

The order of objects in Russian: a corpus study*

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Abstract

The paper presents the results of a corpus study of the order of direct and indirect objects in ditransitive constructions in Russian (like *Petya dal Mashe yabloko* ‘Petya gave Masha an apple’ or *Petya dal yabloko Mashe* ‘Petya gave an apple to Masha’). This topic has been widely discussed in the literature, but previous hypotheses have been based on individual examples and have never been tested on corpus data. Based on earlier research, we have selected parameters that affect the order of the objects, such as the length, depth, animacy and role of individual verbs and statistically tested their real effect on two subsamples: with a dative indirect object and with a prepositional one.

Keywords: word order; ditransitive constructions; animacy; argument prominence hierarchy; information structure; Russian

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Порядок дополнений в русском языке: корпусное исследование

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Аннотация

В статье представлены результаты корпусного исследования порядка прямого и косвенного дополнения в русских дитранзитивных конструкциях (типа *Петя дал Маше яблоко* и *Петя дал яблоко Маше*). Эта тема ранее широко обсуждалась в литературе, однако предыдущие гипотезы были основаны на отдельных примерах и никогда не тестировались на корпусных данных. Основываясь на предыдущих работах, мы отобрали параметры, влияющие на порядок дополнений, такие как длина, глубина, одушевленность дополнений и влияние отдельных глаголов и проверили их влияние на двух подвыборках: с косвенным дативным и предложным дополнениями.

Ключевые слова: порядок слов; дитранзитивные конструкции; одушевлённость; иерархия доступности аргументов; информационная структура; русский язык

1 Introduction

One of the topics that is widely discussed in word order studies is the ordering of direct and indirect objects (DOs and IOs). In the languages in which different word orders are possible, like in German or in Russian, both functional and formal studies seek to determine which factors govern the distribution of these orders and which order can be considered basic, neutral or canonical (these three terms are often used interchangeably). For Russian, these questions have been addressed by many generative syntacticians

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([4, 5, 6, 11, 19, 30, 37, 38, 39, 40], among others). The authors do not agree which order is neutral, IO before DO or DO before IO, and include different factors in the analysis.

However, their conclusions have never been tested in a corpus study — all these papers are based on the analysis of individual examples. Early functional corpus studies of the Russian word order looked at object ordering [45], but did not take almost any potentially relevant factors into account. In the present paper, we aim to close this gap in a corpus study analyzing the role of various factors that were discussed in the literature for Russian and for other languages.

2 Previous Studies

Russian word order has been analyzed in many functional and formal studies. Early functional studies like Sirotinina [45] and Kovtunova [24] demonstrated that new information tends to follow given and elements that are part of the rheme tend to follow those that are not. However, these studies did not consider ditransitive verbs in any detail. Sirotinina only noted that the ‘IO DO’ order is more frequent in Russian. This observation is repeated in the Russian Grammar [34].

Junghanns and Zybatow [19] was the first generative study focusing on ditransitive verbs in Russian. The authors showed that the ‘DO IO’ order, as in (1b), is compatible only with a given DO and/or a narrow focus on the IO. They concluded that ‘IO DO’ is the basic order in Russian, while ‘DO IO’ is derived by direct object scrambling.

- (1) *Odna ženščina podarila mal'čiku jabloko.* S V IO DO
 one_{NOM} woman_{NOM} gave boy_{DAT} apple_{ACC}
 ‘A woman gave a/the boy an/the apple.’
Odna ženščina podarila jabloko mal'čiku. S V DO IO
 one_{NOM} woman_{NOM} gave apple_{ACC} boy_{DAT}
 ‘A woman gave the apple to a boy.’

Dyakonova ([11, 12]) provided further arguments in favor of this conclusion. She showed that idioms with ditransitive verbs often include the verb and the DO (e.g. *stroit' komu-to glazki* ‘to flirt with smb’, *peremyvat' komu-to kostočki* ‘to gossip about smb’), but almost never the verb and the IO. When a part of the VP is topicalized, it can include the verb and the DO, as in (2a), but much less readily the verb and the IO, as in (2b).

- (2) [Čitat' skazki] *roditeli detjam očen' ljubjat.*
 read_{INF} tales_{ACC} parents_{NOM} kids_{DAT} very love
 ??/*Čitat' *detjam roditeli skazki očen' ljubjat.*
 read_{INF} kids_{DAT} parents_{NOM} tales_{ACC} very love

However, Bailyn ([4, 5]) argued for the opposite view relying on the asymmetries in reciprocal and variable binding and examples involving instrumental secondary predicates. Let us consider (3a–d) with reciprocals. (3a) is fine, while (3c) is worse. (3b), which, according to Bailyn, is derived from (3a), is also fine, while (3d), which could be derived from (3c) in the same way, is ungrammatical.

- (3) *Mama predstavila Petrovyx drug drugu.*
 mother_{NOM} introduced Petrovs_{ACC} each other_{DAT}
 ‘The mother introduced the Petrovs to each other.’
Mama predstavila drug drugu Petrovyx.
 mother_{NOM} introduced each other_{DAT} Petrovs_{ACC}
 ?*Mama predstavila Petrovym drug drugu.*
 mother_{NOM} introduced Petrovs_{DAT} each other_{DAT}
 **Mama predstavila drug drugu Petrovym.*
 mother_{NOM} introduced each other_{DAT} Petrovs_{DAT}

Titov [40] supports Bailyn’s ([4, 5]) position arguing that in the analysis of Russian word order, not only widely conceived information structure (the distinctions like given/new, topic/focus, referential/non-referential), but also animacy should be taken into account. She introduces the Argument Prominence

Hierarchy: \pm presupposed, \pm referential, \pm animate and well-formedness constraints requiring the arguments that are higher in the hierarchy to precede those that are lower. Thus, (1a) rather than (1b) is used in an all-new context because the IO is animate and the DO is inanimate in this sentence. Titov [40] claims that when the objects do not differ with respect to animacy or information structure, the ‘DO IO’ order is used.

Here, it is interesting to compare the concept of the basic / neutral / canonical word order in the formal and functional approaches. In the latter, it is the most frequent order. In the former, it is the order that is used when all relevant factors are balanced. If IOs happen to be animate more often than DOs, this might obscure the picture on the surface making some non-canonical word order the most frequent¹. We consider both approaches worthwhile and incorporate both perspectives in our corpus study.

Finally, Boneh and Nash (2017) found different patterns for different individual verbs. They argued that IOs can occupy different positions in the syntactic structure, depending on their semantic role and the type of the predicate. Similar ideas were expressed, for example, in [16] for German.

While most previous studies on Russian focused on information structure, our paper analyzes animacy and several other factors that have been applied to ditransitive constructions crosslinguistically, but did not receive enough attention in Russian. The role of animacy in ditransitive constructions has been discussed in many typological studies (e.g. [14, 21, 18]) and in corpus and experimental work on individual languages: a corpus study on German [20] or an acceptability judgment study on Croatian [42] can be taken as examples. Faltz [14] explained it by “the greater cognitive salience of the typically animate IO argument over the typically inanimate DO argument” (p. 84). More recent accounts share this insight.

Other factors identified as relevant include the presence or absence of the preposition in the IO and the heaviness of the objects. As is well known, in English the order of the objects is fixed, and the IO precedes the DO if and only if it is not introduced by a preposition. This rule does not hold in case of the so-called heavy NP shift: DOs that are especially long and syntactically complex may follow prepositional IOs. The role of heaviness for constituent order has been discussed in numerous studies, including [17, 13, 44, 43].

Another well-known factor is prominalization. Pronouns have various properties ranging from phonology to semantics and information structure that affect their syntactic behavior. In double object constructions, pronouns have a very strong tendency to precede full noun phrases, often cliticizing on the verb, if word order alternations are possible (in the languages like German or Russian). We will look for similar effects in Russian in our corpus study and will test the role of other factors mentioned above.

3 Our corpus study

3.1 Data

The dataset used in this study was obtained from the SynTagRus corpus [1], [36]. It is a dependency treebank developed by the Computational Linguistics Laboratory, A.A. Kharkevich Institute of Information Transmission Problems. Currently the treebank contains over 1.100.000 tokens (over 77.000 sentences) from the texts of various genres.

Initially, we tried to work with a larger Taiga corpus [35], which is automatically annotated. But the error rate was extremely high: about 35% of the extracted sentences had annotation errors, either morphological like verb lemmatization, or syntactic. For instance, about half of the errors were the cases when a DO modifier was annotated as an IO. Conversely, SynTagRus has a comprehensive manually corrected morphological and syntactic annotation in the spirit of the dependency grammar. This allowed extracting the relevant examples with virtually no errors. Besides, the detailed syntactic annotation in SynTagRus allowed us to differentiate verb arguments from adjuncts.

We extracted corpus sentences containing a verb that governs an accusative object and an indirect object, i.e. word forms that are marked with the following relations to the verb: ‘1-компл’ [first comple-

¹How such non-canonical orders are derived is a central question for formal theories, but it is outside of the scope of the present paper. Let us only note that in case of double object constructions, both in Russian and cross-linguistically, there is a big debate whether non-canonical orders result from syntactic movement (e.g. [3, 4, 5, 19, 9, 25, 37]) or are base-generated (e.g. [8, 10, 29, 31, 40])

ment] and ‘2-компл’ [second complement]². Finally, we limited our dataset to 6398 contexts with dative IOs and IOs with a preposition. These two groups were discussed in the literature and would be interesting to compare. We excluded a large number of sentences with IOs in the instrumental case, leaving them for further research, and several other examples with genitive or nominative IOs (primarily with the verbs *lišit* ‘to deprive’ and *nazyvat* ‘to name’). The distribution of word orders in the resulting dataset is given in Table 1.

Word order	Number and percentage of examples
DO V IO	1087 (17%)
IO V DO	616 (9,6%)
DO IO V	208 (3,2%)
IO DO V	125 (2%)
V DO IO	2591 (40,5%)
V IO DO	1771 (27,7%)

Table 1: The distribution of word orders in the final dataset before filtering.

As Table 1 makes clear, one of the objects or both of them often precede the verb in Russian. The distribution of VO vs. OV orders is a separate topic in Russian syntax (e.g. [7, 9, 22, 23, 24, 27, 28, 45, 46]), so in the present study, we decided to focus on the cases in which both objects follow the verb. We also filtered out examples with pronominal objects because their syntactic position is primarily determined by their “lightness”. Figure 1 shows the distribution of word orders in these sentences. If only one of the objects is pronominal, it precedes the other in the absolute majority of cases. Needless to say, this tendency is highly statistically significant ($\chi^2 = 823,13$, $p < 0,001$). As for the sentences with two pronominal objects, there are too few of them for any further analysis.

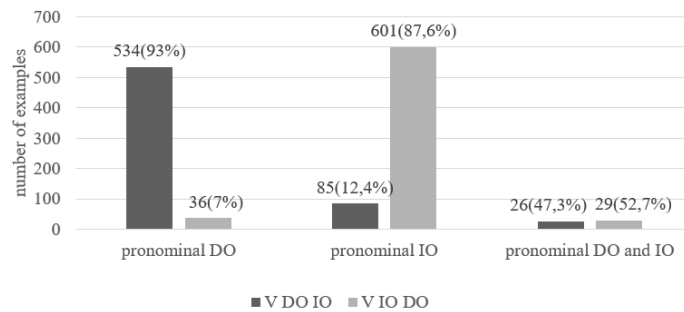


Figure 1: Word order in the sentences with pronominal objects.

After filtering out preverbal and pronominal objects and non-dative IOs without a preposition we had the final dataset containing 3017 contexts that we used for further analysis. In this dataset, grammatical features of the verb and the objects were annotated (including animacy that is especially relevant for the current study), as well as some additional features like the syntactic depth of the objects (the maximal distance from each node in an object subtree to its head, where the distance of a head-dependent pair is 1) and their length in words.

3.2 Analysis and discussion

The distribution of word orders in the final dataset is given in Table 2. The difference between the two subsets, with dative IOs and prepositional IOs, is statistically significant ($\chi^2=147,71$, $p < 0,001$). In the former, there is a modest, but statistically significant predominance of the ‘IO DO’ word order ($\chi^2=4,65$, $p=0,036$). In the latter, the ‘DO IO’ word order is much more frequent ($\chi^2=180,73$, $p < 0,001$).

²A similar algorithm was used for our initial searches in Taiga, but the relevant relations were ‘obj’ and ‘ioj’ or ‘obl’, respectively. The code is available at <https://github.com/bamaxi/dir-indir>.

Word order	V DO IO	V IO DO
Dative subset	313 (44,2%)	394 (55,8%)
Prepositional subset	1598 (69,5%)	701 (30,5%)
Total	1911 (63,5%)	1095 (36,5%)

Table 2: Numbers and percentages of sentences with different word orders in the final dataset.

The factors of interest. Now let us estimate the role of different factors that could influence this distribution: the length and syntactic depth of the objects and their animacy. The main problem for the analysis is that these factors are not balanced in the two subsets and correlate with each other. Table 3 illustrates this showing the average length and depth for animate and inanimate IOs and DOs in the two subsets. In particular, inanimate objects (direct and indirect, in both subsets) have higher average length and depth than animate ones.

		Average depth		Average length	
		Animate	Inanimate	Animate	Inanimate
Prepositional subset	IO	2,1	2,4	3,6	4,2
	DO	1,0	1,3	2,5	3,0
Dative subset	IO	0,9	1,3	2,3	2,9
	DO	1,3	2,1	3,3	4,2

Table 3: Average length and depths of animate and inanimate objects.

Statistical analysis reveals a very strong correlation between length and depth ($\rho=0,92$, $p<0,001$ for DOs; $\rho=0,92$, $p<0,001$ for IOs). For this reason, we will use only one of these factors in some further analyses. To estimate their correlation with animacy, we chose an arbitrary grouping for the variable ‘length’ (one word, 2–4 words, more than four words) and demonstrated that the differences between the resulting length and animacy groups are weak, but significant ($\chi^2=161,67$, $p<0,001$, Cramer’s $V = 0,16^3$). This is shown in more detail on the mosaic plot in Figure 2 (red indicates that the observed values for the group are significantly larger than expected, blue indicates that they are significantly lower than expected).

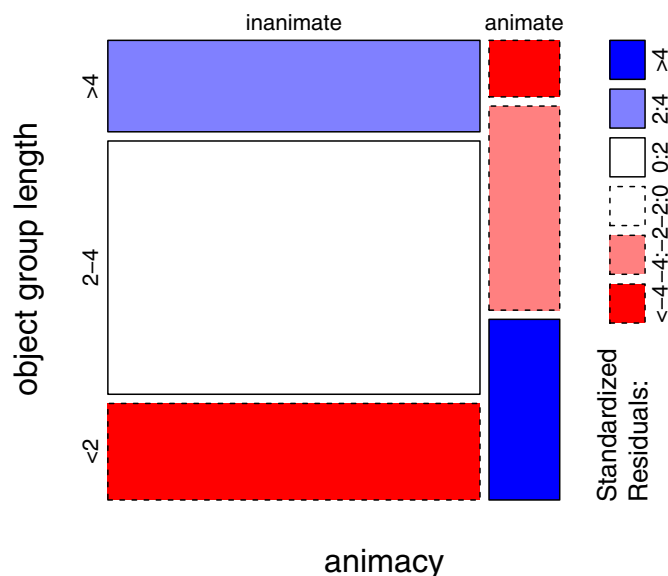
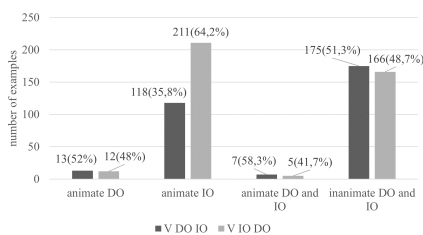


Figure 2: Mosaic plot showing the correlation between animacy and length.

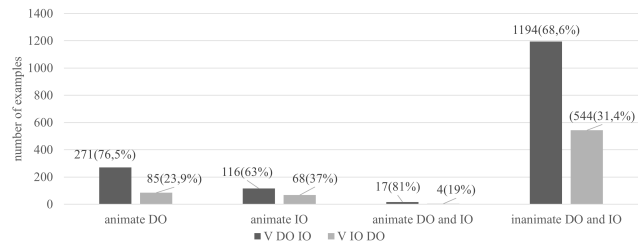
³Cramer’s V is used to estimate the effect size ($V>0,5$ means a large effect, $0,3-0,5$ is medium, $0,1-0,3$ is small [26]).

The reasons why length and depth are closely connected are obvious, while their connection to animacy may be indirect. We mentioned earlier that animate arguments tend to be more salient. We also know independently that more salient arguments tend to have shorter descriptions (e.g. [2, 41, 33]) Below, we will first look at animacy, then at length and depth, and finally will consider all factors together in a regression model.

Animacy. Let us first consider the differences between the two subsets. In the prepositional subset, the majority of objects are inanimate: 2094 (91%) IOs and 1922 (84%) DOs. In the dative subset, an even larger share of DOs are inanimate (670, or 95%), but only slightly more than half of the IOs are (366, or 52%). The distribution of word orders depending on the animacy of the objects is shown in Figures 3a and 3b.



(a) Word order and animacy in the dative subset.



(b) Word order and animacy in the prepositional subset.

Figure 3: Numeric data on word orders as dependent on animacy for the two subsets

As Figures 3a and 3b make clear, the number of sentences in which both objects are animate is too small in both subsets to make any conclusions. When both objects are inanimate, there is a clear preference for the ‘DO IO’ order in the prepositional subset. When either IO or DO is animate, this is still the preferred order, although its share changes (according to Cramer’s V measure, the effect is too weak: $V=0,07$).

In the dative subset, sentences with two inanimate objects have an equal distribution of the two word orders. It changes significantly when only the IO is animate ($\chi^2=17,85$, $p<0,001$, $V=0,16$), which is illustrated by the mosaic plot in Figure 4 (examples in which only DO is animate are rare). Thus, Titov’s [40] prediction that the ‘DO IO’ order will prevail once animacy is balanced was not supported, but we confirmed her intuition that the overall distribution of word orders is influenced by animacy (by the higher frequency of animate dative IOs and the tendency of animate objects to precede inanimate ones).

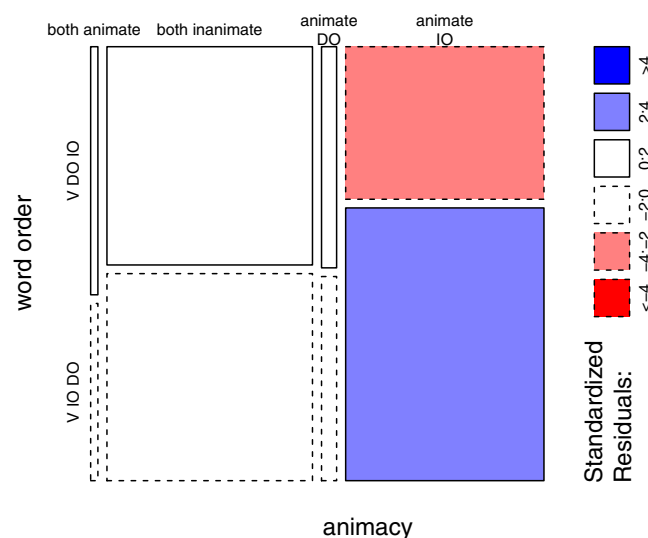


Figure 4: Mosaic plot showing the correlation between animacy and word order in the dative subset.

Length and syntactic depth. Firstly, let us note some differences between the two subsets. As Table

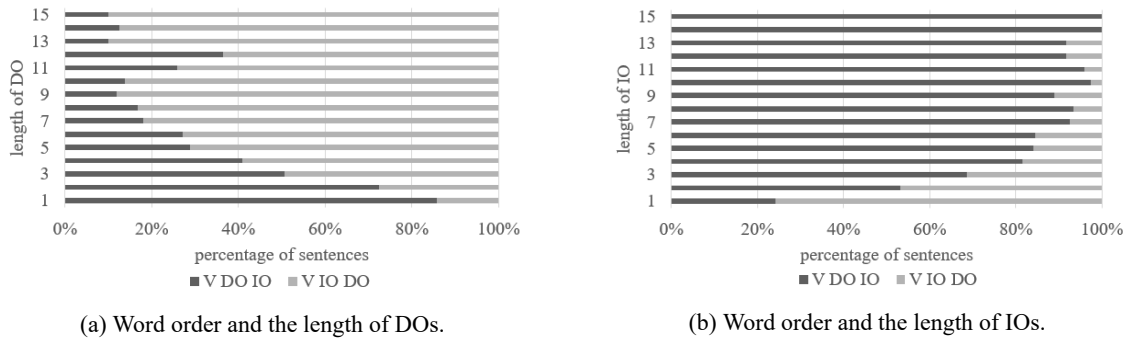


Figure 5: Plots of word order as dependents on objects' lengths

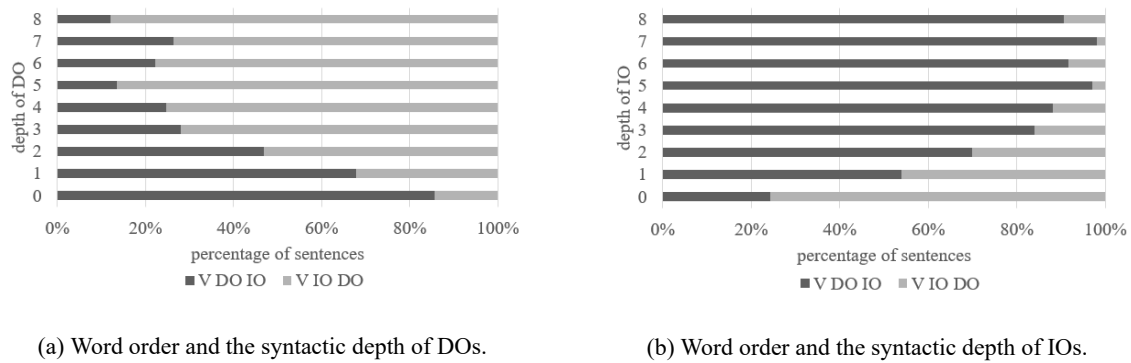


Figure 6: Plots of word order as dependent on objects' syntactic depths

3 above shows, IOs (both animate and inanimate) have higher average length and depth than DOs in the prepositional subset, while the opposite is true for the dative subset. This might have to do with a different distribution of semantic roles in these two subsets and the relative salience of these roles. As for the influence of these two factors on the choice of the object order, we will first illustrate it and then will estimate it statistically in a regression model. As Figures 5a and 5b show, shorter objects tend to precede longer ones.

The syntactic depth of the objects has a similar effect on the word order. This is illustrated in Figures 6a and 6b. The more syntactically complex the object is, the higher its probability to follow the other object.

Regression model. To analyze different parameters together we performed a regression analysis fitting a binomial mixed effect model (logistic regression) on the whole dataset. We used the lme4 package [15] in the R software [32]. Verb lemmas were treated as the random effect. The fixed effect variables were the IO type (dative, coded as 1, or prepositional, coded as 0), the length of the IO and DO and their animacy (animate, coded as 1, or inanimate, coded as 0), as well as two interaction terms: 'IO length * animacy' and 'DO length * animacy'. Table 4 presents the outputs of the model.

	β	SE	z value	p-value
IO type: dative	0,73	0,19	3,83	<0,001
IO length	-2,12	0,18	-12,05	<0,001
DO length	1,80	0,11	15,80	<0,001
IO animacy: animate	0,39	0,20	2,00	0,049
DO animacy: animate	-0,25	0,20	-1,27	0,203
IO length * animacy	0,32	0,34	0,95	0,341
DO length * animacy	0,65	0,39	1,68	0,092

Table 4: The outputs of the regression model.

The model shows that the two subsets are significantly different and that DO and IO lengths are highly

significant factors. The effect of the IO animacy is much weaker, while the DO animacy factor did not reach significance (this is consistent with the results we got analyzing animacy in isolation). Discussing the role of animacy in ditransitive constructions, Titov [40] predicted it to play a moderate role. What has not been predicted either in this or in any other study is the crucial role of length and depth, although these results are not unexpected from a cross-linguistic perspective. Examples with prepositional IOs received very little attention in general, so the difference between them and the sentences with dative IOs has not been discussed for Russian as well.

Individual verbs. Finally, we estimated the role of individual verbs because Boneh and Nash [6] showed that different verbs have different preferences. We selected verb lemmas with more than 20 examples in our dataset and conducted a logistic regression analysis like above. Verb lemmas were treated as fixed effects. The results are presented in Figure 7: it shows β coefficients and standard errors for every verb (the ones that are significantly different from average are shown in red).

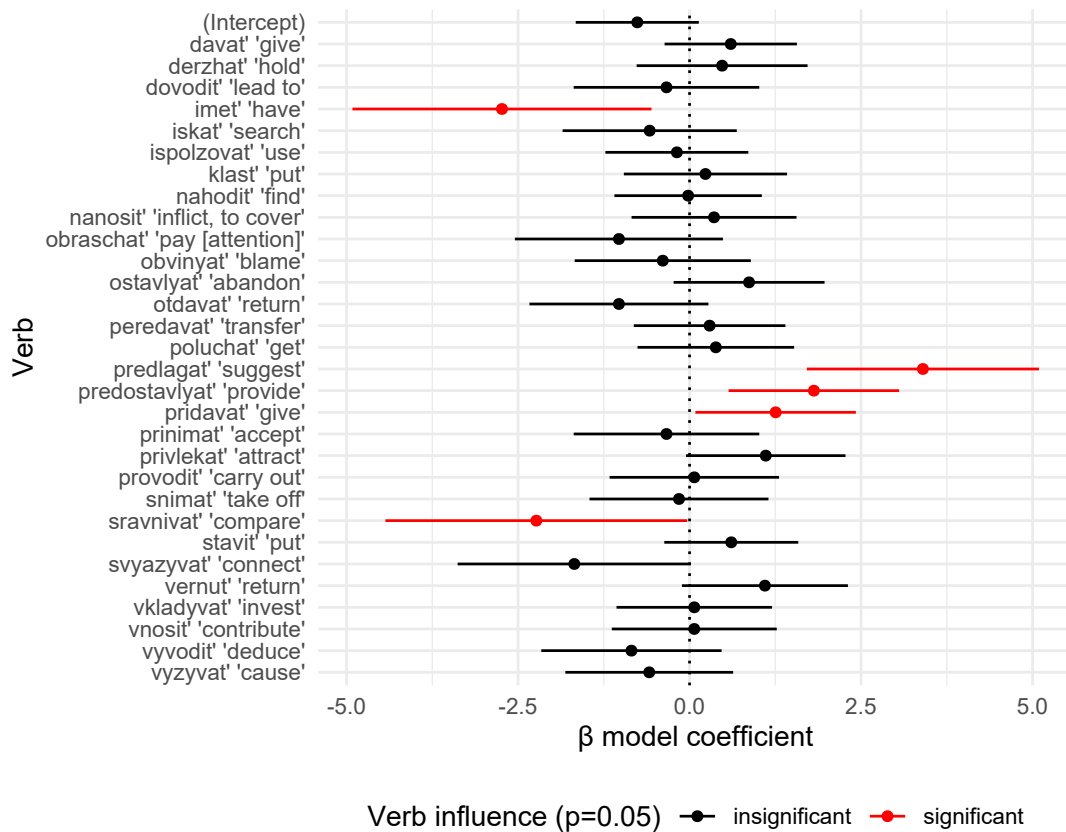


Figure 7: Word order: individual verb preferences.

Two verbs, *predlagat'* 'to offer' and *predostavlyat'* 'to provide', have a significant preference of the 'IO DO' word order. They are almost exclusively used with an animate dative IO and an inanimate DO. The opposite is true for three verbs: *imet'* 'to have', *poluchat'* 'to receive' and *sravnivat'* 'to compare'. They are used with prepositional IOs. The majority of contexts with *imet'* 'to have' involves an idiomatic expression *imet' delo s kem-to* 'to deal with somebody', so the DO is not only very short, but also forms a whole with the verb semantically.

4 Conclusions

The order of arguments with ditransitive verbs in Russian has been extensively discussed in the literature, especially in the generative tradition. However, most studies relied on the analysis of individual examples and did not take into account many factors that were identified as relevant cross-linguistically. To close this gap, we conducted a corpus study and analyzed such factors as animacy, length and syntactic depth of

the objects, as well as the role of individual verbs. We showed that these factors correlate with each other (especially length and depth) and that length and depth, which have not been discussed in the previous studies on Russian, heavily influence the choice of the word order, while animacy plays a moderate role.

We showed that for prepositional IOs, which have not received enough attention in the previous studies, ‘DO IO’ is definitely the neutral word order. In the sentences with dative IOs, the ‘IO DO’ order is more frequent, so it qualifies as basic in the functional approach. In the formal tradition, the basic word order is not necessarily the most frequent — it is the order that is used when all relevant factors are balanced. Analyzing sentences with two inanimate objects does not lead to a definitive answer: the shares of the ‘DO IO’ and ‘IO DO’ orders are virtually the same in them. Thus, even if the basic word order can be established using some syntactic tests — e.g. asymmetries in reciprocal and variable binding and scope taking, as Bailyn [4, 5], suggests — one would still have to explain this result: why don’t we see the prevalence of this order? This could be explained by different preferences of individual verbs, as Boneh and Nash [6] suggested, but we did not see any clear evidence for that in our corpus data. We plan to explore these findings in our further research.

Word order distribution in the sentences with dative and prepositional IOs that we found can be associated with other properties of these sentences. In particular, animate IOs are much more frequent than animate DOs in the former, while the opposite is true for the latter (although the difference is much smaller). In the former, IOs tend to be shorter and less complex than DOs, while the reverse picture is found in the latter. These observations may be connected to the properties of semantic roles typically assigned to dative and prepositional IOs. We are going to study this connection in more detail in our subsequent work.

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