

Abstract

We test the hypothesis that Russian verbal prefixes express meaning even when they are used to create a “purely aspectual” pair (“čistovidovaja para”). This is contrary to traditional assumptions that prefixes in this function are semantically “empty”. We analyze the semantic tags independently established in the Russian National Corpus (www.ruscorpora.ru) for 382 perfective partner verbs with five of the most common verbal prefixes in Russian: *po-*, *s-*, *za-*, *na-*, and *pro-*. Statistical tests show that the relationship between prefixes and semantic tags is significant and robust, and further identify which relationships constitute attractions, repulsions, and neutral relationships. It is possible to specify a unique meaning for each prefix in terms of the semantic tags it attracts or repulses. A detailed analysis of all the verbs in the study shows that the meanings of the prefixed perfective partners yield consistent patterns. Even verbs in repulsed semantic classes are consistent with these patterns. The meaning patterns of verbs with “purely aspectual” prefixes can be compared with the meanings of the prefixes as established on the basis of previous scholarship, which was primarily focused on the meanings of prefixes in their “non-empty” uses. This comparison shows that the verb meanings that appear with “purely perfectivizing” prefixes are the same as those found for “non-empty” uses of prefixes. We conclude that verbs select the prefix that is most compatible with their meanings when forming “purely aspectual” perfective partners, confirming our hypothesis.

1. Introduction

This article focuses on the use of prefixes to form “purely aspectual” perfective partners to simplex imperfective verbs, as in *pisat'* (imperfective) > *napisat'* (perfective) ‘write’. Prefixes used for this purpose are claimed by many scholars to be devoid of meaning (beyond marking the verb as perfective) and thus semantically “empty” (Šaxmatov 1952, Avilova 1959 & 1976, Tixonov 1964 & 1998, Forsyth 1970, Vinogradov 1972, Švedova et al. 1980, Čertkova 1996, Zaliznjak & Šmelev 2000, Mironova 2004). Alternatively, other scholars (Vey 1952; van Schooneveld 1958; Isačenko 1960; Timberlake 2004, 410–411) have proposed that the prefixes do bear meaning, even in their “purely aspectual” function.

All prefixes that are claimed to have a “purely aspectual” function are also recognized as expressing meaning when combined with other base verbs. In order to proceed, it is important to differentiate between verbs in which the prefixes are claimed to be “empty” and those where the prefixes are “non-empty”. Scholars in both formalist and functionalist traditions have proposed that distinctions be made among Russian perfective verbs. Svenonius and Ramchand (Ramchand 2004, Svenonius 2004a–b and 2008) identify three groups of perfectives: those with “purely perfectivizing” prefixes (such as *napisat'* ‘write’), which they set aside and do not analyze further; those with “lexical” prefixes, which have directional or idiosyncratic meanings (such as *perepisat'* ‘re-write’); and those with “super-lexical” prefixes, which have predictable, quantizing meanings (such as *popisat'* ‘write for a while’, *počixat'* ‘sneeze for a while’). Svenonius and Ramchand point out that whereas “lexical” prefixes do introduce additional predication structure, do add arguments, and are low in the tree (VP-internal), “super-lexical” prefixes do not introduce additional predication structure, do not add arguments, and are high in the tree (VP-external). In a largely parallel classification¹, Janda (2007) suggests the term “Natural Perfectives” for verbs formed with “purely perfectivizing” prefixes, “Specialized Perfectives” for verbs formed with “lexical” prefixes, and “Complex Act Perfectives” for verbs formed with “super-lexical” prefixes. Janda additionally identifies “Single Act Perfectives” with a semelfactive meaning (such as *čixnut'* ‘sneeze once’) and

¹ There are some minor differences in the two classifications, but they do not impact the argument in this article and are therefore not discussed. Janda’s (2007) classification has been extended in subsequent work (Makarova & Janda 2009), but this also goes beyond the scope of the present article.

shows that the types of perfectives have distinct tendencies in terms of their semantics and derivational behavior. Whereas Specialized Perfectives nearly always form secondary imperfectives, this type of derivation is resisted to various degrees by the other types of perfectives. Natural Perfectives and Specialized Perfectives usually refer to actions that have a natural culmination (the completion of a document for *napisat'* 'write' or a revision for *perepisat'* 'rewrite'); by contrast, Complex Act Perfectives and Single Act Perfectives usually refer to actions that lack a sense of completability (*popisat'* 'write for a while' is about writing without an inherent telos, and the lack of a culmination is inherent in sneezing as we see in *počixat'* 'sneeze for a while' and *čixnut'* 'sneeze once').

In this article we adopt Janda's (2007) terminology. Thus, the aspectual partner verbs formed by "purely perfectivizing" prefixes are henceforth referred to as "Natural Perfectives". We can thus state our hypothesis as (1):

(1) Hypothesis: The selection of prefixes for Natural Perfectives conforms to semantic preferences.

This hypothesis will be tested using a statistical study of the semantics of Natural Perfectives formed via prefixation. In order to test the hypothesis, we need first to clearly define the set of Natural Perfectives and find a means for objectively assessing semantic preferences. These two challenges have been overcome by means of electronic resources that provide a list of relevant verbs and semantic tags for those verbs, respectively. Those resources are described below.

A distinction between Natural Perfectives and all other prefixed perfectives is well motivated, regardless of what tradition one adheres to. However, in order to investigate the relationship between prefixes and semantics among Natural Perfectives, we need a list of the relevant verbs. The CLEAR (Cognitive Linguistics: Empirical Approaches to Russian) group at the University of Tromsø has prepared an inventory of Russian Natural Perfectives available over the internet at <http://emptyprefixes.uit.no>. This inventory, called the "Exploring Emptiness database", provides information on 1,981 Natural Perfectives formed via prefixation, including all such perfectives listed in two dictionaries plus a list, and vetted by a panel of native speakers.² This study uses the Exploring Emptiness database as the point of departure for collecting relevant Natural Perfectives.

The semantic value of words is a complex issue, particularly in an empirical study, which should ideally use objective measures. The builders of the Russian National Corpus (www.ruscorpora.ru, henceforth "RNC") have developed a system of semantic tags that is adapted from the work of the "Leksikograf" group (<http://lexicograf.ru/main.html>; cf. also Padučeva 2004; Kustova et al. 2005 & 2009), and more generally inspired by the work of the Moscow Semantic School (cf. Apresjan 2005).³ The RNC semantic tags thus represent the collective experience of outstanding linguists who have pursued the semantic description of Russian. A crucial issue for our study is the fact that the semantic tags have been developed and assigned independently, thus achieving a level of objectivity we could not provide if we were to devise and tag relevant verbs ourselves. At the present time many words in the RNC have not yet received a semantic tag, and it is unlikely that semantic tagging will ever be extended to the entire lexicon. However, 92% of the Natural Perfectives attested in the RNC have been assigned a semantic tag,⁴ and our semantic investigation is based upon these tags. Given the fact that this study will use the RNC tags in order to classify verbs according to semantics, we can modify the hypothesis to read as in (1a):

² The sources are: Evgen'eva 1999, Ožegov & Švedova 2001, and Cubberly 1982. The panel of native speakers are: Julia Kuznetsova, Olga Lyashevskaya, Anastasia Makarova, and Svetlana Sokolova.

³ Details on what kinds of issues were faced and how problems were solved in developing the semantic tags are found in Kustova et al. 2009.

⁴ We would like to thank Galina Kustova for her efforts to maximize the tagging of verbs in the RNC.

(1a) Hypothesis: The selection of prefixes for Natural Perfectives conforms to preferences for semantic tags.

The set of preferences for semantic tags that can be found for a verb with a given prefix is referred to as the “semantic profile” of the prefix. As we show below, each prefix has a unique semantic profile, attracting and repulsing various semantic tags each in its own way. Semantic profiling is part of a suite of related methodologies for probing the statistical behavior of linguistic units, including also constructional profiling (Janda & Solovyev 2009), grammatical profiling (Janda & Lyashevskaya forthcoming a), and radial category profiling (Nesset et al. forthcoming, Baydimirova et al. submitted). These methodologies are inspired by behavioral profiling, which investigates the distribution of a variety of features (morphological, semantic, syntactic, lexical, etc.) in connection with linguistic units, particularly as developed by Divjak and Gries (Divjak & Gries 2006, Gries & Divjak 2009).

We discuss the semantic profiling method in Section 2, detailing how we selected the prefixes, semantic tags, and verbs that are included in this study. Section 3 presents a statistical analysis demonstrating that the prefixes *po-*, *s-*, *za-*, *na-*, *pro-* have distinct semantic profiles and identifying which specific tags each prefix attracts and repulses. Section 4 delves deeper, analyzing each group of verbs associated with a specific prefix and tag. Here we show that the meanings of the Natural Perfectives for a given prefix correspond to the meanings of the same prefix as established on the basis of other types of perfectives. We also find that the meanings of the residue of verbs in repulsed semantic classes are consistent with the meanings of both the prefix and the verbs in the corresponding attracted classes. Conclusions are offered in Section 5.

2. Data and methodology

Any quantitative study entails making decisions about what kind of data to include so that the sample is representative, free of errors or factors that might obscure the phenomenon of study, and suitable for statistical analysis. Our study aims to test the hypothesis that the prefixes in Natural Perfectives are not distributed randomly, but show preferences for semantic classes. The following subsections detail how we selected the set of prefixes and semantic classes for this study and the measures we took to eliminate extraneous factors from the dataset.

Additionally we need to observe the assumptions and limitations of the statistical model that we use to test the significance of the outcome. Our model of choice, the chi-square test, assumes that all observations are independent and cannot tolerate any expected value of less than five. The assumption of independence means that it is important to avoid overlapping data, so no one verb can be represented more than once in the dataset. The independence assumption means that we need to control for situations in which verbs are associated with multiple prefixes or multiple semantic classes. The limitation on expected values means that we face paucity of data problems with a matrix that represents all prefixes and all semantic classes. With sixteen rows for prefixes (see 2.1) and twenty-seven columns for semantic classes (see 2.2), such a matrix would have 432 cells. Since there are only 1,981 prefixed Natural Perfectives in Russian (as identified in the Exploring Emptiness database), there are simply not enough Natural Perfectives in Russian to populate this matrix to a level that would give more than five observations for every cell. Furthermore, the uneven distribution of the data and the fact that some data must be eliminated in order to adhere to the independence assumption compound this problem, so it is necessary to limit this study to the prefixes and semantic classes that are associated with the largest numbers of verbs.

2.1. Which prefixes and why

As the title suggests, this study is limited to five prefixes: *po-*, *s-*, *za-*, *na-*, and *pro-*. This subsection details the rationale behind choosing those prefixes and further measures that were taken to prepare the data sample related to selection of prefixes.

Due to issues of allomorphy there is some room for controversy concerning the number of prefixes that form Natural Perfectives in Russian. We take as our starting point Krongauz' (1998) list of nineteen prefixes, which we can reduce to sixteen by collapsing *o-*, *ob-* and *obo-* on the one hand (cf. Baydimirova 2010), and *vz-* and *voz-* on the other. The distribution of these sixteen prefixes across Natural Perfectives is represented in Figure 1.

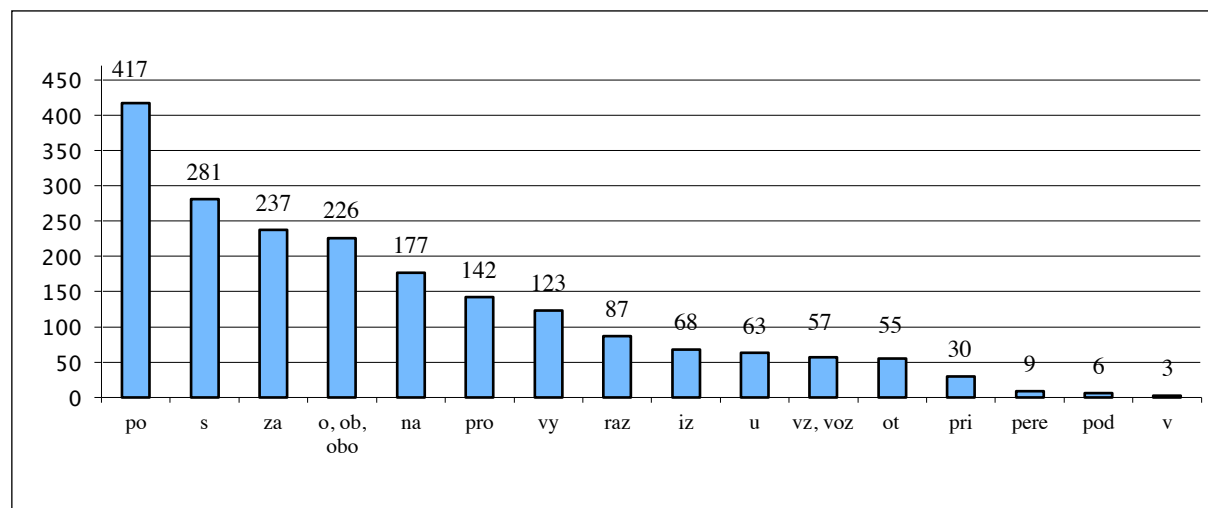


Figure 1. Distribution of aspectual prefixes across Natural Perfectives

Figure 1 makes it easy to identify the prefixes that form the largest numbers of Natural Perfectives. The question is where to draw the line in this distribution, which prefixes from the left to include, and which from the right to exclude. We took a variety of facts into consideration in making our decision. There is a break in the distribution between the “large” prefixes with over one hundred Natural Perfectives (*po-*, *s-*, *za-*, *o-/ob-/obo-*, *na-*, *pro-*, and *vy-*) and the “small” prefixes with fewer Natural Perfectives (*raz-*, *iz-*, *u-*, *vz-/voz-*, *ot-*, *pri-*, *pere-*, *pod-*, and *v-*). This is a good place to start, but this breaking point presents two problems. On the one hand, this division separates *vy-* and *iz-* into two different groups, which is imprudent given the fact that these two prefixes have co-evolved in a special relationship that would be obscured by setting them apart from each other (cf. the detailed analysis in Nessel et al. forthcoming). For this reason, it is best to remove *vy-* from consideration, since one would otherwise need to include *iz-*, which has sparse data. On the other hand, we have the situation of *o-/ob-/obo-*, which presents a unique array of relationships involving phonology, morphology and semantics. It would be difficult, or maybe even impossible to include *o-/ob-/obo-* in this dataset without violating the independence assumption of our statistical model. Given these problems, the best solution is to take the largest prefixes, excluding *o-/ob-/obo-* and stopping before *vy-*. This gives us five prefixes to work with: *po-*, *s-*, *za-*, *na-*, and *pro-*.

Fortunately, restricting the scope to five prefixes does not compromise the present study or the overall goal of demonstrating that the prefixes that form Natural Perfectives are not semantically “empty”. The remaining five prefixes are all very frequent, and are associated with over 63% of all prefixed Natural Perfectives in Russian, so we retain the bulk of the data. Furthermore, two other studies address in detail the meanings of the prefixes that are present in the other eleven prefixes: Baydimirova 2010 presents corpus and experimental data for *o-/ob-/obo-*, and Baydimirova et al. submitted examines the ten smallest prefixes (ranging from *vy-* to *v-*). Both of these studies establish the meanings of prefixes based on their “non-empty” uses (in Specialized Perfectives and Complex Act Perfectives) and show that these meanings overlap with the meanings of the base verbs that form Natural Perfectives with the same prefix. The radial category profiling methodology used in Baydimirova 2010 and Baydimirova et al. submitted could in principle be extended to all the prefixes, but in the case of the larger prefixes would involve labor-intensive

attention to many thousands of verbs. The meanings of the larger prefixes, particularly *po-* and *s-* (which are becoming “default” perfectivizers in Russian, cf. Dickey 2005), are also more semantically diffuse and more challenging for a radial category profiling analysis. For these reasons, the semantic profiling methodology is more appropriate for the larger prefixes. Note, however, that some studies have explored radial categories also for the larger prefixes (LeBlanc 2010 on *po-*; Dickey 2005 on *s-*; Janda 1986, Shull 2003, Zaliznjak 2006, Braginsky 2008 on *za-*).

To summarize, it makes sense to divide the prefixes into a “large” and a “small” group according to the number of Natural Perfectives they are associated with. The large prefixes are both quantitatively and qualitatively different from the small prefixes, motivating different approaches for the two groups. The small prefixes can be analyzed in the exhaustive detail required by radial category profiling, but present too little data for semantic profiling. The large prefixes present overwhelming and diffuse data that is hard to handle for radial category profiling but potentially sufficient for semantic profiling. If we take the five “largest” prefixes, excluding *o-/ob-/obo-* due to confounding factors, we have *po-*, *s-*, *za-*, *na-*, and *pro-*. The next challenge is to make sure that all the observations of the large prefixes are independent, which brings us to the issue of prefix variation.

Prefix variation is present when an imperfective base verb forms two or more Natural Perfectives with the same lexical meaning. For example, if we look up *pisat* ‘write’ in Ožegov & Švedova 2001, we find that it has one aspectual partner verb, *napisat*. But if we look up *gruzit* ‘load’ in the same dictionary, we find that it has not one, but three aspectual partner verbs: *pogruzit*, *nagruzit*, and *zagrutzit*. Though prefix variation is well attested in dictionaries, this phenomenon has been largely overlooked, perhaps because it is at odds with the traditional description of aspect as involving “pairs” of verbs. However prefix variation is not as marginal as one might suspect: 27% of imperfective verbs that form Natural Perfectives via prefixation form two, three, four, five, or even six prefixed aspectual partner verbs (for a detailed analysis of prefix variation see Janda & Lyashevskaya forthcoming b).

Prefix variation is a problematic factor for a chi-square analysis because it violates the assumption of independence of observations. We can think of verbs as “voters” and prefixes as “candidates”, where a statistical model is applied to test voting trends. From this perspective, *pisat* ‘write’ casts only one vote, namely for the prefix *na-*, while *gruzit* ‘load’ casts three votes, for *po-*, *na-*, and *za-*. Thus *gruzit* ‘load’ is stuffing the ballot-box and spoiling the statistical model. The solution we apply is to eliminate all verbs that show prefix variation from the study. The total number of verbs prefixed in *po-*, *s-*, *za-*, *na-*, and *pro-* that are associated with the semantic classes included in the study (see 2.2) is 719. Elimination of prefix variation reduces this number to 395 verbs. The next step is to describe how the largest semantic classes relevant for our prefixes were selected and apply a similar measure to avoid verbs that belong to more than one semantic class.

2.2. Which semantic tags and why

This subsection describes the semantic tags for verbs found in the RNC; why we select the following tags for inclusion in our study: IMPACT, CHANGEST, BEHAV, and a combined class of SOUND and SPEECH; and how verbs with multiple semantic tags were eliminated from the study.

The RNC applies twenty-seven thematic lexico-semantic tags to verbs. The descriptions and examples listed in this subsection are quoted from the RNC website, and thus apply to verbs in general, not specifically to prefixed Natural Perfectives. About half of the tags (fourteen of them) are connected to larger groups. For example, there are three tags labeled IMPACT: a generalized group labeled merely IMPACT (characterized as “fizičeskoe vozdejstvie” ‘physical impact’ with examples *bit* ‘hit’, *kolot* ‘stab’, and *vytirat* ‘wipe, rub’), plus two more specialized sub-groups: IMPACT:CREAT (“sozdanie fizičeskogo ob’ekta” ‘creation of a physical object’, such as *vykovat* ‘forge’, *smasterit* ‘craft, build’, *sšit* ‘sew’) and IMPACT:DESTR (“uničtoženie” ‘destruction’, as in *vzorvat* ‘explode’, *sžeč* ‘burn’, *zarezat* ‘slaughter’). Other grouped tags are MOVE (subgroups: MOVE, MOVE:BODY), BE

(subgroups: BE, BE:EXIST, BE:APPEAR, BE:DISAPP), LOC (subgroups: LOC, LOC:BODY), and PSYCH (subgroups: PSYCH, PSYCH:EMOT, PSYCH:VOLIT).

The remaining thirteen tags are ungrouped categories, and four of them are pertinent to our study. CHANGEST is characterized as “izmenenie sostojanija ili priznaka” ‘change of state or feature’ (examples: *vzroslet* ‘mature’, *bogatet* ‘get rich’, *rasširit* ‘spread’, *ispačkat* ‘soil’). BEHAV is characterized as “povedenie čeloveka” ‘human behavior’ (examples: *kurolesit* ‘play pranks’, *priveredničat* ‘act fussy’). SOUND is characterized as “zvuk” ‘sound’ (examples: *gudet* ‘buzz’, *šelestet* ‘rustle’). SPEECH is characterized as “reč” ‘speech’ (examples: *govorit* ‘talk’, *sovetovat* ‘advise’, *sporit* ‘argue’, *kalamburit* ‘make puns’).

Semantic classes were selected according to the number of Natural Perfectives prefixed in *po-*, *s-*, *za-*, *na-*, and *pro-* they are associated with. As with the selection of prefixes, the goal was to select the semantic classes that yielded the largest numbers of verbs. We needed to ensure that no cell in our matrix would have fewer than five expected observations (prefixed verbs), even with large fluctuations in distribution and after elimination of multiply tagged verbs. Therefore we set a threshold of fifty for the number of verbs in each class. In other words, we only include semantic classes with fifty or more prefixed Natural Perfectives in order to make sure that we have enough data for our analysis. The IMPACT class (including both IMPACT:CREAT and IMPACT:DESTR) is the biggest class for our prefixes, with a total of 127 verbs. The next largest class is CHANGEST, which is tagged on 103 Natural Perfectives with the relevant prefixes. We merge the SOUND and SPEECH classes (henceforth SOUND&SPEECH) on the grounds that they are all verbs denoting the making of sounds, with the latter being more specific to human beings. Together this combined class has 111 Natural Perfectives with our five prefixes. The next largest class is BEHAV, with fifty-four Natural Perfectives. No other semantic class crosses our threshold of fifty.

As with prefixes, we need to avoid collecting multiple observations of semantic classes from any one verb. We thus eliminated from the study any verb that is tagged with more than one of the semantic classes we retained. Fortunately there were not many verbs that needed to be eliminated in this round, only five in the IMPACT class, one in the CHANGEST class, two in the BEHAV class, and five in the combined SOUND&SPEECH class. This leaves 382 Natural Perfectives prefixed in *po-*, *s-*, *za-*, *na-*, and *pro-* for the analysis in Section 3.

3. Statistical analysis

Our aim is to test the hypothesis that the choice of the prefix is related to the meaning of the verb as reflected by its semantic tag. The chi-square test can tell us the probability that the distribution we observe is merely a random event with no significance. A low probability will thus support our hypothesis.

Table 1 presents the distribution of our five prefixes vs. the four semantic classes. The top portion of the table gives the raw scores, which are the numbers of verbs with the given prefixes and the given semantic classes. This top portion of Table 1 is visualized in Figure 2, which gives us a first glance of the semantic profiles of the five prefixes.

	IMPACT	CHANGEST	BEHAV	SOUND&SPEECH
Raw Values				
<i>po-</i>	11	62	11	37
<i>s-</i>	23	11	23	9
<i>na-</i>	31	3	17	8
<i>za-</i>	47	22	1	1
<i>pro-</i>	10	4	0	51
Expected Values (rounded to the nearest integer)				
<i>po-</i>	39	32	16	34
<i>s-</i>	21	18	9	18
<i>na-</i>	19	16	8	16
<i>za-</i>	22	19	10	20
<i>pro-</i>	21	17	9	18
Observed - Expected Values				
<i>po-</i>	-28	30	-5	3
<i>s-</i>	2	-7	14	-9
<i>na-</i>	12	-13	9	-8
<i>za-</i>	24	3	-9	-19
<i>pro-</i>	-11	-13	-9	33
Fisher Test (probability that Observed - Expected could be greater)				
<i>po-</i>	0.0002	1.3e-18	0.05	0.0008
<i>s-</i>	0.015	0.3	2.1e-8	0.1
<i>na-</i>	5.3e-7	0.001	5.5e-5	0.1
<i>za-</i>	1.5e-15	0.01	0.002	2.0e-6
<i>pro-</i>	0.1	0.002	0.0005	5.7e-25

Table 1: Distribution of prefixes vs. semantic classes

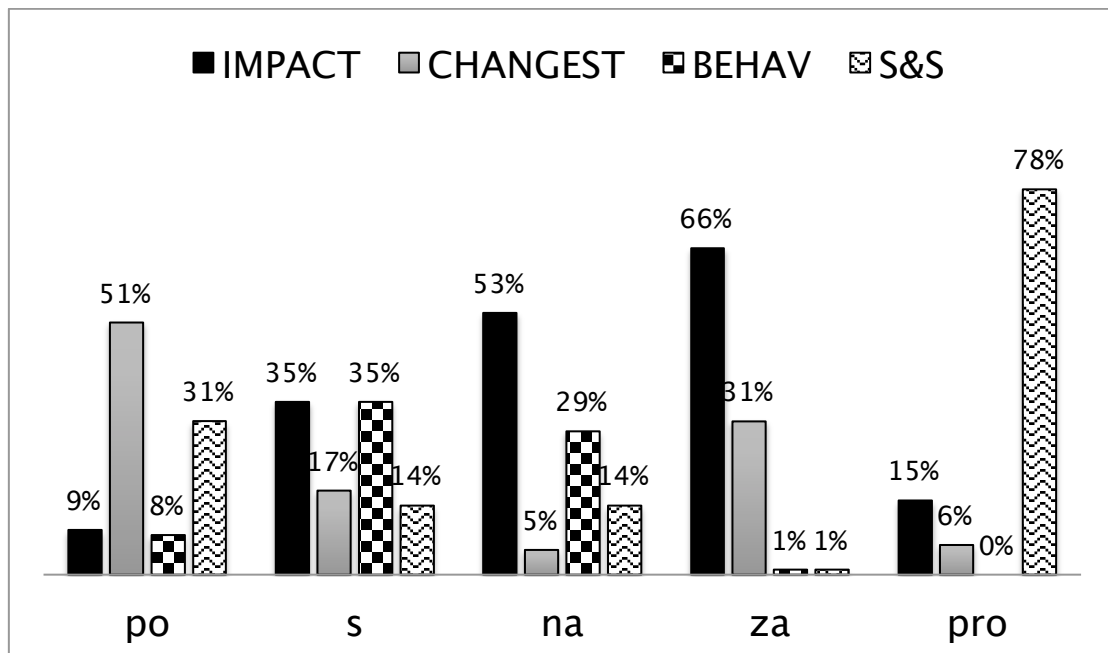
Figure 2: Semantic profiles of *po-*, *s-*, *na-*, *za-*, and *pro-*

Figure 2 presents the semantic profile of each prefix, with the values given as percentages so that they are on the same scale, and the sum of all bars in each cluster at 100% (+/- 1% due to rounding). We see that each prefix behaves differently: *po-* favors CHANGEST, while *pro-* is nearly entirely dominated by SOUND&SPEECH.

IMPACT makes a strong showing in *s-*, *na-*, and *za-*, but the balance of other semantic classes is different for each one. While Figure 2 gives us some insights, the data do not fully reflect all the relevant relationships and are not yet balanced according to the different overall totals for the prefixes and semantic classes. This is achieved in the remaining three portions of Table 1.

While we can see differences among the prefixes in Figure 2, we need to conduct statistical tests in order to find out whether these differences are significant and robust. For this purpose we apply the chi-square test for significance and a test of effect size to measure robustness. The chi-squared value for the matrix in the top portion of Table 1 is 248 (with $df = 12$), and the probability that this distribution is a random event is $2.2e-16$ (another way of writing 0.00000000000000022), which is the lowest number computed by the “R” statistical software package. In other words, the result is statistically very significant. Additionally, the effect size computed for this result is 0.81. Effect sizes range from 0 to 1 and an effect size of 0.1 is considered “small”, 0.3 is considered “moderate”, and 0.5 is considered “large” (Cohen 1988: 215-271; Cohen et al. 2003: 182; King & Minium 2008: 327-330). Thus the effect size far exceeds the standard measure for a large effect.

The second portion of Table 1, labeled “Expected Values”, shows the expected value for each cell, calculated according to the relevant row and column totals, assuming an even distribution. Crucially we see that the lowest expected value is 8 (for the prefix *na-* and the semantic class BEHAV), so all expected values exceed 5. This means that the distribution of data is indeed appropriate for use of the chi-square test described above.

The third portion of Table 1, labeled “Observed - Expected” lists the difference between the number of verbs found with the given combination of prefix and semantic class, minus the expected value for the same cell in the matrix. Positive values here indicate attraction, whereas negative values indicate repulsion. For example, the largest positive value is found for verbs with the *pro-* prefix and the SOUND&SPEECH semantic tag, since the observed value (51) is 33 more than what would be expected (18). The largest negative value (-28) is found for verbs prefixed in *po-* and tagged for IMPACT, where one would expect 39 verbs, but there are only 11. The least deviation from overall frequency-based expectations is for verbs prefixed in *s-* with the IMPACT class, since the actual number of 23 is very close to the expected number of 21.

While these raw scores give some indication of attractions and repulsions, they need to be calibrated to the same scale and tested for statistical significance so that they can be meaningfully compared. This is achieved by using the Fisher Test, which calculates for every cell the probability that the observed value could deviate more from the expected value, given the overall distribution of values. The bottom portion of Table 1 reports the Fisher Test values for all cells.⁵ For example, in the upper left cell we see the value 0.0002 for *po-* and IMPACT. We know that *po-* is repulsed from IMPACT because the expected value is 39, but the actual value is only 11. The Fisher Test value reports the chance that we would find a value lower than 11 in this cell. Since the Fisher Test value is 0.0002, this means that the chance of finding fewer than 11 *po-*prefixed verbs with the IMPACT semantic tag is 1 in 20,000. In other words, we observe a strong repulsion. If we look at the opposite corner of the table, in the bottom right, we find the Fisher Test value for the cell representing *pro-*

⁵ The Fisher Test is computed the same way for each cell, so one example here suffices. If we look at *po-* and IMPACT in the top portion of Table 1, we find 11 verbs in that cell. To compute the Fisher Test we also use three other values that reflect the relationship of this number to the overall numbers: the number of verbs that have the IMPACT tag but a prefix other than *po-* ($23+31+47+10=110$), the number of verbs prefixed in *po-* that do not have the IMPACT tag ($62+11+37=111$), and the number of verbs that do not have the *po-* prefix with the IMPACT tag (total $382-11=371$). Together, these four numbers are input to the Fisher Test, which tells us the likelihood that we could have a deviation even greater from the expected value given the overall values.

prefixed verbs tagged for SOUND&SPEECH, which is $5.7e-25$. Since the observed value exceeds the expected value in this cell, the Fisher Test value we report is for the chance that we would find more than 51 *pro*-prefixed verbs tagged for SOUND&SPEECH. The chance this could happen is extremely low, namely 5.7 with the decimal moved 25 places to the left. Again, we are dealing with a very significant relationship, this time an attraction.

For the purposes of this article, we will report as attractions and repulsions only those combinations for which the Fisher Test value is equal to or lower than 0.01 (a 1/100 chance); higher values will be rated as neutral relationships since 0.01 is a standard threshold for recognizing statistical significance. Some of the relationships are not significant (and thus neutral) according to this measure. For example, the Fisher Test value of 0.3 for *s*-prefixed verbs tagged for CHANGEST tells us there is a 30% chance of finding fewer than 11 such verbs. Three other repulsions have Fisher Test values of 0.1 (*pro*-/IMPACT, *s*-/SOUND&SPEECH, *na*-/SOUND&SPEECH), meaning there is a 10% chance there could have been smaller observed values.

The array of Fisher Test values can be rearranged to show which combinations are most strongly attracted, which are neutral, and which are most strongly repulsed, as in Table 2.

Attractions		Neutral		Repulsions	
Combination	Fisher Test	Combination	Fisher Test	Combination	Fisher Test
<i>pro</i> -/S&S	[+] $5.7e-25$	<i>s</i> -/CHANGEST	[-]0.3	<i>za</i> -/S&S	[-] $2.0e-6$
<i>po</i> -/CHANGEST	[+] $1.3e-18$	<i>pro</i> -/IMPACT	[-]0.1	<i>po</i> -/IMPACT	[-]0.0002
<i>za</i> -/IMPACT	[+] $1.5e-15$	<i>s</i> -/S&S	[-]0.1	<i>pro</i> -/BEHAV	[-]0.0004
<i>s</i> -/BEHAV	[+] $2.1e-8$	<i>na</i> -/S&S	[-]0.1	<i>za</i> -/BEHAV	[-]0.002
<i>na</i> -/IMPACT	[+] $5.3e-7$	<i>po</i> -/BEHAV	[-]0.05	<i>pro</i> -/CHANGEST	[-]0.002
<i>na</i> -/BEHAV	[+] $5.5e-5$	<i>s</i> -/IMPACT	[+]0.015	<i>na</i> -/CHANGEST	[-]0.001
<i>po</i> -/S&S	[+]0.0008				
<i>za</i> -/CHANGEST	[+]0.01				

Table 2: Attractions, neutral relationships, and repulsions between prefixes and semantic classes⁶

Table 2 is arranged according to the strength of the given relationship. Thus the most attracted, most repulsed, and most neutral relationships are at the top of each column, and remaining scores are given in descending order. The most neutral relationships are those where the actual numbers of verbs are closest to the expected values. Table 2 uses the notation [+] and [-] to indicate that the Fisher Test reflects the chance that the combinations would show even more attraction or more repulsion, given overall values.

A further rearrangement of this data gives us another perspective on the semantic profiles of the prefixes, elaborating the visualization in Figure 2. Table 3 lists the semantic classes that are attracted to, neutral to, or repulsed from the five prefixes. Relationships involving Fisher Test values on the order of $e-5$ (1/100,000) or lower are underlined, since these are strongest.

prefix	Attracted	Neutral	Repulsed
<i>pro</i> -	<u>S&S</u>	IMPACT	BEHAV, CHANGEST
<i>po</i> -	<u>CHANGEST</u> , S&S	BEHAV	IMPACT
<i>za</i> -	<u>IMPACT</u> , CHANGEST		<u>S&S</u> , BEHAV
<i>s</i> -	<u>BEHAV</u>	CHANGEST, S&S, IMPACT	
<i>na</i> -	<u>IMPACT</u> , <u>BEHAV</u>	S&S	CHANGEST

The attractions offer a clear set of semantic peaks for the prefixes. Four of the prefixes are primarily attracted to only one semantic class (underlined in Table 3): *pro*- is attracted to SOUND&SPEECH, *po*- is attracted to CHANGEST, *za*- is attracted to IMPACT, and *s*- is attracted to BEHAV. *Po*- and *za*- are more weakly attracted to

⁶ To save space, SOUND&SPEECH is abbreviated as S&S in tables.

SOUND&SPEECH and CHANGEST, respectively. *Na-*, by contrast, is strongly attracted to both IMPACT and BEHAV. *Za-* is repulsed by both of the classes it is not attracted to, and strongly repulsed by SOUND&SPEECH. *S-* has a neutral relationship with all the classes it is not attracted to, and thus is not repulsed by any of them. Clearly each prefix behaves differently and we can pinpoint where the differences lay.

The statistical study thus both supports our hypothesis that the Natural Perfectives have preferences for semantic classes and specifies what these preferences are. The following section analyzes in more detail the actual verbs that stand behind the numbers, interpreting the relationships between prefixes and semantic classes in terms of the meanings that are present in both verbs and prefixes.

4. The semantic profiles of the five prefixes

This section takes each prefix in turn, examining first the semantic class or classes that it is attracted to, the classes for which the prefix has a neutral relationship, and then the repulsions. The analysis is based on the verbs that were included in the statistical study; full lists of these verbs are found in the Appendix, following the order of presentation here, which starts with the prefix showing the strongest attraction, namely that of *pro-* to SOUND&SPEECH. Each analysis closes with a comparison of the meanings found among Natural Perfectives and those that have been proposed for each prefix in previous scholarship. It is important to keep in mind that the previously proposed meanings for prefixes pertain largely or entirely to the “non-empty” uses. Our approach is innovative in that we show how these meanings are relevant also for the use of prefixes in Natural Perfectives, where they have been presumed to be semantically “empty”.

The semantic tags are of course only a rough measure of the meanings of verbs, which are certainly more multi-faceted. They are a good rough measure, as we see that strong patterns emerge. However, there are small residues of verbs in nearly all of the classes that are repulsed from various prefixes (except BEHAV, which has no verbs prefixed in *pro-*). It is essential to note that the few verbs in these repulsed classes are actually attracted to their prefixes, and as we see, this attraction is consistent with the overall pattern of the given prefix. This may seem counterintuitive, but it is possible because the meanings of the verbs are more complex than their semantic tags. For example as we show below, *pro-* is best characterized as meaning ‘through’, and this meaning motivates quantification since movement through the space between points A and B covers a certain quantum of distance. The ‘through’ and ‘quantification’ aspects of *pro-* are compatible with the SOUND&SPEECH and IMPACT classes, as argued below. However, even though the CHANGEST class is less compatible with this meaning pattern, there are four *pro-* prefixed verbs in the CHANGEST class. These verbs are attracted to *pro-* because they signal penetration and thus encode ‘through’.

4.1 The semantic profile of *pro-*

When we look at the Natural Perfectives that are prefixed with *pro-*, a clear pattern emerges. *Pro-* is associated with movement ‘through’ a quantum of space or time. This meaning is most compatible with the semantic classes of SOUND&SPEECH and IMPACT. Either we are dealing with the emission of sounds, which is a penetration of sound waves through space (SOUND&SPEECH), or we see other kinds of penetration involving the drilling of holes or absorption of substances (IMPACT). Although *pro-* is repulsed from the CHANGEST semantic class, all the verbs that it does appear in for this class express some kind of penetration. There is additionally tangible overlap between the use of the prefix *pro-* in Natural Perfectives and its use in perdurative Complex Act Perfectives like *proplakat’* (*vsju noč’*) ‘cry through (the whole night)’, since many of the Natural Perfectives, particularly those in the SOUND&SPEECH class, can also have a perdurative reading.

4.1.1 Attraction: 51 SOUND&SPEECH verbs (23 SOUND and 28 SPEECH)

Making sounds entails sending them ‘through’ space and time, which motivates the attraction of *pro-* to this semantic class. A generic verb in this group serves as an

umbrella term for many of the others: *prozvučat* ‘sound, be heard’. Some verbs in this group denote sounds that can be made by inanimate objects, like *progudet* ‘buzz’, or the weather, as in *progremet* ‘thunder’. Many sounds are characteristic of certain animals, as in *prolajat* ‘bark’ or *promyčat* ‘moo’. Parallel to the animal sounds are a number of sounds specific to human beings, such as *probasit* ‘talk in a deep voice’ and *probormotat* ‘mutter’. Alternatively a few verbs in the SPEECH class involve completion of a specified amount of talking (cf. the parallel to perduratives), such as *prodiktovat* ‘dictate’ and *prointerv’juirovat* ‘interview’. These verbs arguably refer to the metaphorical penetration of an entire performance.

4.1.2 Neutral: 10 IMPACT verbs

The theme of penetrating substances and making holes is salient with the IMPACT verbs that combine with *pro-*. Substances (here lime, disinfectant, and air) penetrate objects and spaces in *proizvestkovat* ‘apply lime (soil)’, *prodezinficirovat* ‘apply disinfectant’, *proventilirovat* ‘ventilate’, and *provejat* ‘winnow’. Three verbs in the IMPACT class refer directly to the drilling of holes: *proburavit* ‘bore, drill’, *proburit* ‘bore, drill’, and *prosverlit* ‘drill, perforate’. The three remaining verbs involve opening up holes with specific instruments: *protaranit* ‘ram’, *promotyžit* ‘hoe’, and *prodiskovat* ‘break up soil with a disk-shaped harrow’.

4.1.3 Repulsions: 0 BEHAV verbs, 4 CHANGEST verbs

The BEHAV semantic class is not represented at all, which is not surprising given that behavior is not something that involves penetration or movement ‘through’ anything and behavior as a state is not often quantized in verbs. CHANGEST is likewise in general not very compatible with *pro-* because a change of state is often punctual and therefore resists quantization in a verb. However, the few verbs that we do find in the CHANGEST class reflect the overall pattern of *pro-*. There are four verbs, two of which encode saturation via penetration with a substance or flavor: *propitat’sja* ‘become saturated’ and *progorknut* ‘become bitter’. The other two verbs in the CHANGEST class involve penetration through holes: *proxudit’sja* ‘become worn out (with holes)’ and *projasnet* ‘clear up’, in which sunlight penetrates the clouds.

4.1.4 Comparison of the semantic profile of *pro-* with previous scholarship on *pro-* Flier (1975: 221-222) designates *pro-* as -LATERAL in a feature analysis, suggesting that its meanings include: ‘through’ (*prolomit stenu* ‘break through the wall’), ‘thoroughness’ (*provarit mjaso* ‘cook the meat thoroughly’), ‘duration’ (*progovorit celyj čas* ‘talk for a whole hour’), ‘distance overcome’ (*proexat desjat kilometrov* ‘ride for ten kilometers’), and ‘result’ (*proventilirovat* ‘ventilate’).⁷ Švedova et al. (1980: §876) offer eight meanings, six of which correspond to Flier’s meanings (though ‘thoroughness’ is broken up into two categories), plus two more, both of which involve missing something: ‘move past’ (*proexat* in the sense of ‘ride past’) and ‘fail to notice/be present’ (*progljadet* ‘overlook’).⁸ The meanings of ‘through’ and ‘thoroughness’ for *pro-* are parallel to the use of *pro-* to perfectivize verbs that describe penetration, making holes, and saturation in the IMPACT and CHANGEST classes. There is also a connection to the SOUND&SPEECH verbs, since sound penetrates space as it travels, both going through the space and overcoming distance. Most of the SOUND&SPEECH verbs are also compatible with the ‘result’ meaning. Additionally, the connection between some Natural Perfectives and perduratives points to the presence of the ‘duration’ meaning. Some of the meanings that have been attributed to *pro-* are not found among our Natural Perfectives: ‘move past’ and ‘fail to notice/be present’. These omissions are perhaps not surprising given that

⁷ Flier (1975: 222) also recognizes an additional meaning, namely ‘satisfaction’ (*prospat’sja* ‘sleep one’s fill’), but states that this meaning shows “little productivity”.

⁸ Some uses can convey these meanings (cf. *Mimo progroxotal gruzovik* ‘a truck rumbled by’ (Krongauz 1998); *Prokukovala ves’ svoj vek, a teper’ zlitsja* ‘She has wasted her life cuckooing and now she is angry’ [Šukšin, Pis’mo (1970-1972)]), however these are Specialized Perfectives.

moving past something is not a natural culmination for moving and failing to notice something is not a natural culmination of an act of perception. Otherwise, however, we observe that the meanings associated with the *pro*-prefixed Natural Perfectives are a subset of the meanings that have been previously attributed to *pro*-.

4.2 The semantic profile of *po*-

The theme of *po*- is closely related to its use to form delimitative Complex Act Perfectives. This prefix is attracted to the CHANGEST class, where it combines with verbs that denote gradual changes along scales defined by adjectives. The result signaled by the *po*-prefixed Natural Perfectives is an increase along a given scale, parallel to the completion of some amount of an activity. We can compare, for example, the Natural Perfective *poteplet* 'get warmer' with a Complex Act Perfective like *poplakat* 'cry for a while', since in both cases we have a loosely quantified action, 'some warming' and 'some crying', that could potentially be continued at a later point in time. In the semantic classes that are neutral for *po*- or repulse this prefix, we find verbs that denote activities that necessarily have some duration, either brief as in the case of *poblagodarit* 'say thank you' or potentially longer, as in *posporit* 'have an argument'. Actions that are truly instantaneous are missing and many verbs are open to an alternative delimitative reading in addition to the "purely aspectual" reading of the Natural Perfectives. The association with the delimitative reading betrays a quantizing function for *po*-, and it is thus not surprising that *po*-, like *pro*- repulses BEHAV, since behavior is usually hard to quantify in a verb. The verbs that do appear with *po*- in the BEHAV class are exceptions to this rule, either verbs that describe quantizable behaviors, or uses that are simply resultative.

4.2.1 Attraction: 62 CHANGEST verbs, 37 SOUND&SPEECH verbs (35 SPEECH and 2 SOUND)

The verbs in this group are nearly all motivated by adjectival rather than verbal roots and thus best described as "factitives" (Townsend 1975: 143-144). At least one verb has instead a nominal root: *posaxarit* 'sugar'. Three verbs have a verbal root: *poseč'sja* 'tear', *potreskat'sja* 'split', and *pospet* 'ripen' (but note that the latter is closely associated with the adjective *spelyj* 'ripe'). Nearly half of the CHANGEST *po*-prefixed Natural Perfectives reference a change in color, such as *pokrasnet* 'turn red', *pobelet* 'turn white', and *počernet* 'turn black'. Other verbs in this group refer to characteristics such as appearance (*poxudet* 'get slimmer', *pomolodet* 'get younger-looking'), temperature (*poxolodet* 'cool down', *poteplet* 'get warmer'), and other qualities (*poredet* 'thin out', *poumnet* 'grow wiser', *polegčat* 'lessen, abate').

On the whole, these verbs are of the type Croft (ms.) refers to as "directed activities" and Mehlig (1994: 590) terms "relative transformatives", because most verbs in this group refer to situations that can be continued further after the completion denoted by the perfective verb. Thus one could potentially say *on poxudel, a potom on ešče sil'nee poxudel* 'he slimmed down and then he got even slimmer'. This type of perfective is thus a bit unusual since most perfective verbs do not leave room for a continuation of the same action; cf. the unacceptability of **on napisal knigu, a potom ešče bol'she napisal knigu* 'he wrote a book and then wrote the book even more'. However, delimitative Complex Act Perfectives also allow further continuation of a completed event, as in *on poplakal, a potom ešče poplakal* 'he cried for a bit and then did a bit more crying'. Thus there are two generalizations we can make concerning the *po*-prefixed CHANGEST verbs: 1) most of them are not formed from verbal roots, and 2) their Natural Perfectives do not refer to a single definitive result, but rather the result of some change along a scale comparable to the completion of some amount of an activity in a delimitative Complex Act Perfective.

The 35 SPEECH verbs include situations typically of shorter duration such as *poblagodarit* 'thank', *požalovat'sja* 'complain', and *poprosit* 'request'; as well as situations of variable duration such as *pomolit'sja* 'pray', *posovetovat* 'give advice', and *poxvastat'(sja)* 'brag'. The latter are comparable to delimitative Specialized Perfectives such as *pogovorit* 'talk for a while', *porugat* 'curse for a while', and

pokritikovat ‘criticize for a while’. The two SOUND verbs prefixed in *po-* are *posmejat’sja* ‘laugh’ and the colloquial verb *pozvonit’sja* ‘ring’.

4.2.2 Neutral: 11 IMPACT verbs

The verbs in this group are resultative and refer either to well defined tasks, like *pobrit’(sja)* ‘shave’ and *podoit’* ‘milk’, or to various kinds of touching, as in *poščupat’* ‘touch, feel’, *počesat’sja* ‘scratch’, and *poščekotat’* ‘tickle’. Again, many of these verbs are open to interpretation also as delimitatives.

4.2.3 Repulsion: 11 BEHAV verbs

Most of the verbs in the BEHAV semantic class are motivated by non-verbal roots and/or can have a delimitative reading, as in *požadničat’* ‘act greedy’ and *polenit’sja* ‘act lazy’. Additionally we see verbs that conform to neither of these trends, like *poslušat’sja* ‘obey’ and *postesnjat’sja* ‘be shy’, which are more generally resultative.

4.2.4 Comparison of the semantic profile of *po-* with previous scholarship on *po-*

In this study, *po-*prefixed Natural Perfectives are primarily verbs denoting changes of state along a gradient scale, and are motivated by adjectival instead of verbal roots. Dickey (2007) argues that for Russian *po-* is the “primary” perfectivizing prefix, which may be why it is the prefix of choice even for verbs that are motivated by adjectival roots. We see a continuum between the resultative reading of Natural Perfectives with this prefix and an alternate delimitative reading. How does this square with the meanings of *po-* that have been identified not just for Natural Perfectives, but also for other types of perfective verbs? The most comprehensive recent work on *po-* is LeBlanc 2010, presenting a statistical study of data from the RNC. For perfective verbs, LeBlanc identifies the following meanings of *po-*: resultative, delimitative, attenuative, distributive, and ingressive.⁹ The attenuative meaning, despite the fact that it is listed in major grammars, is apparently exceedingly rare in Modern Russian, since LeBlanc’s study failed to discover any examples, so it can be put aside as a marginal phenomenon.¹⁰ The Natural Perfectives in our study, by contrast, are overwhelmingly resultative, though many form a continuum with the delimitative meaning, and this is consistent with LeBlanc’s (2010: 98) observation of a close link between the resultative and delimitative meanings (note also that Dickey 2007 tracks the historical connection between these meanings). The distributive and ingressive meanings are, however, not observed among Natural Perfectives in *po-*. This is not surprising given the fact that these meanings are not entirely compatible with the purely perfectivizing function of a Natural Perfective, since a distributive puts focus instead on multiple situations and an ingressive puts focus on the beginning rather than completion of an action. In short, we see that the *po-*prefixed Natural Perfectives in our study have meanings that overlap with some of the meanings generally associated with *po-* (‘resultative’ and ‘delimitative’), but do not overlap with others (‘distributive’ and ‘ingressive’).

4.3 The semantic profile of *za-*

The *za-*prefixed Natural Perfectives mostly express either covering or putting something into a fixed state. Fixed states are achieved either literally (via attachment) or metaphorically, in which case the resultant state is one in which an object is less flexible and less vulnerable to change. Covering is compatible with the IMPACT class since covering impacts a surface, and both covering and change to a fixed state are compatible with CHANGEST. Both IMPACT and CHANGEST are attracted to *za-*, accounting for nearly all of the *za-*prefixed verbs. Only two verbs remain, one each in

⁹ Note that this list is consistent with the meanings listed in both standard grammars of Russian and in more specialized works pertaining to *po-*, such as Dmitrieva 1991. A sixth meaning, the intermittent-attenuative, is associated only with imperfective verbs.

¹⁰ It is likely that LeBlanc did not find attenuative uses because his study focused on mainly written examples. These uses are probably more frequent in spoken language.

the SPEECH and BEHAV classes, both of which conform to the overall pattern in that they describe a change to a more fixed state.

4.3.1 Attraction: 47 IMPACT verbs, 22 CHANGEST verbs

Over half of the *za*-prefixed verbs in the IMPACT class denote covering, such as *zaasfal'tirovat* 'cover with asphalt', *zamaskirovat'(sja)* 'mask', and *zamusolit* 'slobber all over'. A smaller subgroup applies something to a container rather than a surface, resulting in verbs of filling such as *zabutit* 'fill with rubble' and *zaballastirovat* 'load with ballast'. Covering often entails attachment, and the latter meaning is emphasized in verbs like *zakrepiť* 'fasten' and *zativrit* 'brand'. The fixing of attachment is related also to the achievement of fixed states in which something is less mobile and subject to change, as in *zakonservirovat* 'preserve' and *zakristalizirovat* 'crystallize'. More metaphorical fixing is present in verbs like *zabronirovat* 'reserve', where the right to access something becomes "fixed" through an agreement.

The CHANGEST verbs that use *za*- can likewise be grouped as involving covering (*zagrjaznit'(sja)* 'get dirty', *zapylit'sja* 'get covered with dust', *zaindevet* 'become covered with frost') or fixed states (*zamerznut* 'freeze', *zatverdet* 'harden', *zagustet* 'thicken').

4.3.2 Repulsions: 1 SPEECH verb, 1 BEHAV verb

Covering and change to a fixed state do not harmonize well with SOUND&SPEECH and BEHAVE. Each of these semantic classes contains only one *za*-prefixed Natural Perfective. The SPEECH verb is *zakontraktovat* 'make a contract' where the result is a fixed plan, and the BEHAV verb is *zadurit* 'become unreasonable' where a human being reaches a fixed state that goes beyond the boundaries of acceptable behavior.

4.3.3 Comparison of the semantic profile of *za*- with previous scholarship on *za*-

The *za*-prefixed Natural Perfectives in our study exhibit the following kinds of meanings: 'covering', 'filling', 'attachment', and 'change to a more fixed state'. We can compare this with the range of meanings that have been posited by Janda (1986) for *za*-, which are: 'deflection', 'fix', 'change of state', 'excess', 'inchoative', 'exchange', 'surface', 'cover', 'splatter', and 'fill'. We see that the meanings associated with the Natural Perfectives are a subset of the range of *za*- meanings identified by Janda. 'Fix' and 'attachment' refer to the same meaning and are closely related to the change of state meaning, which is restricted only to "change from 'normal' to 'abnormal', since in every case the trajector exchanges its canonical condition of health, activity, transience, pliability, and/or freedom, for an opposite state" (Janda 1986: 97). Janda has two versions of the 'covering' meaning, since 'splatter' "is identical to <cover> except that the trajector is a group of objects or a divisible object rather than a single mass" (Janda 1986: 129). The 'fill' meanings correspond. However, *za*- also has a number of other meanings that are not represented among our Natural Perfectives, namely: 'deflection', 'excess', 'inchoative', 'exchange', and 'surface'. Again, these meanings of *za*- are quite specialized and thus probably less compatible with the function of Natural Perfectives. However, base verbs denoting covering, filling, attachment, and change to a fixed state can easily perfectivize with *za*- as we see.¹¹

¹¹ Though the names of the meanings are different, Zaliznjak's (2006: 311-328) network is very similar, containing the following major classifications (and their approximate correspondents in Janda's system): 'begin' (= 'inchoative'), 'become' (= 'change of state'), 'cover', 'fix', 'damage' (= 'excess'), 'get' (= 'exchange'), and 'space' (= 'deflection'). Braginsky (2008) presents a smaller network of three meanings for *za*-, spatial, resultant, and inchoative, plus a set of rules to handle contextual variation. However, the same ideas of covering, filling, attachment and change to a fixed state are represented, many under the heading of 'become established'.

4.4 The semantic profile of *s*-

Behavior is often spontaneous and thus sudden, motivating the only attraction we observe in the profile of *s*-, namely to the BEHAV class, and we note that many *s*-prefixed verbs in the BEHAV class can have semelfactive readings. All other classes show a neutral relationship to *s*- and they include additionally meanings that can be characterized as ‘together’ and ‘down’.

4.4.1 Attraction: 23 BEHAV verbs

Verbs in this group can have semelfactive Single Act Perfective readings in addition to their more neutral resultative Natural Perfective readings. These verbs refer to a single performance of something (often negative) that could potentially be repeated, and these verbs often have non-verbal roots. Examples include: *sglupit* ‘do something stupid’, *sxitrit* ‘do something clever’, *smalodušničat* ‘act like a coward (on one occasion)’, and *soriginal’ničat* ‘do something original’.

4.4.2 Neutral: 11 CHANGEST verbs, 9 SPEECH verbs, 23 IMPACT verbs

The CHANGEST verbs describe processes of aging, rotting, and becoming more compact, which arguably combine the meanings of ‘together’ and ‘down’, as we see in *sostarit* (*sja*) ‘age’, *sgnit* ‘rot’, and *skondensirovat* ‘condense’.

Most of the SPEECH verbs that have the *s*- prefix are similar to the attracted BEHAV verbs. These verbs can have a semelfactive reading, like *sostrit* ‘make a witty remark’ and *skalamburit* ‘make a pun’, but some can also relate to the ‘together’ meaning, as in *sformulirovat* ‘formulate’ (which involves putting words or ideas together).

Though the same raw number of *s*-prefixed verbs is associated with the IMPACT semantic class as with the BEHAV class, the former is a neutral relationship because the IMPACT class is more than twice as large as the BEHAV class, and 23 is nearly the same as the expected value based on frequency alone, which is 21. The majority of *s*-prefixed verbs in the IMPACT class instantiate the ‘together’ meaning in which parts are joined to make a whole, as in *sšit* ‘sew’, *svjazat* ‘tie, knit’, and *smasterit* ‘craft, build’. This includes also the generic verb *sdelat* ‘make, do’ which has more abstract uses as well. Some verbs in this group express a downward movement: *srubit* ‘chop down’ and *sžeč* ‘burn down’.

4.4.3 Comparison of the semantic profile of *s*- with previous scholarship on *s*-

Dickey (2005) and Dickey and Janda (2009) trace the development of meanings of the *s*- prefix in Russian. The spatial meanings of the Old Church Slavonic *sb-* prefix included a centripetal meaning, as in OCS *sbniti se* ‘come together’, and a downward-ablative meaning, as in OCS *sbtresti* ‘shake off’. These two meanings are equivalent to the ‘together’ and ‘down’ meanings that characterize the *s*-prefixed Natural Perfectives analyzed in this section. Dickey (2005: 10) argues that both the ‘centripetal’/‘together’ meaning and the ‘downward-ablative’ meaning contributed to the development of a more generalized ‘resultative’ meaning. In addition to motion verbs, the ‘centripetal’/‘together’ meaning was (and still is) present in verbs used to mean ‘assemble’ and ‘build’, which have an inherent result (cf. *sšit* ‘sew’). Similarly, verbs with the ‘downward-ablative’ meaning yield a result; for example OCS *sokratiti*/Russian *sokratit* ‘shorten’ names a result achieved by ‘cutting away’ or by compression, thus including ‘together’. In combination the two meanings support more general resultative interpretation, facilitating use with factitive verbs like *sgustit* ‘thicken’. The semelfactive is an innovation in Russian, motivated by the actional flexibility of the spatial meanings and their resultative extensions (see Dickey and Janda 2009).

The meanings we find among the *s*-prefixed Natural Perfectives are thus consistent with the meanings found for *s*-prefixed verbs in general, in keeping with the pattern observed thus far.

4.5 The semantic profile of *na-*

The semantic profile of *na-* is somewhat more diffuse than for the other prefixes, since it lacks the focus of having only one strongly attracted semantic class, and is instead similarly attracted to both IMPACT and BEHAV. There is a consistent focus throughout all the *na*-prefixed verbs on accumulation, either physically on a surface or more abstractly in terms of increased density or intensity. This focus on accumulation is compatible with IMPACT and BEHAV and to a lesser extent SPEECH. Accumulation is less relevant for most CHANGEST verbs since a change of state affects an entire object, but the few CHANGEST verbs that are perfectivized with *na-* are consistent with the accumulation meaning.

4.5.1 Attractions: 31 IMPACT verbs, 17 BEHAV verbs

Again the fact that the IMPACT class has over twice as many verbs overall should be kept in mind, since *na-* is equally attracted to both classes, despite the differences in raw numbers. The physical accumulation of substance on a surface is most consistently realized in the IMPACT class, where we find verbs like *navoščit* ‘wax’ and *namylit* ‘(sja) ‘soap’.

Accumulation is mostly metaphorical in the BEHAV class, usually referring to accumulation of negatively-evaluated behavior, as in *nabezobrazničat* ‘behave disgracefully’ and *naxuliganit* ‘behave like a hooligan’. Note the parallel here to Specialized Perfectives with an ‘accumulation’ meaning, such as *nagrešit* ‘commit many sins’ (as opposed to the Natural Perfective *sogrešit* ‘sin’).

4.5.2 Neutral: 8 SPEECH verbs

The SPEECH verbs are parallel to the BEHAV verbs in reporting a quantity of verbal behavior, as in *nagrubit* ‘be rude’, *naklevetat* ‘gossip’, and *naproročit* ‘prophesize’.

4.5.3 Repulsion: 3 CHANGEST verbs

The CHANGEST verbs refer to accumulation in terms of filling a volume, be it with electrical charge in *naèlektrizovat* ‘electrify’, or smoke in *nadymit* ‘fill with smoke’.

4.5.4 Comparison of the semantic profile of *na-* with previous scholarship on *na-* Russell 1985 and Švedova et al. 1980 (361-2) identify the following meanings associated with *na-*: ‘surface-oriented action’ (*napudrit* ‘powder’), ‘training’ (*naučit* ‘teach’), ‘resultative’ (*napugat* ‘frighten’), ‘accumulation’ (*nakupit* ‘buy a lot of’), and ‘intensive’ (*nagrešit* ‘do a lot of sinning’).¹² The examples betray the fact that all of these meanings are variations on the ‘accumulation’ meaning, involving an accumulation of powder on a surface, an accumulation of teaching leading to a result, and intensity achieved by accumulation. Thus the meanings of the *na*-prefixed Natural Perfectives reflects the same range of meanings found for *na*-prefixed verbs in general.

4.6 Summary of the semantic profiles of *pro-*, *po-*, *za-*, *s-*, and *na-*

Table 4 summarizes the meanings that are found for the Natural Perfectives prefixed in *pro-*, *po-*, *za-*, *s-*, and *na-*. The main point of this table is to show that the meanings of the verbs that use a given prefix are consistent, regardless of whether they appear in attracted or repulsed classes. In other words, even those few verbs that do appear in the repulsed classes have meanings that are compatible with the overall meaning pattern of the given prefix.

¹² Švedova et al. (1980: 362) additionally lists an unproductive ‘superficial performance’ meaning (*naigrat* ‘play superficially’), but Russell (1985: 73) notes that most sources associate this meaning only with imperfective verbs.

	Meanings in attracted classes	Meanings in neutral classes	Meanings in repulsed classes
<i>pro-</i>	sound penetration, perdurative (S&S)	penetrating surfaces, making holes (IMPACT)	saturation, penetration through holes (CHANGEST)
<i>po-</i>	factive, delimitative, resultative (CHANGEST, S&S)	resultative, delimitative (IMPACT)	factive, resultative, delimitative (BEHAV)
<i>za-</i>	covering, filling, fixed states, attachment (IMPACT, CHANGEST)	---	fixed states (SPEECH, BEHAV)
<i>s-</i>	resultative, semelfactive (BEHAV)	resultative, semelfactive, together, down (CHANGEST, SPEECH, IMPACT)	---
<i>na-</i>	accumulation on surface (IMPACT, BEHAV)	accumulation of behavior (SPEECH)	accumulation that fills a volume (CHANGEST)

Table 4: Meanings of verbs associated with semantic profiles

In all cases it is possible to describe the meanings of the prefixed Natural Perfectives as a subset of the meanings that have been posited for the corresponding prefixes. Even the meanings of the verbs representing semantic classes that are repulsed from a prefix are themselves consistent with the meaning of the prefix. For example, whereas *pro-* repulses CHANGEST verbs overall, it can perfectivize CHANGEST verbs that denote saturation or penetration through holes. Prefixal meanings that are not attested among our Natural Perfectives are generally meanings that are phasal, very specific, or involve some kind of negation and thus are incompatible with the function of creating aspectual partner verbs with the same meaning as the imperfective simplex verbs. Thus we do not observe, for example, *po-* prefixed Natural Perfectives with an ingressive meaning, *za-* prefixed Natural Perfectives with a deflection or ingressive meaning, or *pro-* prefixed Natural Perfectives with the meaning ‘fail to notice’.

5. Conclusions

We have presented a methodology for investigating the semantics of verbal prefixes, namely semantic profiling. Semantic profiling uses the frequency distribution of semantic classes tagged on verbs with given prefixes to discover the semantic preferences of prefixes. The input consists of semantic classifications that have been independently assigned following the conventions of the Moscow semantic school. This data is therefore maximally accurate and informative and we show that it can be used in statistical tests.

We have shown that five of the verbal prefixes that are most widely used to form Natural Perfectives in Russian, *pro-*, *po-*, *za-*, *s-*, and *na-*, have unique semantic profiles. More specifically, we performed an analysis of the distribution of semantic tags in the RNC, with the result that each prefix is attracted to and repulsed by a different set of semantic classes. Our findings are both statistically significant and robust in their effect size. These findings support the hypothesis that Natural Perfectives associate with prefixes in accordance with semantic preferences. A detailed analysis of the prefixed verbs makes it possible to specify patterns of meanings and compare these patterns with the meanings that have been suggested for the prefixes in previous studies. We find that the meanings of the prefixed Natural Perfectives correspond well to the meanings of the prefixes. This is true despite the fact that the prefixes are purportedly “empty” in the Natural Perfectives and that the meanings of the prefixes have been established primarily on the basis of their “non-empty” uses. In other words, the meanings of the supposedly “empty” prefixed

Natural Perfectives correspond to the meanings of the prefixes in their “non-empty” uses (in Specialized, Complex Act, and Single Act Perfectives). This result is consistent with the results of another study that focuses on a different set of prefixes and a different methodology: Baydimirova et al. submitted applied radial category profiling to examine most of the remaining prefixes, and found that the meanings of Natural Perfectives cover the same range or are a subset of the meanings of prefixes as established on the basis of their uses in other types of perfectives.

Returning to the perspective of tree structure, we recall that it has been argued (Ramchand 2004, Svenonius 2004a–b and 2008) that the meaning of the prefix is related to the prefix’s position in the tree. The present results do not refute this claim, but rather elaborate it. One could state that the meanings of the prefixes are not only related to the position of the prefix in the tree, but are related also to the meanings of the verbs in the case of the so-called “purely aspectual” uses of prefixes. Indeed, all of these meanings cohere for any given prefix.

It appears then, that a simplex verb selects the prefix that it uses to form a Natural Perfective according to semantic principles, choosing the prefix with the meaning that conforms best to the verb’s own meaning. This study was limited to verbs that use only one prefix to form a Natural Perfective and have only one semantic tag. It was also limited to only five prefixes and did not take into account token frequency. Further research may show whether our conclusion can be corroborated while taking these and other factors into account.

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Appendix of verbs and semantic tags

The appendix is arranged according to the presentation of the semantic profiles in the article, with reference to corresponding section numbers.

4.1 The semantic profile of *pro-*

4.1.1 Attraction: 51 SOUND & SPEECH verbs (23 SOUND and 28 SPEECH)

SPEECH	<i>probasit'</i>	'talk in a deep voice'	SPEECH	<i>prokonsul'tirovat'sja</i>	'consult'
SPEECH	<i>probormotat'</i>	'mutter'	SPEECH	<i>prokričat'</i>	'yell'
SOUND	<i>probrenčat'</i>	'jingle'	SOUND	<i>prokukarekat'</i>	'crow'
SOUND	<i>probrexat'</i>	'yelp, bark'	SOUND	<i>prokukovat'</i>	'cuckoo'
SPEECH	<i>probrjuzžat'</i>	'grumble'	SOUND	<i>prolajat'</i>	'bark'
SOUND	<i>probrjacat'</i>	'clank'	SPEECH	<i>prolepetat'</i>	'babble'
SPEECH	<i>prohubnit'</i>	'mutter'	SPEECH	<i>prolopotat'</i>	'splutter'
SPEECH	<i>proburčat'</i>	'grumble'	SOUND	<i>promurlykat'</i>	'purr'
SOUND	<i>provereščat'</i>	'squeal'	SOUND	<i>promyčat'</i>	'moo'
SPEECH	<i>proveščat'</i>	'prophecy'	SPEECH	<i>promjamlit'</i>	'hum and haw'
SOUND	<i>progavkat'</i>	'bark'	SOUND	<i>promjaukat'</i>	'meow'
SOUND	<i>progogotat'</i>	'cackle'	SPEECH	<i>propesočit'</i>	'criticize'
SOUND	<i>progremet'</i>	'thunder'	SOUND	<i>prosvistet'</i>	'whistle'
SOUND	<i>progromyxtat'</i>	'rumble'	SOUND	<i>prosignalit'</i>	'signal'
SOUND	<i>progroxotat'</i>	'crash, rumble'	SPEECH	<i>prosklonjat'</i>	'decline; bandy about'
SOUND	<i>progudet'</i>	'buzz'	SPEECH	<i>prosprjagat'</i>	'conjugate'
SPEECH	<i>prodeklamirovat'</i>	'recite'	SPEECH	<i>protelegafirovat'</i>	'telegraph'
SPEECH	<i>prodiktovat'</i>	'dictate'	SPEECH	<i>protelefonirovat'</i>	'telephone'
SOUND	<i>prozvenet'</i>	'ring'	SOUND	<i>protjavkat'</i>	'yelp'
SOUND	<i>prozvučat'</i>	'sound, be heard'	SOUND	<i>prourčat'</i>	'rumble'
SPEECH	<i>proinstruktirovat'</i>	'instruct'	SPEECH	<i>proxripet'</i>	'wheeze'
SPEECH	<i>prointerv'juirovat'</i>	'interview'	SPEECH	<i>procitirovat'</i>	'quote'
SPEECH	<i>proinformirovat'</i>	'inform'	SPEECH	<i>prošeptat'</i>	'whisper'
SOUND	<i>prokvakat'</i>	'croak'	SPEECH	<i>proèkzamenovat'</i>	'examine'
SPEECH	<i>prokomentirovat'</i>	'comment'	SPEECH	<i>proèkzamenovat'sja</i>	'be examined'
SPEECH	<i>prokonsul'tirovat'</i>	'offer consultation'			

4.1.2 Neutral: 10 IMPACT verbs

<i>proburavit'</i>	'bore, drill'	<i>prodiskovat'</i>	'break up soil with a disk-shaped harrow'
<i>proburit'</i>	'bore, drill'	<i>proizvestkovat'</i>	'apply lime (soil)'
<i>proventilirovat'</i>	'ventilate'	<i>promotyžit'</i>	'hoe'
<i>provejat'</i>	'winnow'	<i>prosverlit'</i>	'drill, perforate'
<i>prodezinficirovat'</i>	'apply disinfectant'	<i>protaranit'</i>	'ram'

4.1.3 Repulsions: 0 BEHAV verbs, 4 CHANGEST verbs

<i>progorknut</i>	'become bitter'	<i>proxudit'sja</i>	'get worn out'
<i>propitat'sja</i>	'become saturated'	<i>projasnet</i>	'clear up'

4.2 The semantic profile of *po-*

4.2.1 Attraction: 62 CHANGEST verbs

<i>pobagrovet</i>	'turn purple'	<i>poprostat</i>	'become unpretentious'
<i>pobelet</i>	'turn white'	<i>poredet</i>	'thin out'
<i>poblednet</i>	'turn pale'	<i>porozovet</i>	'turn pink'
<i>pobleknut</i>	'lose color'	<i>poryžet</i>	'turn reddish'
<i>poburet</i>	'turn brown'	<i>porjabet</i>	'get speckled'
<i>povzroslet</i>	'mature'	<i>posaxarit</i>	'sugar'
<i>povlažnet</i>	'become damp'	<i>posvežet</i>	'freshen'
<i>poglupet</i>	'become stupid'	<i>posedet</i>	'turn gray'
<i>pogolubet</i>	'turn blue'	<i>poseret</i>	'turn grizzly'
<i>podeševet</i>	'become cheaper'	<i>poser'eznet</i>	'become serious'
<i>podlinnet</i>	'become longer'	<i>poseč'sja</i>	'tear'
<i>podorožat</i>	'increase in price'	<i>posivet</i>	'turn gray'
<i>podurnet</i>	'grow ugly'	<i>posizet</i>	'turn blue-gray'
<i>poželtet</i>	'turn yellow'	<i>posinet</i>	'turn dark blue'
<i>pozdorovet</i>	'turn recuperate'	<i>posmirnet</i>	'become quiet'
<i>pozelenet</i>	'turn green'	<i>posmuglet</i>	'turn swarthy'
<i>pozelenit</i>	'paint green'	<i>pospet</i>	'ripen'
<i>pozlatit'sja</i>	'turn golden'	<i>posurovet</i>	'become severe'
<i>pozolotet</i>	'turn golden'	<i>poteplet</i>	'get warmer'
<i>pokrasnet</i>	'turn red'	<i>potončat</i>	'become thin'
<i>pokrupnet</i>	'grow larger'	<i>potreskat'sja</i>	'split'
<i>polevet</i>	'shift leftward'	<i>potusknet</i>	'turn dim'
<i>polegčat</i>	'lessen, abate'	<i>potusknut</i>	'turn dim'
<i>polilovet</i>	'turn violet'	<i>poumnet</i>	'grow wiser'
<i>pomolodet</i>	'get younger-looking'	<i>poxolodet</i>	'cool down'
<i>pomračnet</i>	'turn dark'	<i>poxolodnet</i>	'cool down'
<i>pomutnet</i>	'muddy'	<i>poxorošet</i>	'grow prettier'
<i>pomjagčet</i>	'get soft'	<i>poxrabret</i>	'become braver'
<i>poplotnet</i>	'grow stout; become dense'	<i>poxudat</i>	'get slimmer'
<i>popolnet</i>	'grow stout'	<i>poxudet</i>	'get slimmer'
<i>popravit</i>	'shift rightward'	<i>počernet</i>	'turn black'

4.2.1 Attraction: 37 SOUND & SPEECH verbs (2 SOUND: *posmejat'sja* 'laugh' and *pozvonit'sja* 'ring'; all others are SPEECH)

<i>poblagodarit'</i>	'thank'	<i>poprosit'</i>	'request'
<i>pobožit'sja</i>	'swear'	<i>poprosit'sja</i>	'ask for'
<i>povinit'sja</i>	'confess'	<i>poručit'sja</i>	'guarantee'
<i>povorožit'</i>	'tell fortunes'	<i>posetovat'</i>	'complain'
<i>pogutorit'</i>	'chat'	<i>posmejat'sja</i>	'laugh'
<i>požalit'sja</i>	'complain'	<i>posovetovat'sja</i>	'get advice'
<i>požalobit'sja</i>	'complain'	<i>posporit'</i>	'argue'
<i>požalovat'sja</i>	'complain'	<i>posulit'</i>	'promise'
<i>pozvat'</i>	'call'	<i>posulit'sja</i>	'promise'
<i>pozvonit'sja</i>	'ring'	<i>potoropit'</i>	'hurry'
<i>pozdorovat'sja</i>	'say hello'	<i>potrebovat'</i>	'require'
<i>pointeresovat'sja</i>	'be curious about'	<i>poxvalit'</i>	'praise'
<i>pokljast'sja</i>	'swear'	<i>poxvalit'sja</i>	'boast'
<i>polajat'sja</i>	'bark'	<i>poxvastat'</i>	'brag'
<i>pomolit'sja</i>	'pray'	<i>poxvastat'sja</i>	'brag'
<i>poobeščat'</i>	'promise'	<i>poxodatajstvovat'</i>	'intercede'
<i>poobeščat'sja</i>	'promise'	<i>pocapat'sja</i>	'bicker'
<i>popenjat'</i>	'blame'	<i>pošutit'</i>	'make a joke'
<i>poprivetstvovat'</i>	'welcome'		

4.2.2 Neutral: 11 IMPACT verbs

<i>pobrit'</i>	'shave'	<i>pokryt'</i>	'cover'
<i>pobrit'sja</i>	'shave'	<i>pokusat'</i>	'bite'
<i>podoit'</i>	'milk'	<i>počesat'sja</i>	'scratch oneself'
<i>podrat'sja</i>	'fight'	<i>poščekotat'</i>	'tickle'
<i>pokolotit'</i>	'wallop'	<i>poščupat'</i>	'touch, feel'
<i>pokorobit'</i>	'warp'		

4.2.3 Repulsion: 11 BEHAV verbs

<i>podelikatničat'</i>	'be soft on smby.'	<i>poslušat'sja</i>	'obey'
<i>požadničat'</i>	'act greedy'	<i>postesnjat'sja</i>	'be shy'
<i>pokuražit'sja</i>	'swagger'	<i>potešit'sja</i>	'amuse'
<i>polenit'sja</i>	'act lazy'	<i>poxlopotat'</i>	'hustle about'
<i>poostorožničat'</i>	'be over-cautious'	<i>poceremonit'sja</i>	'stand on ceremony'
<i>poskupit'sja</i>	'scrimp'		

4.3 The semantic profile of *za-*

4.3.1 Attraction: 47 IMPACT verbs

<i>zaasfal'tirovat'</i>	'cover with asphalt'	<i>zamaskirovat'sja</i>	'mask'
<i>zaballastirovat'</i>	'load with ballast'	<i>zamesit'</i>	'knead'
<i>zabarrikadirovat'</i>	'barricade'	<i>zaminirovat'</i>	'mine'
<i>zabarrikadirovat'sja</i>	'barricade oneself'	<i>zamordovat'</i>	'victimize'
<i>zabetonirovat'</i>	'concrete'	<i>zamusolit'</i>	'slobber all over'
<i>zabintovat'</i>	'bandage'	<i>zamyzgat'</i>	'make filthy'
<i>zabodat'</i>	'gore'	<i>zaplatat'</i>	'patch'
<i>zabronirovat'</i>	'reserve'	<i>zaprudit'</i>	'dam up'
<i>zabutit'</i>	'fill with rubble'	<i>zapjatnat'</i>	'soil'
<i>zavualirovat'</i>	'veil'	<i>zasilosovat'</i>	'store in a silo'
<i>zagatit'</i>	'make a brushwood road'	<i>zaskirdovat'</i>	'mow up'
<i>zagipsovat'</i>	'cover with gypsum'	<i>zasuslit'</i>	'slobber all over'
<i>zagudronirovat'</i>	'cover road with tar'	<i>zasusolit'</i>	'slobber all over, suck'
<i>zadekorirovat'</i>	'decorate'	<i>zatavrit'</i>	'brand'
<i>zadrapirovat'</i>	'drape'	<i>zatorcevat'</i>	'trim'
<i>zadrapirovat'sja</i>	'drape'	<i>zatuševat'</i>	'shade'
<i>zazubrit'sja</i>	'get notched'	<i>zatjukovat'</i>	'pack in bales'
<i>zakamuflirovat'</i>	'camouflage'	<i>zaxloroformirovat'</i>	'chloroform'
<i>zakonservirovat'</i>	'preserve'	<i>zašnurovat'sja</i>	'lace up'
<i>zakrepiť</i>	'fasten'	<i>zašpaklevat'</i>	'putty'
<i>zakristallizovat'</i>	'crystallize'	<i>zašpuntovat'</i>	'groove'
<i>zalatat'</i>	'patch'	<i>zaštopat'</i>	'darn'
<i>zamarkirovat'</i>	'mark'	<i>zaštukovat'</i>	'mend'
<i>zamaskirovat'</i>	'mask'		

4.3.1 Attraction: 22 CHANGEST verbs

<i>zavšivet'</i>	'become lousy'	<i>zamusolit'sja</i>	'get covered with slobber'
<i>zagrjaznit'</i>	'make dirty'	<i>zaplesnevet'</i>	'become moldy'
<i>zagrjaznit'sja</i>	'get dirty'	<i>zapylit'sja</i>	'get covered with dust'
<i>zagustet'</i>	'thicken'	<i>zarubcevat'sja</i>	'get covered with a scar'
<i>zaindevet'</i>	'get covered with frost'	<i>zastudenet'</i>	'become jellied'
<i>zakonspirirovat'</i>	'make secret'	<i>zatverdet'</i>	'harden'
<i>zacosnet'</i>	'stagnate'	<i>zatravenet'</i>	'get covered with grass'
<i>zalubenet'</i>	'harden'	<i>zaxilet'</i>	'become sickly'
<i>zamarinovat'</i>	'marinate'	<i>zaxiret'</i>	'fall into decay'
<i>zamerznut'</i>	'freeze'	<i>začaxnut'</i>	'wither'
<i>zamuslit'sja</i>	'get covered with slobber'	<i>zašeršavet'</i>	'become rough'

4.3.2 Repulsions: 1 SPEECH verb (*zаконтрактovat'* 'make a contract'), 1 BEHAV verb (*zadurit'* 'become unreasonable')

4.4 The semantic profile of s-

4.4.1 Attraction: 23 BEHAV verbs

<i>svelikodušničit'</i>	'do something generous'	<i>smošenničit'</i>	'cheat'
<i>sglupit'</i>	'do something stupid'	<i>smuxlevat'</i>	'swindle'
<i>sdvurušničit'</i>	'be a double-dealer'	<i>snaxal'ničit'</i>	'be impudent'
<i>s"exidničit'</i>	'speak maliciously'	<i>sobez'janničit'</i>	'ape'
<i>sžulit'</i>	'cheat'	<i>sozorničit'</i>	'play tricks'
<i>sžul'ničit'</i>	'cheat'	<i>soriginal'ničit'</i>	'do something original'
<i>slevačit'</i>	'work on the side'	<i>spodličat'</i>	'act meanly'
<i>sliberal'ničit'</i>	'play the liberal'	<i>sprovocirovat'</i>	'provoke'
<i>slovčit'</i>	'dodge'	<i>sxalturit'</i>	'do something carelessly'
<i>slukavit'</i>	'be cunning'	<i>sximičit'</i>	'contrive'
<i>smalodušestvovat'</i>	'act like a coward (once)'	<i>sxitrit'</i>	'do something clever'
<i>smalodušničit'</i>	'act like a coward (once)'		

4.4.2 Neutral: 11 CHANGEST verbs

<i>svarit'sja</i>	'get cooked'	<i>smjagčit'</i>	'make softer'
<i>sgniť</i>	'rot'	<i>sostarit'</i>	'age'
<i>sgnoit'</i>	'let rot'	<i>sostarit'sja</i>	'age'
<i>sžat'sja</i>	'shrink'	<i>stvorozit'</i>	'curdle'
<i>skondensirovat'</i>	'condense'	<i>stvorozit'sja</i>	'curdle'
<i>skosobočit sja</i>	'get lopsided'		

4.4.2 Neutral: 9 SPEECH verbs

<i>sagitirovat'</i>	'campaign for'	<i>srifmovat'</i>	'make a rhyme'
<i>skalamburit'</i>	'make a pun'	<i>storgovat'sja</i>	'strike a bargain'
<i>skomandovat'</i>	'command'	<i>sformulirovat'</i>	'formulate'
<i>sorientirovat'</i>	'orient'	<i>s"jazvit'</i>	'say sth sarcastic'
<i>sostrit'</i>	'make a witty remark'		

4.4.2 Neutral: 23 IMPACT verbs

<i>sbrošjurovat'</i>	'stitch up'	<i>smontirovat'</i>	'mount'
<i>svarganit'</i>	'knock off'	<i>sostrjapat'</i>	'cook'
<i>svarit'</i>	'cook'	<i>srabotat'</i>	'work out'
<i>svit'</i>	'twist; weave'	<i>sravnjat'</i>	'even out'
<i>svjazat'</i>	'tie, knit'	<i>srubit'</i>	'chop down'
<i>sdelat'</i>	'make, do'	<i>ssučit'</i>	'twist'
<i>sžat'</i>	'reap'	<i>strenožit'</i>	'hobble'
<i>sžēč'</i>	'burn down'	<i>sfabrikovat'</i>	'fabricate'
<i>skomkat'</i>	'crumple'	<i>sfal'cevat'</i>	'fold'
<i>skopnit'</i>	'stook'	<i>sfugovat'</i>	'joint'
<i>skulemat'</i>	'crumple'	<i>sšit'</i>	'sew'
<i>smasterit'</i>	'craft, build'		

4.5 The semantic profile of *na-*

4.5.1 Attractions: 31 IMPACT verbs

<i>nabelit'sja</i>	'whiten'	<i>naoxrit'</i>	'apply ochre'
<i>nabronzirovat'</i>	'bronze'	<i>napičkat'</i>	'force-feed'
<i>navaksit'</i>	'polish (shoe)'	<i>naploit'</i>	'quill'
<i>navorsit'</i>	'tease (fibers)'	<i>napomadit'</i>	'pomade'
<i>navorsovat'</i>	'tease (fibers)'	<i>napomadit'sja</i>	'pomade oneself'
<i>navoščit'</i>	'wax'	<i>napryskat'</i>	'sprinkle'
<i>naglancevat'</i>	'glaze'	<i>nasandalit'</i>	'apply sandalwood'
<i>nagofrirovat'</i>	'crimp'	<i>nasur'mit'</i>	'cover with surma'
<i>nananifolit'</i>	'apply rosin'	<i>nasur'mit'sja</i>	'paint oneself with dye'
<i>nakostyljat'</i>	'give a good drubbing'	<i>nafabrit'</i>	'stain (mustaches)'
<i>nakraxmalit'</i>	'starch'	<i>nafabrit'sja</i>	'stain (mustaches)'
<i>namalevat'sja</i>	'paint (one's face)'	<i>naxoxlit'</i>	'ruffle up'
<i>namelit'</i>	'chalk'	<i>našinkovat'</i>	'shred'
<i>namylit'</i>	'soap'	<i>našpigovat'</i>	'apply lard'
<i>namylit'sja</i>	'soap (oneself)'	<i>namozolit'</i>	'work until one has callouses'
<i>naodekolonit'</i>	'sprinkle with cologne'		

4.5.1 Attractions: 17 BEHAV verbs

<i>nabedokurit'</i>	'get into mischief'	<i>nakurolesit'</i>	'play tricks'
<i>nabezobrazničat'</i>	'behave disgracefully'	<i>naplevat'</i>	'spit'
<i>nabuzit'</i>	'make a row'	<i>naprokazit'</i>	'play pranks'
<i>nagrubijanit'</i>	'be rude'	<i>naprokazničat'</i>	'play pranks'
<i>nadeboširit'</i>	'kick up a row'	<i>napyžit'sja</i>	'puff up'
<i>naerundit'</i>	'play the fool'	<i>nasvinjačit'</i>	'make a dirty act'
<i>nakaveržit'</i>	'make tricks'	<i>naxuliganit'</i>	'behave like a hooligan'
<i>nakaverzničat'</i>	'make tricks'		

4.5.2 Neutral: 8 SPEECH verbs

<i>nagrubit'</i>	'be rude'	<i>naproročit'</i>	'prophesize'
<i>naderžit'</i>	'be fresh with smb.'	<i>naspletničat'</i>	'gossip'
<i>naklevetat'</i>	'gossip'	<i>naxamit'</i>	'be rude'
<i>nakljaužničat'</i>	'libel'	<i>najabedničat'</i>	'snitch'

4.5.3 Repulsion: 3 CHANGEST verbs

<i>nadymit'</i>	'fill with smoke'	<i>naèlektrizovat'</i>	'electrify'
<i>naxolodit'</i>	'cool'		