala.
 knit.PST.SG.F
 ‘In the pond sank the scarf and mitten that mother had knit.’
 (Adapted from Krejci 2020: 252)

Krejci argues that (15b) is impossible, because due to the ATB-analysis ‘scarf’ and ‘mitten’ are found in different VPs. This claim is based on the assumption that DPs have to form a constituent in order to be the head of a relative clause. We will further consider this claim more precisely.

4 Experimental study

In the following section we will take the three predictions made by Krejci’s ATB-analysis as a reference point for our experimental study. Here we repeat the hypotheses.

Hypothesis 1 (H1). PA is impossible when the word order is SV.

Hypothesis 2 (H2). PA is impossible when the predicate is symmetrical.

Hypothesis 3 (H3). PA is impossible when the coordinated subject is the head of a relative clause.

In order to test these statements, we used the experimental syntax methodology (see e.g. Schütze 1996, Gerasimova 2023, Sprouse 2023). We conducted two acceptability judgement experiments. The first experiment covered H1 and H2, while the second one focused on H3. In what follows we will discuss the design, the procedure and the results of both experiments.

4.1 Design

4.1.1 Experiment 1

The first experiment (Exp1) included three independent variables: 1. word order (VS / SV), 2. predicate symmetry (symmetrical / non-symmetrical), 3. agreement strategy (PA — sg / FA — pl). The dependent variable was acceptability on the Likert scale 1–7. Three binary variables yielded eight experimental conditions, each of them appeared in four lexicalizations. The stimuli material included 32 lexicalizations.

All the stimuli had a unified structure with adjunct PP added either in the first or the last position in the sentence, depending on the word order. As we discussed in Section 2, PA in Russian can be influenced by multiple factors. That is why we had to fix certain parameters to exclude their influence on the acceptability. All the conjuncts in coordinated subjects were inanimate and singular. All the predicates were in the present tense in order to avoid possible

gender conflict; imperfective aspect was used in all the stimuli. All the verbs had a reflexive morpheme *-sya* which denoted passive in half of the stimuli and decausative in the other half. The gender of the conjuncts differed in half of the sentences. Stimuli examples for all conditions are given in Table 1.

	Variables			Sentence	ATB-analysis prediction
	WO	sym.	agr.		
1	VS	sym	sg	<i>Na staroj fotografii slivaetsya litso i fon.</i> in old photo merge.PRS.3.SG face and background	*
2	VS	sym	pl	<i>Na staroj fotografii slivayutsya litso i fon.</i> in old photo merge.PRS.3.PL face and background	OK
3	VS	non-sym	sg	<i>Na staroj fotografii stiraetsya litso i fon.</i> in old photo be.erased.PRS.3.SG face and background	OK
4	VS	non-sym	pl	<i>Na staroj fotografii stirayutsya litso i fon.</i> in old photo be.erased.PRS.3.PL face and background	OK
5	SV	sym	sg	<i>Litso i fon slivaetsya na staroj fotografii.</i> face and background merge.PRS.3.SG in old photo	*
6	SV	sym	pl	<i>Litso i fon slivayutsya na staroj fotografii.</i> face and background merge.PRS.3.PL in old photo	OK
7	SV	non-sym	sg	<i>Litso i fon stiraetsya na staroj fotografii.</i> face and background be.erased.PRS.3.SG in old photo	*
8	SV	non-sym	pl	<i>Litso i fon stirayutsya na staroj fotografii.</i> face and background be.erased.PRS.3.PL in old photo	OK

Table 1. Experimental stimuli, lexicalization ‘Face and the background merge / are erased in the old photo’.

Condition 1 is predicted by H2 to be ungrammatical, as it contains a symmetrical predicate. Condition 7 is banned by H1: PA is impossible with SV word order. Condition 5 is covered by both H1 and H2.

The experiment also included 32 fillers to make the purpose of the experiment less clear to the participants. The fillers were similar to the stimuli, but contained a coordinated DP in the direct object position. Half of the fillers were grammatical (16a), while the other half were made ungrammatical via a case mistake in one of the conjuncts. For instance, the ungrammatical filler (16b) would be correct if *shelkom* ‘silk.INS’ was replaced by *shelk* ‘silk.ACC’.

- (16) a. *Vanya kladet komp'yuter i zaryadku v pokhodnyj ryukzak.*
 Vanya puts computer and charger in hiking backpack
 ‘Vanya puts the computer and the charger in the hiking backpack.’

- b. *Dlya bal'nogo plat'ya koroleva vybiraet barkhat i
 for ball gown queen chooses velvet.ACC and
 shelkom.
 *silk.INS (^{OK}silk.ACC)
 'For a ball gown, the queen chooses velvet and silk.'

4.1.2 Experiment 2

Before describing the design of the second experiment (Exp2), we should return to the assumptions behind H3. Krejci (2020) argues that PA is impossible with the coordinated head of a relative clause, as the apparent coordinated subject does not form a constituent that could be relativized: the DPs are in different VPs. However, the presumption of this statement is false. Grammatical sentences with two non-coordinated DPs simultaneously being the heads of a single relative clause are attested in literature (see e.g. Perlmutter & Ross 1970, Cinque 2019). Such sentences are called *split-antecedent relative clauses* (SARC). An English example is given in (17a). SARCs are possible in Russian as well (Kholodilova 2014), the Russian translation in (17b) seems to be acceptable to us.

- (17) a. *A man_i entered the room and a woman_j went out who_{i,j} were quite similar.*
 (Perlmutter & Ross 1970: 350)
 b. Voshel muzhchina_i i vyshla zhenshchina_j,
 enter.PST.M.SG man.M and go.out.PST.F.SG woman.F
 kotorye_{i,j} byli pokhozhi.
 which.PL be.PST.PL similar.PL

The acceptability of SARCs in Russian leads us to a new possible analysis of sentences like (15b), repeated as (18a). We could claim that such sentences in fact initially contain SARCs. The only difference from sentences like (17) is that the verbal heads are identical. Therefore the ATB-analysis is applicable to this configuration as well (see the derivation in (18b)⁷), and nothing blocks the grammaticality of sentences like (18a).

- (18) a. *V prudu utonul sharf i varezhka, kotorye mat' svyazala.
 in pond sink.PST.SG scarf and mitten which.PL mother.F
 knit.PST.SG.F
 'In the pond sank the scarf and mitten that mother had knit.'
 b. utonul [[~~utonul~~ sharf] [i [~~utonul~~ varezhka]]], kotorye mat' svyazala
 'sink.PST.M.SG [[sink.PST.M.SG scarf] [and [sink.PST.F.SG mitten]]] which.PL
 mother.F knit.PST.SG.F'

⁷ One can notice that the verbs in (18b) are not identical: the one in the first conjunct bears m gender feature, while the one in the second conjunct bears f feature. However, the agreement does not happen before ATB-movement, the already finite verbs are given here for the sake of demonstration. Thus, there is no obstacles to ATB-movement.

We come to an interesting conclusion: whatever acceptability result we get for sentences like (18a), we will be able to account for it using the ATB-analysis. However, it is still worth exploring H3 in order to test Krejci’s empirical observation. Moreover, we could aim at clarifying the structure of sentences like (18a) by comparing their acceptability score to the one of the standard SARCs. SARCs in Russian are sometimes viewed as marginal and rare (Kholodilova 2014), and have not been studied using acceptability judgement paradigm. Besides, SARCs with the subject heads are sometimes claimed to be ungrammatical (Conrod & Woo 2018), or at least less acceptable than the ones with object heads. If sentences with apparent hydras and PA are rated significantly higher than the ones with standard SARCs, this would show us that the former ones do contain hydras structurally and are not derived by means of ATB-movement.

This discussion leads us to the design of Exp2. Apart from the standard hydras and SARCs we added control conditions — the ones where only one of the conjuncts was the head of the relative clause, with *kotoryj* ‘which’ bearing singular number feature. The presence of the relative clause should not influence the acceptability of these conditions at all. Thus, the design included two independent variables: 1. predicate in the matrix clause (one sg verb / one pl verb / two sg verbs), 2. relative clause head (two DPs / one DP). Just as in Exp1, the dependent variable was acceptability judgement (Likert scale 1–7)⁸. The stimuli material consisted of 24 lexicalizations.

Similarly to Exp1, the stimuli had a unified structure, both the matrix and the embedded clause contained PP-adjuncts. The word order in the matrix clause was VS, and in the embedded clause it was SV. The conjuncts were inanimate and singular, their gender always differed (half of the stimuli were f + m, another half were m + f). The matrix clause contained a present tense imperfective aspect verb. *Kotoryj* ‘which’ always had the object role in the embedded clause. Table 2 shows stimuli examples.

⁸ The reading time of each word was measured in Exp2 as well, but we will not be focusing on these data in the paper.

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	Variables		Sentence	ATB-analysis prediction
	matrix predicate	rel. clause head		
1	1 sg V	2 DPs	<i>Na polke stoit stakan i kniga, kotorye Masha dostala iz shkafa.</i> on shelf stand.PRS.3.SG glass and book which.PL Masha took out.of closet	*
2	1 sg V	1 DP	<i>Na polke stoit stakan i kniga, kotoruyu Masha dostala iz shkafa.</i> on shelf stand.PRS.3.SG glass and book which.SG Masha took out.of closet	no prediction
3	1 pl V	2 DPs	<i>Na polke stoyat stakan i kniga, kotorye Masha dostala iz shkafa.</i> on shelf stand.PRS.3.PL glass and book which.PL Masha took out.of closet	OK
4	1 pl V	1 DP	<i>Na polke stoyat stakan i kniga, kotoruyu Masha dostala iz shkafa.</i> on shelf stand.PRS.3.PL glass and book which.SG Masha took out.of closet	no prediction
5	2 sg Vs	2 DPs	<i>Na polke stoit stakan i lezhit kniga, kotorye Masha dostala iz shkafa.</i> on shelf stand.PRS.3.SG glass and lie.PRS.3.SG book which.PL Masha took out.of closet	no prediction
6	2 sg Vs	1 DP	<i>Na polke stoit stakan i lezhit kniga, kotoruyu Masha dostala iz shkafa.</i> on shelf stand.PRS.3.SG glass and lie.PRS.3.SG book which.SG Masha took out.of closet	no prediction

Table 2. Experimental stimuli, lexicalization ‘On the shelf stand(s) a glass and (lies) a book which Masha took out of the closet’.

Condition 1 from the Table 2 is predicted to be ungrammatical by H3. However, once again, both grammatical and ungrammatical results could fit into ATB-analysis. Condition 3 is a standard example of a hydra, and is predicted by ATB-analysis to be fully grammatical, as it does not have PA configuration. The other conditions are not discussed by Krejci. 2, 4 and 6 are control conditions — in these sentences only one non-coordinated DP is the head of the relative clause, they do not contain either hydras or SARCs. 5 is a standard SARC.

Exp2, just like Exp1, included both grammatical and ungrammatical fillers with the total of 24 sentences (19). They were similar to the stimuli, but they had a non-coordinated subject in the matrix clause. The ungrammatical fillers contained case mistakes in the adjunct (19b).

- (19) a. *Po radio igraet pesnya, kotoruyu Zhanna i Lyuda*
 on radio plays song which Zhanna and Lyuda
vyuchili v molodosti.
 learned in young.age
 ‘The song that Zhanna and Lyuda learned when they were young is playing on the radio.’
- b. **V vitrinoy siyaet kubok, kotoryj Zhora*
 in *showcase.INS (^{OK}showcase.LOC) shines cup which Zhora
napoliroval do bleska.
 polished until gloss
 ‘A cup that Zhora had polished very well shines in the showcase.’

4.2 Data collection and procedure

Both experiments were designed in PCIBex Farm (<https://farm.pcibex.net/>). The participants were recruited separately for each experiment via a crowdsourcing platform Toloka (<https://toloka.ai/>). After the answers of the participants who did not meet the response quality requirements⁹ were excluded, the total number of participants in Exp1 was 75, in Exp2 — 84. All the participants were native Russian speakers located in Russia. All of them gave informed consent to data processing. Among the participants of Exp1 were 27 women, 47 men, and one participant who did not specify their gender. The age range in Exp1 was 19–68 (mean 37.93, SD 10.18). 40 women and 44 men participated in Exp2. The age ranged from 18 to 74 (mean 39.4, SD 10.91).

The procedure was as follows: after completing the sociolinguistic questionnaire, the participants were given 4 training trials to get acquainted with the task. The training trials were excluded from the data before statistical analysis. After that, participants were given stimuli and fillers one by one in a pseudorandomized order. Each participant was attributed to one experimental list that was formed using Latin square. The participant-to-list distribution is shown in Table 3 and Table 4. In the main part of the experiment, each participant had to choose acceptability rating from 1 to 7 for the total of 64 sentences in Exp1 and 48 sentences in Exp2. There were 4 comprehension questions in each experiment to control the participants’ attention level.

A	B	C	D	E	F	G	H
10	10	11	9	10	10	8	8

Table 3. Participant to list distribution in Exp1.

A	B	C	D	E	F
14	14	15	15	14	12

Table 4. Participant to list distribution in Exp2.

⁹ We used the following diagnostics to detect substandard responses: answers on control comprehension questions, comparison of mean judgements of grammatical and ungrammatical fillers, amount of too fast (<300ms) responses, amount of missed responses. We excluded the responses of 13 participants in Exp1, and the responses of 15 participants in Exp2.

4.3 Results

The data analysis was carried out in R separately for each experiment (R Core Team 2022). The scores were normalized and analyzed via linear mixed effects models (lmerTest package, Kuznetsova et al. 2017), Tukey’s multiple pairwise comparisons, and Student’s t-test.

4.3.1 Experiment 1

The optimal model for Exp1 contained the fixed effects of agreement strategy, word order, their interaction, symmetry, and the random effect of lexicalization and participant. The significant factors turned out to be agreement strategy ($\beta = -0.58$, $SE = 0.07$, $t = -8.04$, $p\text{-value} < 0.001$), and interaction of agreement strategy and word order ($\beta = 0.36$, $SE = 0.08$, $t = 4.65$, $p\text{-value} < 0.001$). Other factors were not significant (symmetry: $p\text{-value} = 0.131$, word order: $p\text{-value} = 0.895$). The results of Tukey’s pairwise comparisons for significant factors are given in Table 5.

compared conditions		estimate	SE	t	p-value
pl	sg	0.40	0.06	6.57	<0.001
SV, sg	VS, sg	-0.35	0.06	-5.96	<0.001
SV, pl	VS, pl	0.01	0.06	0.13	0.999
SV, pl	SV, sg	0.58	0.07	8.04	<0.001
VS, pl	VS, sg	0.22	0.07	3.10	0.012

Table 5. Tukey’s pairwise comparison result for Exp1.

The interaction plot is given in Figure 1. There are no significant differences between conditions in gray frames. All the stimuli were graded significantly higher than ungrammatical fillers (Student’s t-test, $p\text{-value} < 0.001$). The condition numbers correspond to the ones in Table 1.

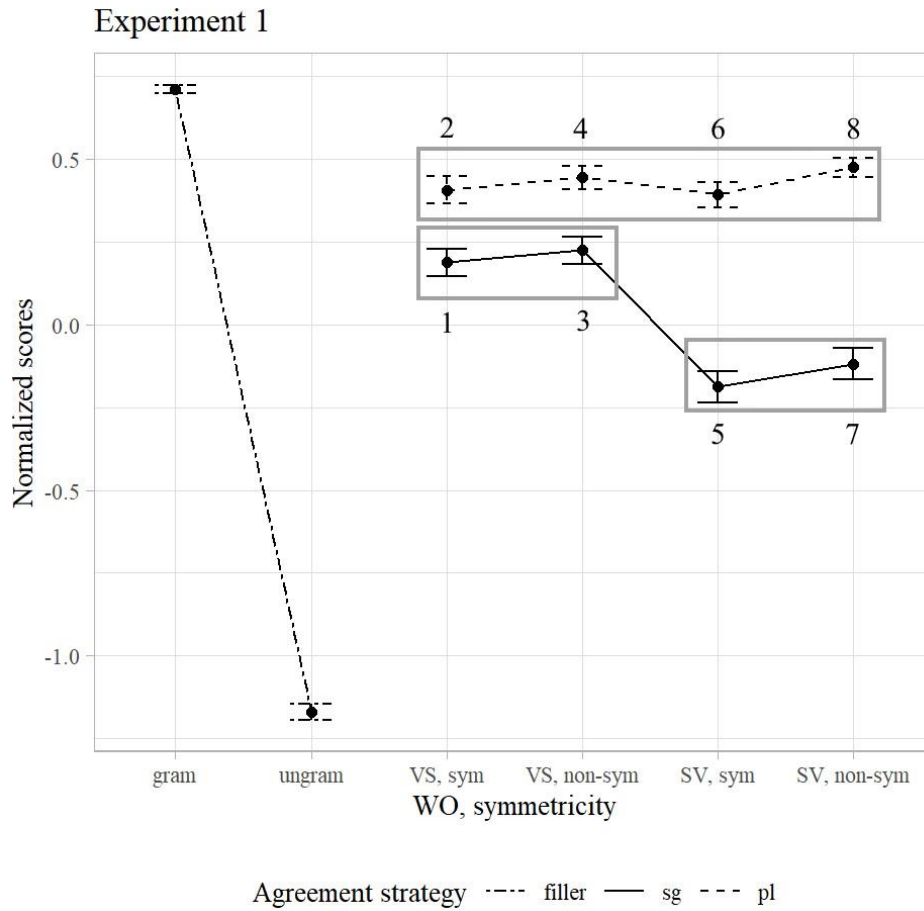


Figure 1. Interaction plot for Exp1.

To summarize, none of the hypotheses is supported by our data. Concerning H2, PA is not only possible in clauses with symmetrical predicates, it is graded just as acceptable as PA of non-symmetrical predicates. H1 is not proven either: PA in SV sentences does not yield ungrammatical result. However, word order does influence the acceptability judgement, as PA in SV sentences gets lower scores than PA in VS sentences. Moreover, PA is generally graded lower than FA regardless of the word order.

4.3.2 Experiment 2

For Exp2, the optimal model included the following fixed effects: predicate in the matrix clause, relative clause head, and their interaction, and the random effect of lexicalization and participant. The significant effects were predicate in the matrix clause ($1_{pl} V 1_{2sg} Vs \beta = -0.32$, $SE = 0.07$, $t = -4.35$, $p\text{-value} < 0.001$; $1_{sg} V 1_{2sg} Vs \beta = -0.34$, $SE = 0.07$, $t = -4.67$, $p\text{-value} < 0.001$), interaction of the relative clause head and matrix predicate factors ($2_{DPs} 1_{1DP} : 1_{pl} V 1_{2sg} Vs \beta = 0.36$, $SE = 0.10$, $t = 3.50$, $p\text{-value} < 0.001$). The factor of relative clause head was not significant ($p\text{-value} = 0.134$). Table 6 presents Tukey's multiple comparison results. The gray frames denote the lack of significant differences between conditions in the interaction plot in Figure 2. The condition numbers are equal to the ones from Table 2.

compared conditions		estimate	SE	t	p-value
2 sg Vs, 1 DP	1 sg V, 1 DP	0.34	0.07	4.67	<0.001
2 sg Vs, 1 DP	1 pl V, 1 DP	0.32	0.07	4.35	<0.001
1 pl V, 1 DP	1 sg V, 1 DP	0.02	0.07	0.32	0.999
2 sg Vs, 2 DPs	1 sg V, 2 DPs	0.15	0.07	2.03	0.333
2 sg Vs, 2 DPs	1 pl V, 2 DPs	-0.04	0.07	-0.60	0.991
1 pl V, 2 DPs	1 sg V, 2 DPs	0.19	0.07	2.63	0.097
2 sg Vs, 1 DP	2 sg Vs, 2 DPs	-0.13	0.08	-1.51	0.662
1 sg V, 1 DP	1 sg V, 2 DPs	-0.32	0.08	-3.83	0.003
1 pl V, 1 DP	1 pl V, 2 DPs	-0.49	0.08	-5.86	<0.001

Table 6. Tukey's pairwise comparison result for Exp2.

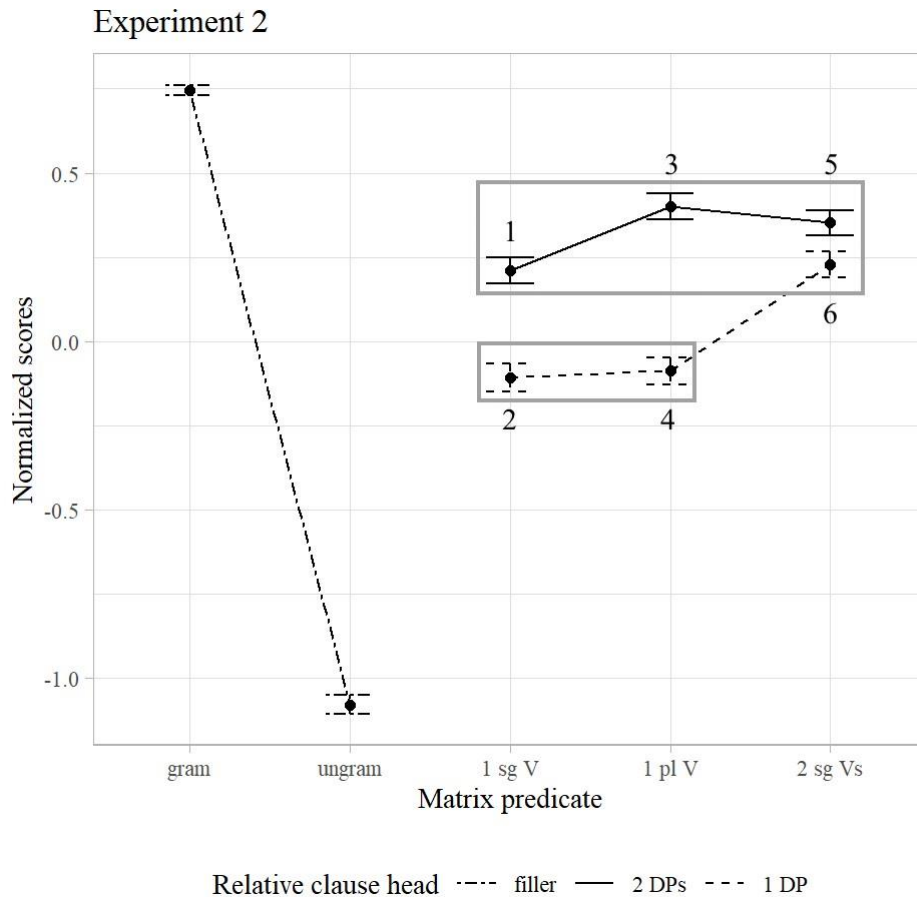


Figure 2. Interaction plot for Exp2.

As can be seen, H3 is not supported by our data: PA is just as acceptable with coordinated heads of a relative clause as FA (cf. conditions 1 and 3). PA with hydras is graded as high as standard SARCs as well (cf. conditions 1 and 5). This does not help us to differentiate between VP-coordination and DP-coordination analyses, but provides an additional valuable result: SARCs are highly acceptable in Russian. Interestingly, the control conditions 2 and 4 are significantly

less acceptable than all other conditions. This should be explored more thoroughly in further studies, but we could suggest that this is caused by pragmatic reasons. In these conditions, one of the conjuncts in a coordinated DP is much more specified than the other one.

5 Discussion

None of the predictions of ATB-analysis (Krejci 2020) is supported by our data. The fact that PA is not ungrammatical if the predicate is symmetrical or if the word order is SV argues against the claim that PA is derived by means of V movement out of VP coordination. Although PA in clauses with SV word order is indeed rated significantly lower than in VS clauses, ATB-analysis cannot account for its marginal acceptability. Such configuration is predicted to be fully ungrammatical for structural reasons: DPs in different VPs cannot be moved to Spec,TP and yield a coordinated subject.

The third hypothesis (PA is impossible when the coordinated subject is the head of a relative clause) does not hold either. PA with hydras is just as acceptable as FA with hydras. However, this result does not argue directly against ATB-analysis. In our paper we discussed an alternative analytical option, implying that the sentences with PA and apparent hydras in fact contain split antecedent relative clauses instead. Thus, both DPs in different VPs are the heads of a relative clause, and nothing blocks PA derivation via V-to-Asp movement. The by-product of our study is the following result: sentences having SARC with subject heads and VS word order in the matrix clause are fully grammatical in Russian. The sentences with standard SARC are rated as high as sentences with PA hydras, which does not allow us to differentiate between VP-coordination and DP-coordination analyses of PA in this configuration.

Our experimental study has both empirical and theoretical outcomes. As we have discussed, the constraints on PA in Russian are complex. Moreover, the authors often disagree on how strict these constraints are. For instance, the view on positional restrictions varies from yielding ungrammatical result (Shvedova 1980, Krejci 2020) to completely insignificant (Bošković 2010). Our experimental study has shown that the truth is somewhere in the middle. Word order does influence the acceptability of PA, but does not block it entirely; this goes in line with the studies of Pekelis (2013a, 2013b) and Sannikov (2008). Regarding the predicate symmetry, our results show that this factor is not significant at all, contrary to many predictions found in the literature (Pekelis 2013b, Shvedova 1980, Sannikov 2008, Krejci 2020).

As our data are not consistent with the predictions of VP-coordination analysis, we propose that the DP-coordination analysis is a more viable option. The DP-coordination analysis by Bošković (2010) does not block PA in the case of predicate symmetry and SV word order. However, it does not account for the difference in acceptability of PA with SV and VS. We could suggest that the lower acceptability of PA in SV clauses is explained by the fact that it requires Secondary Agree, as opposed to PA in VS clauses that only needs Primary Agree. Thus, the initial failure of feature valuation causes a lower acceptability level.

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Abbreviations

1 = 1st person
 3 = 3rd person
 I = I agreement class
 II = II agreement class
 ABS = absolutive
 ACC = accusative
 F = feminine
 INS = instrumental
 LOC = locative
 M = masculine
 N = neuter
 NOM = nominative
 O = object
 PL = plural
 PRS = present tense
 PST = past tense
 S = subject
 SG = singular
 V = verb

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