



NATIONAL RESEARCH UNIVERSITY
HIGHER SCHOOL OF ECONOMICS

Anna G. Klezovich, Kirill A. Aksenov

WORD ORDER WITHIN THE NOMINAL DOMAIN IN RUSSIAN SIGN LANGUAGE

BASIC RESEARCH PROGRAM

WORKING PAPERS

**SERIES: LINGUISTICS
WP BRP 72/LNG/2018**

WORD ORDER WITHIN THE NOMINAL DOMAIN IN RUSSIAN SIGN LANGUAGE³

This work aims at investigating the word order within the nominal domain in Russian Sign Language (RSL) with respect to Universal 20 and a hierarchy of adjectives. Universal 20 proposed by Greenberg (1963) postulates that there are three possibilities of the word order in the noun phrase, namely Demonstrative > Numeral > Adjective > Noun, Noun > Demonstrative > Numeral > Adjective, and Noun > Adjective > Numeral > Demonstrative. Later Cinque (2005) extended the definition of Universal 20 by proposing that actually 14 word orders can be derived from the base-generated word order Demonstrative > Numeral > Adjective > Noun, and, therefore, 14 word orders are acceptable. In addition to that, Scott (2002) proposed that adjectives of different semantic types also have a universal order. In this work we compare RSL data with these hierarchies and conclude that the underlying word order in RSL conforms to Scott's (2002) hierarchy and to Cinque's (2005) definition of Universal 20. In order to derive the underlying word order for RSL we explore which word orders are acceptable, which are unacceptable, and which of the attested word orders are the most neutral. Moreover, we explain the variability of the attested in RSL word orders with the number of modifiers by noun (single modifiers occur in preposition more often than multiple modifiers).

JEL Classification: Z.

Keywords: linguistic universals, Universal 20, adjectives hierarchy, noun phrase, word order, Russian Sign Language, sign languages.

¹ National Research University Higher School of Economics. School of Linguistics. Bachelor Student; E-mail: belkannkl@gmail.com

² National Research University Higher School of Economics. School of Linguistics. Master Student; E-mail: kirill-ax@yandex.ru

³ The publication was prepared within the framework of the Academic Fund Program at the National Research University Higher School of Economics (HSE) in 2018 — 2019 (grant №18-05-0053) and by the Russian Academic Excellence Project «5-100».

1. Introduction

Linguistic universals which are initially proposed by Greenberg (1963) are of a particular interest to linguists due to the fact, that some of the known linguistic universals might not work as expected in another modality. This work aims at investigating one of the syntactic universals, namely Universal 20. Here is Greenberg (1963)'s definition of this universal:

"When any or all of the items (demonstrative, numeral, and descriptive adjective) precede the noun, they are always found in that order. If they follow, the order is either the same or its exact opposite"

Greenberg's definition was revisited after several supposedly unacceptable word orders were found⁴. Cinque (2005) addresses this problem by stating that all orders which can be derived from the base generated word order (Demonstrative > Numeral > Adjective > Noun (Dem Num A N)) with the noun phrase movement on one or two nodes and/or pied-piping of the [NP [XP]] structure or of the [XP [NP]] structure, should be attested in some languages. Consequently, out of 24 mathematically possible word orders only 14 are acceptable (Tab. 1). None of the unacceptable word orders have been found so far in any languages of the world.

Tab. 1. Acceptable word orders in the NP according to (Cinque 2005).

Word order	Estimate of a number of languages which represent this order
Dem Num A N	very many languages
Dem Num N A	many languages
Dem N Num A	very few languages
N Dem Num A	few languages
A N Dem Num	very few languages
N A Dem Num	few languages
Dem A N Num	very few languages
Dem N A Num	many languages
N Dem A Num	very few languages

⁴ (Heine 1981) found N > Num > A > Dem word order in Gabra (Cushitic), Luo (Nilotic), and Logoli (Bantu). (Hawkins 1983) discovered another unacceptable word order (N > A > Dem > Num) in Aghem (Bantu).

Num A N Dem	very few languages
Num N A Dem	few languages
N Num A Dem	few languages
A N Num Dem	very few languages
N A Num Dem	very many languages

Note: Estimates on the number of languages are given here with respect to how many movements are required to derive this order from the base-generated one. The most marked options appear in the least languages.

For example, Dem N Num A is derived when the NP moves two nodes around numeral and adjective without pied-piping.

Another theory concerning word order within the NP is the Universal DP hypothesis (Abney 1987). This hypothesis implies that there is another projection over the noun phrase, namely the determiner phrase. DP is postulated in this theory regardless of the presence of overt determiners in a language. What is of particular interest for us here is that the Universal DP hypothesis entails a strict order of functional projections within the NP. Consequently, Scott (2002) proposes a hierarchy of adjectives according to their semantic types (Fig. 1). Thus, if an article-less language conforms to this hierarchy, it leads us to conclude that this language might have the DP functional projection and confirm the Universal DP hypothesis. Whereas if an article-less language does not depict this hierarchy in its NP, then it contradicts the Universal DP hypothesis. Some article-less languages, like spoken Russian, have been proven to have this hierarchy of adjectives in its nominal domain ((Pereltsvaig 2007) for Russian). RSL also lacks articles, therefore, it is interesting to check, whether this hierarchy applies to it.

Fig. 1. (Scott 2002) adjectives hierarchy.

Subjective Evaluation > Size > Length > Height > Speed > Depth > Width > Weight > Temperature > Wetness > Age > Shape > Color > Nationality/Origin > Material > Typing Attribute

Both theories discussed above are based on the cartographic approach to syntax. Cartographic approach builds more fine-grained structures by analyzing different types of adjectives, numerals, relative clauses and etc. as separate functional projections. The cartography of syntax was initially proposed by (Cinque & Rizzi 2008). The cartographic approach also entails such concept as the underlying word order. Under this approach all languages are supposed to have one underlying

word order of the constituents within each phrase, noun phrase in our case, and all other attested in a language word orders can be derived from the underlying word order. The underlying word order is perceived as the most neutral word order for a particular language. However, informants do not tend to produce in the casual speech long structures like noun phrases which comprise all possible for the noun phrase constituents. Researchers who apply the cartographic syntax approach to their work usually elicit word orders for all possible pairs of constituents and then merge the results into one underlying word order. For instance, that is the technique which Mantovan (2015) uses in her work on the word order within the nominal domain in Italian Sign Language (LIS).

The purpose of this work is to investigate which word orders are acceptable and which are unacceptable in RSL with respect to the following modifiers: numerals, adjectives of four types (evaluation, size, material, color), and demonstrative. In addition to that, we discuss which of these acceptable orders appear to be neutral and give an explanation to the variability of acceptable word orders. What is more, we derive an underlying word order from the acceptable neutral word orders for pairs of modifiers and compare this underlying word order with Cinque's (2005) extended Universal 20 and Scott's (2002) adjectives hierarchy. As a result, we prove that the underlying word order in RSL conforms to both hierarchies.

This article is structured as follows: methodology of our experiment is presented in Section 2. In Section 3 we analyze the results from the two elicitation tasks we have, namely, discuss, which word orders are attested and which are not. Furthermore, in Section 3 we provide some explanations on the variability of the attested word orders. We derive the underlying word order within the noun phrase by comparing results from our elicitation tasks in Section 4. Sections 5 and 6 represent the discussion of our findings and conclusions respectively.

2. Methodology

The data was collected using two elicitation tasks. There were 12 pairs of the informants in the “clouds” task and 12 pairs of the informants in the acceptability judgment task. Informants partially intersected. There were 20 pairs of the participants of the experiment in total. Participants were performing the tasks in pairs, because of the fact that this way they have an opportunity to discuss their language intuitions, which helps us to ensure that they are not simplifying anything and not using loan translations from spoken Russian for the sake of non-native speakers of RSL, researchers who handle the experiment.

The elicitation tasks involved three modifiers: demonstrative, adjective (color, evaluation, size, and material), and numeral. The ‘clouds’ task consists of numerals, and adjectives of all four

types named above. The acceptability judgment task comprises demonstratives, numerals, adjectives, and separately adjective of size + adjective of evaluation, because this combination of modifiers was not properly elicited in the ‘clouds’ task.

2.1. The ‘clouds’ task

The first task, so-called “clouds” task, is inspired by Mantovan’s (2015) research on word order in the nominal domain in LIS. In her research Mantovan (2005) showed informants sets of written words and asked them to combine these words into a sentence and then expand the sentence with additional words. Our research replicates this technique, but instead of showing sets of words we showed our informants slides with scattered words on them (see Appendix 1.) in order to avoid any kind of linear order of the words, so that it does not influence the informants’ intuition on word order in a sentence.

Suppose we have the following 'cloud' (scattered on a slide words):

{BUY, WALLET, MOTHER }

The output sentence for these words in RSL is:

- 1) MOTHER BUY WALLET
'A mother buys a wallet'

Then another word pops up on the slide - ‘fashionable’, so that informants add this word to the initial sentence.

- 2) MOTHER BUY FASHIONABLE WALLET
'A mother buys a fashionable wallet'

Finally, the word 'leather' pops up, which induces the following output sentence:

- 3) MOTHER BUY FASHIONABLE LEATHER WALLET
'A mother buys a fashionable leather wallet'

Commonly speakers tend to avoid producing long and heavy structures in the speech. When informants add new words into already produced in the target language sentences, it makes them easier to produce heavy structures naturally. Therefore, this design of the experiment comparing with the simple translation implies less influence of the meta-language of the experiment.

Each informant responded to 33 stimuli in the form explained above. There were usually 4 stimuli for each word order. However, sometimes this number differed due to the fact that the survey went through some changes on the second stage of the experiment.⁵

2.2. The acceptability judgment task

The second task is the acceptability judgment task. Informants were shown 36 videos with a signer who produced sentences with all possible orders of modifiers.⁶ Informants were asked to grade these sentences on a scale from 1 (“Absolutely incorrect”) to 5 (“Totally correct”). The same informants were never shown lexically the same sentence, but with the different word order. Acceptability judgment elicitation task was also filmed due to the fact that informants had an opportunity to correct the sentences which they perceived as ungrammatical and, furthermore, to explain why some sentences are incorrect in their opinion. This was a crucial issue, because sometimes informants graded some sentence very low, not because they did not like the word order, but because they did not like some particular sign produced by a signer on a video.

All videos were annotated in ELAN software (Crasborn & Sloetjes 2008). Only sentences, which contain noun phrases with modifiers, were annotated.

3. Results

3.1. The acceptability judgment task

For each pair of modifiers from the acceptability judgment task we created boxplot graphs, such as the one on Fig. 2. On the X axis six word orders are plotted (all logically possible orders out of three constituents). On the Y axis ranking of these word orders by the informants is plotted. The ranking is normalized with the z-score. As a result, we got boxplots for four combinations of numeral + demonstrative, demonstrative + adjective, numeral + adjective, and adjective of size + adjective of evaluation.

With the help of these graphs we can estimate which of the orders for each combination of the modifiers are the most acceptable and neutral, which orders are totally unacceptable, and which ones are acceptable but not neutral. In addition to that, we also took into account the informants’ comments on each of the sentences, which contributed to an understanding of a way to treat the outliers. Consequently, we derived several criteria for estimating the acceptability of particular

⁵ Some of the stimuli were eliminated, because there turned out to be no signs for some of the words and informants were finger-spelling them, which might have caused more influence of spoken Russian.

⁶ One of the surveys:

https://docs.google.com/forms/d/e/1FAIpQLSc31f4L965YuP50RwGicJmxzVifEKMeB_X0IWPUJ5IDC5Vvsw/viewform

word orders. The criteria for unacceptability are the following: at least one grade “1”; significantly lower median, comparing with other word orders. The criteria for acceptability are as follows: all respondents graded this order with “5”; somebody said about an unacceptable word order that it should be corrected to this one. We conclude that the word order is neutral when both criteria for acceptability apply or when all other word orders for this combination are unacceptable or controversial, where controversial means that none of the criteria apply.

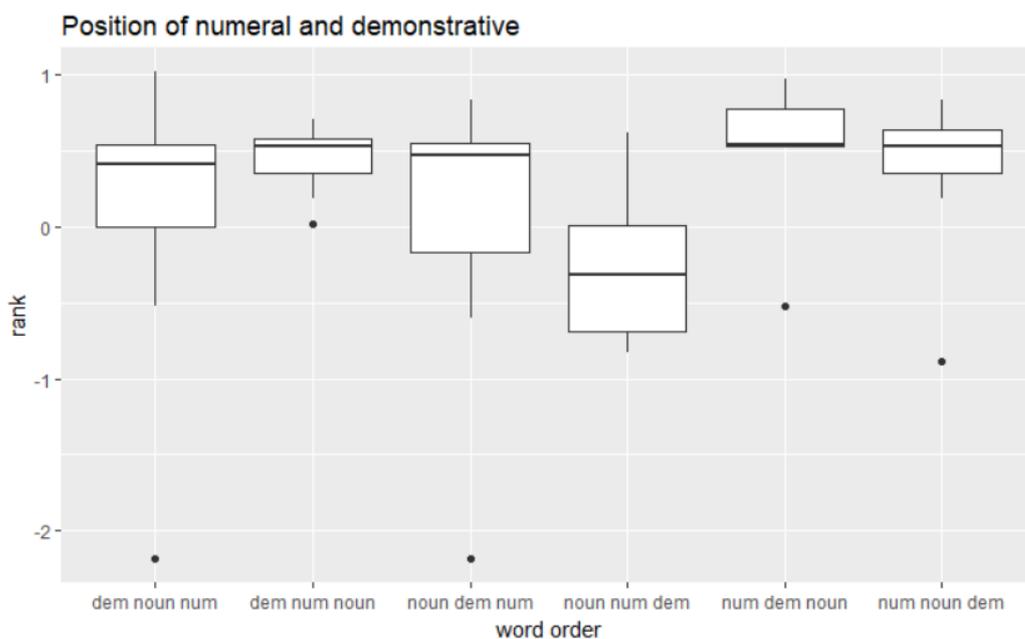


Fig. 2. Evaluation results for numeral + demonstrative combination of modifiers.

Here we give an example of how we estimated the acceptability of word orders for the combination of numeral and demonstrative using these criteria. So, the Num Dem N word order has the highest median on the Fig. 2. This word order has one outlier, which can be explained with the fact that the informants who gave this order a low grade did not understand clearly a finger-spelled name in the sentence and they gave it a 4, while all other informants gave this word order a 5. As a result, the criterion “all respondents graded this order with 5” applies to this word order, thus, it is fully acceptable and it might be the neutral word order for this combination of modifiers. The Dem Num N word order was graded with 4 twice, although all other informants graded it with a 5. Num N Dem was evaluated once with 3 and twice with 4. Therefore, none of our criteria apply to word orders Dem Num N and Num N Dem. However, one of the informants corrected the sentence with the word order Dem N Num to Dem Num N, consequently, Dem Num N is acceptable. Dem N Num 's median is rather low, and it has one outlier. Dem N Num was graded with 1 once, thus, it is unacceptable, according to our criteria. However, one of the informants, who graded this sentence with 3, stated that the problem with this word order is in the order of adverb and verb and not in the

word order within the NP. N Dem Num elicited the most disagreement in its grades and had one outlier. The N Num Dem word order has the lowest median and mean value 4.5. It also provoked a plenty of disagreement among informants. However, no criteria can apply to N Dem Num or to N Num Dem, so we cannot conclude anything on the acceptability of these two orders. As a result of this analysis we get two grammatical word orders and one ungrammatical: Num Dem N, Dem Num N, *Dem N Num.

In a similar fashion we analyzed all other combinations of modifiers. The summary of the results for this task for each combination of the modifiers is presented in the Tab. 2.

Tab. 2. Acceptable and unacceptable word orders for four combinations of modifiers.⁷

adjective + numeral	adjective + demonstrative	numeral + demonstrative	adjective of evaluation + adjective of size
Num N A	A N Dem	Num Dem N	N Ae As
N Num A	Dem N A	Dem Num N	N As Ae
* A N Num	A Dem N	* Dem N Num	* As N Ae
* Num A N	* N Dem A		
* N A Num			
* A Num N			

Notes: First row of each column represents neutral (according to our criteria) word order.

Taking into account as many neutral orders (from the first row of the Tab. 2) as possible, we can derive the underlying word order. In this case we can use only three neutral word orders: Num N A, Num Dem N, and N Ae As. For the combination adjective + demonstrative we can take another acceptable word order, namely Dem N A, due to the fact that in this case the adjective is postnominal, which makes it possible to merge it with all other neutral orders. Therefore, we can merge Num N A, Num Dem N, N Ae As, and Dem N A into the word order Num Dem N A.

Another word order which can be derived from these results is Dem Num N A. It can be merged from the orders Num N A, Dem N A, Dem Num N and N Ae As. However, it takes into account only two neutral word orders, while Dem Num N A is merged out of three neutral orders.

⁷ Ac = adjective of color, Am = adjective of material, As = adjective of size, Ae = adjective of evaluation, Num = numeral, N = noun.

Although it is important to notice here that our technique of estimating which order is neutral is rather subjective, so that both merged word orders remain as two possibilities.

3.2. The ‘clouds’ task

In this section we discuss the results of the ‘clouds’ task. To start with, we derive the underlying order. Then we explain the variability of the attested word orders.

The following word orders for pairs of modifiers⁸ were elicited with the help of the ‘clouds’ task (in the descending order of their frequency, the most frequent word order for each pair of modifiers is on the left):

- Ac⁹ Am¹⁰ N > Am Ac N, N Ac Am, Ac N Am, N Am As, Am N Ac, N Am Ac N, N Ac Am N;
- Ae Ac N > Ac Ae N, Ae N Ac, N Ae Ac Ae, N Ac Ae, N Ae Ac;
- Num Ac N > Ac Num N, N Num Ac, N Ac Num, Num N Ac, Ac N Num;
- As Ac N > N Ac As, Ac As N, N As Ac, Ac N As;
- Ae Am N > Am Ae N, N Am Ae, Am N Ae, N Ae Am, Ae N Am, N Ae Am;
- As Am N > N Am As, Am As N, N As Am, Am N As, N.As Am;
- Ae Num N > Num N Ae, N Ae Num, N Num Ae;
- As Num N
- Ae N.As

It is possible to merge the most neutral word orders from the list above into the underlying word order which is represented in the example (4). Position of the adjective of size is uncertain.

4) (As) Ae (As) Num Ac Am N

Turning to the explanations of the variability, the list of attested word orders above shows some general tendencies. For instance, there is a general tendency for the preposition of modifiers (68% of cases) (see Tab. 3). 21% of modifiers occur in the postposition. There are also two rare cases: when noun is surrounded by modifiers (8% of cases) and when one or more modifiers are surrounded by repeated noun.

⁸ Single modifiers are not taken into account in the list, because the underlying word order can be derived only from word orders with more than one modifier.

⁹ Ac = adjective of color

¹⁰ Am = adjective of material

Tab. 3. Position of modifiers with respect to noun.

Position of modifier	Percentage
preposition	68%
postposition	21%
_ N _	8%
N _ N	3%

The other strong tendency which can explain the variability of word orders is that single modifiers occur in the preposition more often, than multiple modifiers. This has been proven with the mixed-effects model *glmer* from R *lme4* package (Bates et al. 2015). The formula for this model which makes predictions for the position and the number of modifiers by the number of modifiers by noun with random slopes per signer can be seen in the example (5), where “modifiers” is a binary variable (multiple modifiers Vs. single modifier) and “position” is also a binary variable (preposition Vs. postposition):

5) `glmer(formula = position ~ modifiers + (1+modifiers|signer), data, family=binomial)`

The summary of this model is presented in the Tab. 4. The model shows that the probability of the occurrence of multiple modifiers by noun in preposition is 0.69 ($\exp(0.8136) / (1 + \exp(0.8136))$). In addition to that, the model shows that the probability of the occurrence of a single modifier in preposition is 0.83 ($\exp(0.8136 + 0.7887) / (1 + \exp(0.8136 + 0.7887))$). Therefore, we can conclude that the difference between probabilities 0.69 and 0.83 is statistically significant and that when there is only one modifier by noun it is more likely to occupy preposition than when there is more than one modifier by noun.

One can also think that there has to be a dependency on the type of modifiers. However, we have found no statistically significant correlation between the types of modifiers and their position with respect to noun.

Tab. 4. Position of modifiers with respect to noun.

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	0.8136	0.1869	4.353	1.34e-05 *** ¹¹
modifiers+1-many	0.7887	0.2102	3.751	0.000176 ***

Furthermore, word order in the nominal domain appears to depend on such sociolinguistic factor as the age of the informants. To be more specific, younger informants are inclined to produce modifiers in postposition in about half of the cases. It means that younger informants use modifiers in pre- and postposition almost equally. In the Tab. 5 signers S7 and S10 are younger than the others, and the percentage of cases with postposition for them is almost the same as the percentage of cases with preposition. However, this statement is yet to be statistically proved. Since the consultants were working in pairs and converged on one particular order (or, alternatively, the judgment of one pair member was confirmed by the other), it seems impossible to establish the exact role of age in the consultants arriving at a particular order, or use it as a predictor in a statistical model.

Tab. 5. Signers' preferences for pre- or postposition of the modifiers.

	post	pre
S1	0.23	0.77
S2	0.45	0.55
S3	0.24	0.76
S4	0.37	0.63
S5	0.39	0.61
S6	0.27	0.73
S7	0.49	0.51
S8	0.21	0.79
S9	0.32	0.68
S10	0.48	0.52
S11	0.15	0.85
S12	0.24	0.76

¹¹ *** means <0.001

4. Underlying word order

In this section two supposedly underlying word orders which have been discovered in the elicitation tasks are merged into the underlying word order of the constituents of the NP for RSL.

So in the ‘clouds’ task the derived underlying order is (As) Ae (As) Num Ac Am N, whereas in the acceptability judgment task there are two supposedly underlying word orders, namely Num Dem N A and Dem Num N A. From these two word orders we can derive either Dem Num N A or Dem Num A N, because apparently the position of the adjectives of the different semantic types cannot be estimated.

However, both estimated word orders confirm Cinque’s (2005) expanded definition of Universal 20. Dem Num A N is simply a base-generated word order, while the Dem Num N A word order can be derived from the base-generated word order with the movement of the NP one node around the adjective phrase and pied-piping of the [NP [XP]] structure. Fig. 3 depicts the derivation of Dem Num N A word order from the base-generated one.

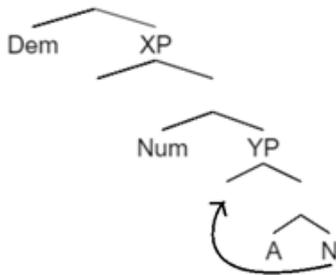


Fig. 3. The derivation of Dem Num N A word order.

As for Scott’s (2002) hierarchy, relative ordering of adjectives in RSL conforms to it. If we merge (As) Ae (As) Ac Am N from the ‘clouds’ task with the most neutral result for the combination of modifiers adjective of size + adjective of evaluation from the acceptability judgment task (N Ae As), we will get exactly Scott’s hierarchy – Ae As Ac Am (N). But how do we merge prenominal adjectives of (As) Ae (As) Ac Am N word order with the postnominal adjectives N Ae As? We consider that prenominal modification of the N Ae As in the most neutral case would be Ae As N and not As Ae N due to the fact that N Ae As most likely was derived with the movement of the noun to the left from the base-generated word order without any other movements of adjectives of different types. This way the resulting word order N Ae As is less marked. So, consequently the underlying relative ordering of adjectives is Ae > As > Ac > Am, which conforms to Scott’s hierarchy.

5. Discussion

In this section we discuss the implications of our findings and the theoretical challenges we faced during our experiment.

The important fact worth discussing here is that the results from the two tasks differ. In the ‘clouds’ task, the tendency for the preposition of modifiers is stronger than in the acceptability judgment task. Furthermore, in the ‘clouds’ task, adjectives of different types can be merged into the underlying word order, while in the acceptability judgment task adjectives can be either in pre- or in postposition, and they cannot be merged into the underlying word order. The influence of spoken Russian in the ‘clouds’ task can be a reason for such divergence of results from the elicitation tasks. Recall that in the ‘clouds’ task, the informants were shown words of spoken Russian, whereas in the acceptability judgment task informants were presented RSL stimuli. Thus, we should lend more weight to the results of the acceptability judgment task. Keeping that in mind we turn now to discussing the main theoretical implication of our findings.

The main challenge which the collected data poses us is the fact that adjectives do not converge into the underlying word order. It means that adjectives of different semantic types do not form a homogeneous class. For instance, they can be split by other phrases like the NP (e.g. Ac N Am, Am N Ae etc.) or the NumP (e.g. Ae Num Ac Am N). Even if we assume the underlying word order to be Dem Ae As Num Ac Am N, this word order cannot be derived from the base-generated Dem Num A N word order. Under the Universal DP hypothesis there are only two types of movements: either a movement of the NP to the left or pied-piping, neither of which can help us to derive the word order where different types of adjective do not form a homogeneous class. Therefore, the data on RSL cannot be explained within the framework of the Universal-DP hypothesis, but it can be explained under the Parameterized-DP hypothesis.

However, there is also another perspective on the non-homogeneity of adjectives in RSL. It is possible that if we postulate four underlying word orders for each type of adjectives separately and then compare these word orders with the cinquean extended NP-projection (2005) and Universal 20, there will be no contradiction. This point of view will allow us to take into account variability of word orders in languages, while Cinque’s (2005) work does not take it into account. In order to check this hypothesis we should extend acceptability judgment experiment¹² with adjectives of all four types and elicit this way word orders for all possible pairwise combinations of numeral, demonstrative, adjective of color, adjective of material, adjective of evaluation, and

¹² The ‘clouds’ task is not suggested here, because of its priming with spoken Russian.

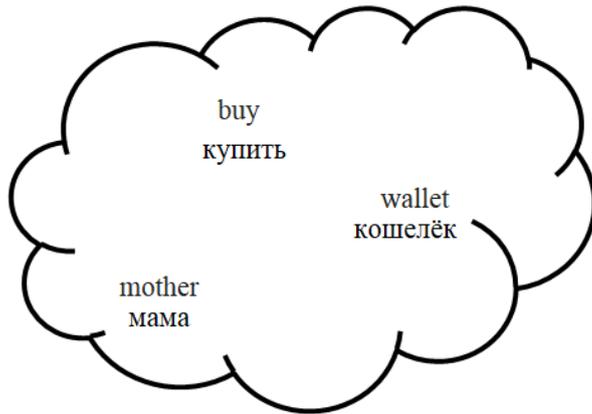
adjective of size with noun. Having this data, we can derive an underlying word order for each type of adjective. If these orders conform to Cinque's (2005) findings, it will be possible to state that underlying word orders differ in RSL and are different for adjectives of different types. So, we leave this design of the experiment for the future perspective.

6. Conclusion

In this section we summarize the main results of our study. First of all, with the help of the 'clouds' task we discovered which word orders are attested in RSL and which of them are the most frequent. In addition to that, the variability of the attested word orders was explained with the number of modifiers per noun. To be more specific, we have proved that single modifiers are inclined to occur in preposition more often than multiple modifiers. Moreover, the position of modifiers does not depend on their type according to our findings. Secondly, with the help of the acceptability judgment task we discovered which word orders are the most acceptable and which word orders are the least acceptable. Finally, we derived the underlying word orders. The underlying relative order of adjectives of different types is $A_e > A_s > A_c > A_m$ and it conforms to Scott's (2002) hierarchy of adjectives. The underlying word order for adjective + demonstrative + numeral in RSL is either Dem Num N A, or Dem Num A N. The adjectives of different types do not form a homogeneous group and, therefore, cannot be merged into one underlying word order.

To sum up, this work has described which positions various modifiers can occupy in the nominal domain in RSL and gave several explanations for the variability of the attested word orders. What is yet to be done is to expand this research to other types of modifiers, for example, possessives and quantifiers, in order to make an extended projection of the NP for RSL. In addition to that it would be interesting to conduct an experiment with individual informants, so that it would be possible to check whether there is an influence of sociolinguistic factors, like age, on the word order of constituents in the nominal domain.

7. Appendix



Appendix. 1. The ‘cloud’ example.

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Contact details:

Anna G. Klezovich

National Research University Higher School of Economics (Moscow, Russia). School of Linguistics. Bachelor Student;

E-mail: belkannkl@gmail.com

Kirill A. Aksenov

National Research University Higher School of Economics (Moscow, Russia). School of Linguistics. Master Student;

E-mail: kirill-ax@yandex.ru

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