WELCOME TO THE CLUB: DESIGNING THE INVENTORY OF SEMANTIC ROLES FOR ADJECTIVES[1]

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The argument constructions of adjectives has largely been out of the scope of research on semantic roles both in theoretical and IT fields. Before adding the roles of adjectival arguments to the network of semantic roles it is important to determine whether the adjectival roles form a separate list or whether they can be seen as an extension of roles assigned to the patterns of verbs and nominalizations. We discuss the general principles of how the inventory of adjectival roles should be organized in comparison with the existing inventories of verbal roles. In order to verify our statements, we carry out an experimental survey aimed at measuring the similarity between adjectival and verbal roles. The results have shown that both semantic interpretation of roles and their typical morpho-syntactic expression are significant for the evaluation and should be taken into account in working out the inventory. Besides, the specificity of adjectives lies in their prototypical stative semantics, which favors some differences in assigning a semantic role as compared to verbs. The results of the survey also provide some evidence for verification and development the inventory of verbal semantic roles.

Keywords: semantic roles, semantic similarity, predicate-argument constructions, adjectives, verbs, Russian language, experimental linguistics, inter-rater agreement

О МЕСТЕ СЕМАНТИЧЕСКИХ РОЛЕЙ ИМЕН ПРИЛАГАТЕЛЬНЫХ В ГРАФЕ РОЛЕЙ

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Предикатно-аргументные конструкции имен прилагательных, в отличие от глагольных конструкций, чаще всего остаются вне зоны внимания как теоретиков, так и специалистов IT-отрасли. Ставя вопрос о включении семантических ролей прилагательных в общую сеть семантических ролей, прежде всего, важно определиться, образуют ли они отдельную систему или их можно рассматривать как расширение инвентаря ролей глаголов и номинализаций. Для проверки наших предположений о принципиальном устройстве системы адъективных ролей мы провели опрос экспертов, в котором просили оценить сходство между ролями прилагательных и глаголов. Результаты показали, что и семантическая интерпретация ролей, и их морфо-синтаксическое оформление оказывают влияние на оценку, а следовательно, должны быть приняты во внимание при разработке инвентаря. Кроме того, прототипически имена прилагательные имеют стативную семантику, и это находит отражение в том, насколько близкими воспринимаются роли участников при прилагательном и глаголе. Результаты опроса дают также новые данные для проверки и уточнения инвентаря семантических ролей самих глаголов.

Ключевые слова: семантические роли, семантическая близость, предикатно-аргументные конструкции, модель управления, имя прилагательное, глагол, русский язык, экспериментальное исследование, согласие асессоров

1. A new species or an extension to the known network?

The classification of semantic roles is an important issue in both theoretical and computational tasks. The theoretical notion of a semantic role contributes to the study of the semantic-syntax interface, for example, in explaining which semantic differences between the arguments interfere with the differences in their morpho-syntactic marking. In computational linguistics, this concept lies at the foundation of semantic role labeling (Màrquez et al. 2008, Palmer et al. 2013, Kuznetsov 2015) and other fields which involve natural language understanding. The problem is, however, that

manually created lists of semantic roles (see e.g. Fillmore 1968; Berkeley FrameNet, Dowty 1991, Apresjan 1995: 125–126; Apresjan et al. 2010: 370–377, Paducheva 2004: 587–588) are sometimes fundamentally different. They vary greatly in number and in the ways particular roles can be interpreted, cf. for example the narrow inventory suggested in [Fillmore 1968] and the potentially unlimited inventory of Berkeley FrameNet including such roles as Agriculturist, Colonists, Electricity etc.

The issue of how the inventory of semantic roles should be designed has been posed primarily for verbal arguments (including nominalized patterns). As regards the arguments of concrete nouns (e.g. *dyra v polu* 'hole in the floor', *kofe s molokom* 'coffee with milk') and adjectives (e.g. *dal'ekij ot Moskvy* 'distant from Moscow', *izvesten svoimi publikacijami* 'famous for their publications', *nepravil'nyj nomer* 'wrong number'), their classification is hardly elaborated (cf. a few noteworthy remarks in Bulygina, Shmelev 1997: 58–73; Vol'f 1978; Apresjan 2004). To say more, the very idea of adjectives evoking the semantic predicate-argument relations is not generally acknowledged in the computational linguistics community. For example, the Russian semantic analyzer ABBYY Compreno [Anisimovich et al. 2012] considers a noun as a predicate and an adjective as an argument (with the semantic role Property) in attributive constructions, and not vice versa, mostly overlooking the predicative uses of adjectives. PropBank/Ontonotes 5 [Palmer et al. 2005] covers only a limited number of adjectival argument patterns under the following rationale: "Crosslinguistically, it is common for there to be overlap between what is expressed as a verb and what is expressed as an adjective. <…> Because PropBank is in part a resource for machine translation and several parallel PropBanks exist in different languages, it is important to annotate predicate adjectives in English" [Bonial et al. 2015: 59].

The problem arises that the building the inventory of semantic roles for Russian adjectives is a long way behind the current research on Russian adjectives, cf. [Arkhangelskiy et al. 2010; Kustova 2007, 2009; Rakhilina et al. 2010, among others]. There are no full inventories of semantic roles for adjectives which could be accepted as a gold standard or at least as a starting point. Neither can we rely on any SRL system developed for Russian (since they are still at an early stage, cf. Kuznetsov 2015, Shelmanov, Smirnov 2014) or any other language and obtain objective evaluation metrics for different inventories of semantic roles. Since there is no established tradition of labeling the semantic roles of adjectival arguments, it is important to form the opinion of the community taking into account possible divergences. Rather than building a theory from scratch, we propose a bottom-up experimental approach based on experts' judgement.

In this paper, we probe the hypothesis that the roles in adjectival patterns are (at least to some extent) congruent to the roles of verbal arguments. We suggest that empirical evidence gathered in an experiment while collecting experts' judgements will reveal certain implicit knowledge and assumptions on how the pattens are structured and what priorities the researchers have regarding links between them. In Section 2, we present the design of the experiment and the principles for selecting the verbal roles stimuli. Section 3 outlines the results of the experiment: we discuss here what factors have proved to be relevant for creating the inventory of roles for adjectives. In Section 4, we analyze some evidence provided by our survey which could be helpful for improving the inventory of verbal roles. Section 5 concludes.

2. Questionnaire and data

2.1. Design of the experiment

20 adult native Russian speakers (mean age 34, sd=16) participated in the study. All respondents were either students of linguistics or professional linguists (lecturers, researchers, developers of computational linguistic systems), which presupposed that they were acquainted with at least one of the existing inventories of verb roles. The questionnaire was anonymous (only the sociolinguistic data on occupation and age were collected) even though the participants could optionally provide their name and email address if they were interested in feedback regarding the results of the survey. The survey was administered as an online questionnaire with no time limits. The expected time for its completion was 20–30 minutes.

The experiment was designed as a score-assignment test. The participants were asked to rate the similarity between the target pair ADJECTIVE—ITS ARGUMENT and the control pair VERB—ITS ARGUMENT according to a scale of 1 to 7, see Fig. 1. The stimuli included 16 target sentences which illustrated the use of seven adjectives (*gotovyj* 'ready', *svobodnyj* 'free (from)', *sil'nyj* 'strong, impressive, *blizkij* 'close', *ščedryj* 'generous', *izvestnyj* 'famous for, known by', *vinovatyj* 'guilty') in different meanings and in different morphosyntactic patterns (e.g. with different dependent prepositional phrases, see the examples in Sections 3 and 4). The difference between attributive and predicative uses was not specially investigated in this study, the examples included both types of syntactic patterns (10 predicative constructions among the 16 target entries and 6 attributive constructions).

Some adjectives in our smaple have cognate verbs (e.g. *gotovyj—gotovit', blizkij—priblizit'* , *vinovatyj—obvinit')*. In some cases we might think of simply transferring verbal arguments and their roles to adjectival constructions. However, this decision is not applicable in the general case due to the possible asymmetry between verbal and adjectival valency patterns, cf. *Ja **gotov** pomoč' tebe* 'I am ready to help you' vs. **On **gotovit** men'a pomoč' tebe*, expected meaning 'He is making me ready to help you'; *Ja **vinovat** pered Vami* 'I am guilty towards you' vs. **On **obvinil** men'a pered Vami*, lit. 'He accused me towards you'.

Each target sentence was followed by 3–4 control pairs VERB—ITS ARGUMENT also shown in a sentence. The pairs had been selected in such a way that they would range from very similar to hardly similar to the target adjectival pair (according to preliminary judgements of the authors and taking into account both their frame semantics and morphosyntax). It was possible for the participants (but not obligatory) to suggest their own version of the pair VERB—ITS ARGUMENT most close to the target stimulus (a free answer field in the questionnaire). However, we have not received free answers indicating that any variants which could possibly gain a high score were missing.

Each participant went through all 58 questions. The order of adjectives and questions was randomized in four sets of stimuli. A sample questionnaire is available at https://goo.gl/xy8ST0.

IV. Близкий

IV-b. Автор статьи высказывает близкие НАМ идеи.

ИВАН ПЕТРОВИЧ болеет уже несколько недель. *

1	2	3	4	5	6	7
◉	○	○	○	○	○	○

ТЕТКА думает, что ему придется уехать. *

1	2	3	4	5	6	7
◉	○	○	○	○	○	○

ПРОДАВЕЦ режет сыр на тонкие куски. *

1	2	3	4	5	6	7
◉	○	○	○	○	○	○

Лиза открыла СВЕТЕ дверь. *

1	2	3	4	5	6	7
◉	○	○	○	○	○	○

Fig. 1. A block of questions. The adjective *blizkij* 'close' in the target context *Avtor stat'ji vyskazyvaet <u>blizkie</u> NAM idei* 'The author of the article puts forward ideas <u>close</u> TO US' and four contexts to be evaluated: *IVAN PETROVIČ <u>boleet</u> uzhe neskol'ko nedel'* 'IVAN PETROVICH has been <u>sick</u> for a few weeks', *TETKA <u>dumaet</u>, čto emu pridets'a ujehat'* 'His AUNT <u>thinks</u> that he will have to leave', *PRODAVETS <u>režet</u> syr na tonkie kuski* 'The SELLER slices the cheese into thin slices', and *Liza <u>otkryla</u> SVETE dver'* 'Liza <u>opened</u> the door FOR SVETA'.

2.2. The inventory of verbal roles

Our research relies on Russian FrameBank (http://www.framebank.ru). This is an open access database which includes a dictionary of Russian lexical constructions and a corpus of their uses tagged with a FrameNet-like annotation scheme (see [Lyashevskaya 2010; Lyashevskaya, Kashkin 2015a, b] for details). At present the dictionary provides data for ca. 4,000 target verbs, adjectives, and nouns, and the corpus part includes ca. 50,000 annotated examples. Constructions of each verb in the dictionary differ, first, in the morpho-syntactic pattern, and, second, in the meaning of a verb.

FrameBank includes the elaborated inventory of verbal roles, which we can rely on in our study. Bearing in mind the major differences between different role inventories and some vagueness of the task to create a role inventory good for all purposes, we aim to develop the inventory for adjectives within the existing annotation scheme of FrameBank. The inventory of semantic roles used in FrameBank contains 91 roles and is based on the following principles (for a more detailed discussion see [Kashkin, Lyashevskaya 2013], [Lyashevskaya, Kashkin 2015b]):

- The roles correlate with the semantic classification of the lexicon. Traditionally "broad" roles such as Agent or Patient should get different labels in different semantic classes, cf. Agent in destruction vs. speech vs. motion
- The roles of semantically close lexemes should systematically coincide or systematically differ.
- The full inventory of roles should cover all the lexical domains.
- The inventory is organized hierarchically in order to provide flexible search options (see the role network at http://marker.framebank.ru/GraphSemRoles.pdf).
- The scope of a semantic role follows the principle of a prototype and its periphery. For instance, the prototype of Patient is a participant changing under the physical influence of an Agent; peripheral examples (Patient of a non-physical process, Patient which is not changing, Patient created as a result of a physical action) get specific labels (Theme, Result, etc.) and are considered as specific types of Patient.

However, the database of FrameBank includes primarily verbs, whereas an adequate sample of adjectives is still to be added there. The inventory of semantic roles for adjectives has not been fully developed either. In order to get some verifiable evidence on how this inventory should be organized, we have carried out a survey using some data on verbal roles implemented into the dictionary of FrameBank.

3. Analysis

3.1. From roles of verbal arguments to roles of adjectival arguments

Figure 2 summarizes the results of the survey. Each bar represents the mean score of each question, the vertical line above and below the bar being the standard deviation of individual scores. For each adjectival role, the results are ordered from the best matching verbal role to the poorest matching one. The multi-rater agreement was, predictably, not very high (exact Conger's kappa = 0.0579, light kappa = 0.0604[1][2]) since the scores were subjective and based on different theoretical assumptions on how semantic roles are classified: some of the respondents draw subtle semantic distinctions typical of fine-grained role inventories, whereas others may combine rather heterogenous entities within one class.

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[2] The scores are obtained using the function KappaM in DeskTools package of R.
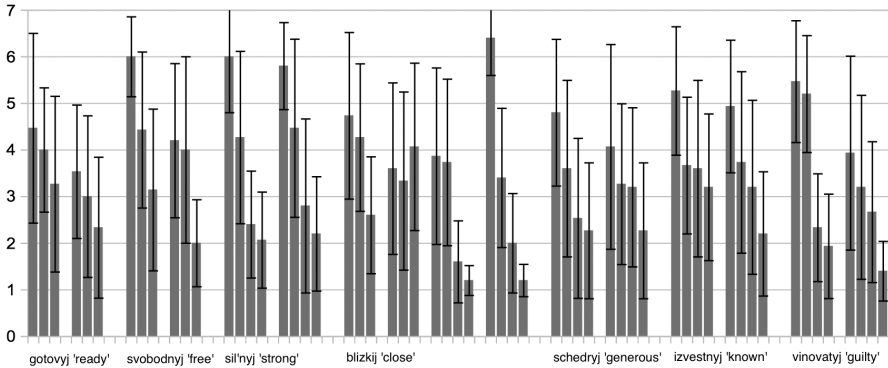
Fig. 2. Rater scores for the questionnaire

On the whole, the results suggest that the roles of adjectival arguments (at least provided in our data sample) can be adequately tagged using the inventory of roles describing verbal arguments. 6 of the 16 experimental blocks contain an example which has received a high average mark from 5 to 7 showing the similarity between the roles of the target verbal argument and of the target adjective. These examples are listed below (the role of the verbal argument in FrameBank and the average mark are given in brackets after an example):

(1) *Natal'ja Jur'jevna byla očen' <u>blizka</u> **s otcom*** 'Natalya Jurievna was very close to her father'—*Kol'a <u>družit</u> **s Natašej*** 'Kolya is friends with Natasha' (Counter-Agent of social relation; 6.4)

(2) *Avar'ijnye vyhody i prohody dolžny byt' <u>svobodny</u> **ot ručnoj kladi*** 'Emergency exits and passages must be free of hand luggage'—*My <u>očistili</u> čerdak **ot hlama*** 'We cleared the attic of junk' (Patient; 6).

(3) *Pet'a <u>sil'en</u> **v matematike*** 'Petya is good (lit.: strong) at mathematics'—*On vseh <u>obošel</u> **v učebe*** 'He left everyone behind in his studies' (Sphere; 6).

(4) *Zhdanov <u>sil'en</u> **ritorikoj*** 'Zhdanov is impressive (lit.: strong) in his rhetoric'—*Sredi sverstnikov on <u>vydel'als'a</u> **svoej l'uboznat'el'nost'ju*** 'He was notable among his peers for his curiosity' (Quality; 5.8).

(5) *Ja <u>vinovat</u> **pered vami*** 'I am to blame for doing something wrong to you (lit.: guilty towards you)'—*On ne stanet <u>unižat's'a</u> **pered načal'nikom*** 'He will not humiliate himself in front of his boss' (Counter-Agent of social relation; 5.5), *On <u>izvinils'a</u> **pered passažirami*** 'He apologized to the passengers' (addressee; 5.2).

(6) *Etot žurnalist <u>izvesten</u> **svoimi razoblačitel'nymi publikacijami*** 'This journalist is famous for his unmasking publications'—*Pavel <u>porazil</u> vseh **dlinnymi volosami*** 'Pavel amazed everyone with his long hair' (Property of the Reason for emotional state; 5.2)

Among the other 10 blocks, 7 blocks include at least one argument with the average score from 4 to 5, for instance:

(7) *Samymi <u>ščedrymi</u> **na novogodnie podarki** v etom godu stanut rukovoditeli rossijskih kompanij i gosslužaščie* 'This year the most generous in giving New Year's presents will be the managers of Russian companies and civil servants'—*Deduška <u>dal</u> rebenku **konfetu*** 'Grandfather gave a sweet to a child' (Patient; 4.8).

(8) *Ja <u>gotov</u> **pomoč tebe*** 'I am ready to help you'—*My <u>hotim</u> **popast' na vystavku*** 'We want to get to the exhibition' (Content of thought; 4.5), *I vot nastupil den', kogda ranenyj <u>smog</u> **vstat'*** 'Finally the day came when the wounded man was able to stand up' (Content of action; 4).

A factor that might have influenced some answers of the respondents is whether an adjective is used in an attributive construction or in a predicative one: the latter may be expected to be more "verbal". As can be seen from the examples above, there are many predicative uses with high evaluation. However, some attributive constructions have also gained high scores, e.g. (7). Furthermore, we have received plenty of low scores for the predicative constructions, i. e. this type of syntactic construction is not necessarily evaluated as semantically similar to a random verbal construction, and the survey shows substantial differences in comparing one and the same predicative use of an adjective with verbal constructions varying in their role pattern. This is what we have actually expected to test, and in this sense the opposition between attributive and predicative uses does not interfere with our conclusions. A further interesting point could lie in comparing evaluations for attributive and predicative uses of one and the same adjective, but this task has so far remained beyond the scope of our research.

Our survey has therefore provided a representative subset of the role inventory for adjectives. These roles come from the verbal role inventory. Their list can be found in Table 1. The roles are provided with examples of adjectives taken from the experimental data. The morphosyntactic constructions are labelled according to the general annotation scheme of Russian FrameBank (where Sx means 'substantive in the case x').

In total, Table 1 includes 14 roles with the overall rating 4 or higher. Surely, this list is not exhaustive, as we have not aimed at creating its final version, and the experimental data does not cover all possible adjectival constructions. Rather, we put forward the hypothesis that verbal roles can be transferred to adjectival constructions and confirmed it by our experiment. The inventory from Table 1 can be enlarged following the principles which result from our survey and which will be discussed in the next sections.

Table 1. Inventory of semantic roles for adjectives:
a preliminary list for the study

Semantic role	Adjective and morpho-syntactic pattern
Counter-Agent of social relation	*blizkij s + S$_{ins}$* 'close to smb (e.g., a friend)', *vinovatyj pered + S$_{ins}$* 'guilty towards smb'
Patient	*svobodnyj ot + S$_{gen}$* 'free from sth', *schedryj na + S$_{acc}$* 'generous in sth (e.g., gifts)'
Content of thought	*gotovyj V$_{inf}$* 'ready to do sth.'
Content of action	*gotovyj V$_{inf}$* 'ready to do sth.' (a competing role in the results of the survey)
Content of utterance	*schedryj na + S$_{acc}$* 'lavish with sth (speech etc.)'
Addressee	*vinovatyj pered + S$_{ins}$* 'guilty towards smb' (a competing role in the results of the survey)
Beneficiary	*svobodnyj dl'a + S$_{gen}$* 'free for smb/sth'
Location	*blizkij k + S$_{dat}$ / ot + S$_{dat}$* 'close to sth.'
Point of destination	*blizkij k + S$_{dat}$* 'close to sth.' (a competing role in the results of the survey)
Sphere	*sil'nyj v + S$_{loc}$* 'strong in sth.'
Social environment	*izvestnyj v + S$_{loc}$* 'famous among smb'
Goal	*svobodnyj dl'a + S$_{gen}$* 'free for smb/sth' (a competing role in the results of the survey)
Feature	*sil'nyj S$_{ins}$* 'strong with sth.'
Property of Reason for mental state	*izvestnyj S$_{ins}$* 'famous with sth.'

3.2. Roles of adjectival arguments: semantics vs. morpho-syntax

Let us now go on to the possible principles for assigning roles to adjectival arguments. As can be seen from Section 3.1, adjectival arguments with high average scores often take the same morpho-syntactic marking as the corresponding verbal arguments. However, this is not always the case, cf. example (7) where a Given thing is involved into different constructions with the verb *dat'* 'to give' and the adjective *ščedryj* 'generous'. On the whole, the factors of semantics and morpho-syntax interact in assigning semantic roles to adjectival arguments in our data[3]. There are two important trends which follow from our survey.

First, the choice of a semantic role is deeply influenced by the semantic classes of the target verb / adjective and of their target arguments. Verbal constructions with

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[3] The coarse binary classification "same VS different" of similarity in meaning and morpho-syntax applied to the data shows a significant difference in the scores obtained in four groups (Chisq. p-value = 0.0009, df = 1).

the same morpho-syntactic marking get the higher score, the closer they are semantically to the adjectival construction from a given experimental block. This supports the idea that the classification of semantic roles should correlate with the semantic classification of verbs suggested in [Kashkin, Lyashevskaya 2013; Lyashevskaya, Kashkin 2015b] and implemented in the dictionary of FrameBank. Thus, the closest verbal construction for the adjectival example *Pet'a sil'en v matematike* 'Petya is good (lit.: strong) at mathematics' is represented in the sentence *On vseh obošel v učebe* 'He left everyone behind in his studies' (Sphere; 6), while the same morpho-syntactic construction from *Ja živu v Moskve* 'I live in Moscow' (Place; 2.4) receives a significantly less average score (2.4 vs. 6). Similarly, the example *Etot žurnalist izvesten svoimi razoblačitel'nymi publikacijami* 'This journalist is famous for his unmasking publications' has been primarily related to *Pavel porazil vseh dlinnymi volosami* 'Pavel amazed everyone with his long hair' (Property of the Reason for emotional state; 5.2), whereas the instrumental construction from *Ivan razbil okno palkoj* 'Ivan broke the window with a stick' gets the much less average score of 3.2 due to the semantic difference between the verbs of mental state and of physical impact.

Second, if an experimental block includes several verbal constructions which can be treated as adequate semantic correspondences to the target entry, the respondents tend to choose the closer morpho-syntactic pattern. For instance, the argument of the adjective *svobodnyj* 'free' in *Avar'ijnye vyhody i prohody dolžny byt' svobodny ot ručnoj kladi* 'Emergency exits and passages must be free of hand luggage' receives the same role as the prepositional phrase in *My očistili čerdak ot hlama* 'We cleared the attic of junk' (Patient; 6), while the direct object in *My ubrali al'bomy s polok* 'We removed the albums from the shelves' gets a nearly half the average score (3.1) due to its different syntactic status. The adjective *izvestnyj* 'known, famous' in the sentence *Policija zaderžala narkotorgovca, izvestnogo v opredelennykh krugakh pod kličkoj "Korotyška"* 'The police arrested a drug pushed known as "Shorty" in criminal circles' has an argument which is more probably related to the argument expressing Social circle in *Soobščenie posejalo paniku v r'adah vraga* 'The message spread panic among the ranks of the enemy' (4.9) than to the Subject of mental state in *Ivan znaet, čem končilos' delo* 'Ivan knows how the things have finished' (3.2). While the semantics of the highlighted arguments in both verbal constructions is adequate for the target adjective, the most preferable is the example with the same syntactic rank of the argument.

An interesting example of how morpho-syntax and lexical semantics interact in assigning a semantic role is provided by the example *Avtor stat'ji vyskazyvaet blizkie nam idei* 'The author of the article puts forward ideas close to us'. There are two verbal constructions with nearly the same similarity rank here: *Tetka dumaet, čto emu pridets'a ujehat'* 'His aunt thinks that he will have to leave' (Subject of mental state, 3.7) and *Liza otkryla Svete dver'* 'Liza opened the door for Sveta' (Benefactive, 3.9). The experiencer-like role of Subject of mental state might seem a more precise semantic label for the argument of *blizkij* 'close' in the sentence above, however its syntactic function is different, which might probably have reduced its average rank in our survey. On the contrary, the benefactive argument in 'open the door for X' takes the same syntactic marking and has been evaluated as a more exact correspondence to the argument of *blizkij* 'close', despite its semantic distance from the prototype of a beneficiary.

3.3. Semantics: stative vs. dynamic

One more semantic factor important in working out the inventory of roles for adjectives is static vs. dynamic character of a situation. While verbs show a great variety in their aspectual properties, adjectives prototypically refer to states. According to our study, sometimes this may provoke the difference between role patterns of verbs and adjectives. For example, the adjective *blizkij* 'close' in its literal spatial meaning can bear arguments marked either as Point of destination (9) or as Initial point (10)—the latter class of examples is probably not a prototype for this adjective, but it does occur in the Russian National Corpus and has therefore been included into our survey.

(9) *Ekspedicija obsledovala <u>blizkie</u> **k Saransku** sela* 'The expedition explored the villages close to Saransk'

(10) *V tu že subbotu, rannim večerom, uspel Aleksandrov sbegat' s kon'kami na nebol'šoj, no ujutnyj i <u>blizkij</u> **ot doma** katok Patriarših prudov* 'On the same Saturday, early in the evening, Aleksandrov had time to run with his skates to the small but cosy skating-rink of Patriarshie ponds, which was close to (lit.: from) his home'

The respondents had to evaluate these examples against verbal constructions with Point of destination (*podojti k domu* 'approach the house'), Initial point (*otojti ot dveri* 'move away from the door'), and Location (*hodit' u reki* 'go along the river'). The results are summarized in Table 2:

Table 2. Role assessment for the arguments of *blizkij + k* 'close to' and *blizkij + ot* 'lit. close from'

	Point of destination	Initial point	Location
blizkij k + S$_{dat}$ (Point of destination—like)	4.3	2.6	**4.7**
blizkij ot + S$_{dat}$ (Initial point—like)	3.6	3.3	**4.1**

Table 2 shows that the locative arguments of *blizkij* 'close' are more likely to get the role of location typical of statives like 'to be', 'to live', etc. The intrinsic stative nature of adjectives is therefore the most important factor here. However, the syntactic marking of the argument has also influenced the preferences of our respondents, cf. the values for Point of destination and Initial point. Note also that the results for *blizkij* does not match the argument structure of its verbal cognate *priblizit'* 'to bring nearer', as the latter cannot take a stative argument marked as Location and typical of existential or posture predicates.

4. On benefits for the structure of verbal roles

The results of our experiment highlight some points in how the inventory of verbal roles is organized. As has already been mentioned, the roles used in the Russian FrameBank are structured as a network. The graph was created manually based on semantic similarity between the roles (see the definitions in [Lyashevskaya, Kashkin 2015b: 505–525] and the references therein). The judgments obtained from our survey help to verify the decisions we have previously taken. We rely on the following principle here. If two examples with verbs both get a high average score of their semantic similarity to a given adjectival construction, the roles of target verbal arguments in these examples are also evaluated as semantically similar. If two examples with verbs get significantly different scores, the target roles are also assessed as considerably different. If both verbal examples get low scores, it means nothing for comparing the two verbal roles, since they can diverge from the target adjectival role in different ways.

A case study can be provided by the following experimental block:

(11) *Natal'ja Jur'jevna byla očen' blizka* **s otcom** 'Natalya Jurievna was very close to her father'

(12a) **On** *vospityvaet trjoh synovej* 'He brings up three sons' (Subject of social relation; 2)

(12b) *Kol'a družit* **s Natašej** 'Kolya is friends with Natasha' (Counter-Agent of social relation; 6.4)

(12c) *Mit'a podrals'a* **s Lešej** 'Mitya fought with Lyosha' (Counter-Agent; 3.4)

(12d) **Krest'janin** *rubit drova* 'The peasant is chopping firewood' (Agent; 1.2)

The graph suggested in [Kashkin, Lyashevskaya 2013] represents Counter-Agent and Subject of social relation as subtypes of Agent, whereas Counter-Agent of social relation is considered a subtype of both Counter-Agent and Subject of social relation. While the latter decision does not prove to be inadequate in our experimental data (Counter-Agent receives a not quite low score), Agent and Subject of social relation have got low scores, which present a challenge for further refinements of a role hierarchy.

5. Conclusions

The survey allowed us to formulate some principles which could govern assigning semantic roles to adjectival arguments. We have shown that adjectives and verbs can share the same role inventory, since quite a few verbal roles were evaluated as good candidates for adjectival constructions. The inventory of adjectival roles can be at least a subset of the inventory intended for verbs (however, we cannot infer from our survey

whether two role inventories are all the same, because the experimental data was still limited). based on the inventory of verbal roles. On the whole, the choice should be based on the semantic similarity between adjectival and verbal arguments. However, if there are several variants possible on semantic grounds, the following principles come into force:

- The priority should be given to a role which is expressed by a verbal argument of the same syntactic rank as the target adjectival argument.
- If there are several possible candidates belonging to either stative or dynamic verbs, the priority should be received by the roles of stative verbs, due to the prototypically stative nature of adjectives.

The experiment allowed us to produce the first draft of the role inventory for adjectival constructions. Including 14 items at present, it will obviously be enlarged at the next research steps following the principles discussed in this paper.

A further step of our project will consist of implementing this strategy into the dictionary of adjectival constructions in FrameBank, together with elaborating it for a bigger data set with more adjectives and more subtle semantic differences between them. Another interesting point could be in comparing valency patterns of attributive and predicative uses of adjectives based on FrameBank data. The assessment of the new role inventory in the existing SRL modules will also be helpful for both the dictionary tasks and for the development of automatic semantic analysis for Russian.

References

1. *Anisimovich K., Druzhkin K., Minlos F., Petrova M., Selegey V., Zuev K.* (2012). Syntactic and Semantic parser based on ABBYY Compreno linguistic technologies, in Proceedings of the International Conference "Dialogue", Vol. 11–2, pp. 91–103.
2. *Apresjan Ju. D.* (1995), Selected papers, Vol. 1, Lexical Semantics [Izbrannye trudy, tom I. Leksicheskaja semantika], Jazyki Russkoj Kul'tury, Vostochnaja Literatura, Moscow.
3. *Apresjan Ju. D.* (ed.) (2004), New Russian Explanatory Synonym Dictionary [Novyj ob"iasnitel'nyj slovar' sinonimov russkogo jazyka], Jazyki slavjanskoj kul'tury, Moscow.
4. *Apresjan Ju. D., Boguslavskij I. M., Iomdin L. L., Sannikov V. Z.* (2010), Theoretical issues of Russian syntax: the interrelation between grammar and vocabulary [Teoreticheskie problemy russkogo sintaksisa: vzaimodejstvie grammatiki i slovarja], Jazyki slavjanskih kul'tur, Moscow.
5. *Bonial C., Bonn J., Conger K., Hwang J., Palmer M., Reese N.* (2015). English PropBank Annotation Guidelines. Center for Computational Language and Education Research, Institute of Cognitive Science, University of Colorado at Boulder.
6. *Bulygina T. V., Shmelev A. D.* (1997), Language conceptualization of the world (based on Russian grammar) [Jazykovaja konceptualizacija mira (na materiale russkoj grammatiki)], Jazyki Russkoj Kul'tury, Moscow.

7. *Callison-Burch C., Fordyce C., Koehn Ph., Monz C., Schroeder J.* (2007), (Meta-) Evaluation of machine translation, in Proceedings of WMT, pp. 136–158.

8. *Dowty D. R.* (1991), Thematic proto roles and argument selection, Language, Vol. 67, pp. 547–619.

9. *Dras M.* (2015), Evaluating human pairwise preference judgements, Computational Linguistics, Vol. 41 (2), pp. 309–317.

10. *Faruqui M., Dyer C.* (2014), Community Evaluation and Exchange of Word Vectors at wordvectors.org, in Proceedings of System Demonstrations, ACL 2014, available at: http://www.cs.cmu.edu/~mfaruqui/papers/acl14-vecdemo.pdf

11. *Fillmore Ch. J.* (1968), The Case for Case, in Bach E. and Harms (Ed.), Universals in Linguistic Theory. New York, pp. 1–88.

12. *FrameNet*. An online resource, available at: http://framenet.icsi.berkeley.edu

13. *Karpova O. S., Reznikova T. I., Arkhangel'skij T. A., Kjuseva M. V., Rakhilina E. V., Ryzhova D. A., Tagabileva M. G.* (2010), A database of polysemous qualitative adjectives and adverbs in Russian [Baza dannyh po mnogoznachnym kachestvennym prilagatel'nym I narechijam russkogo jazyka], Computational Linguistics and Intellectual Technologies: Proceedings of the International Conference "Dialog" [Komp'juternaja lingvistika i intelleltual'nye tehnologii: po materialam ezhegodnoj Mezhdunarodnoj konferentsii "Dialog"], Moscow, pp. 163–168.

14. *Kashkin E. V., Lyashevskaya O. N.* (2013), Semantic roles and construction net in Russian FrameBank [Semanticheskie roli i set' konstrukcij v sisteme FrameBank], Computational linguistics and intellectual technologies. Proceedings of International Conference "Dialog", Vol. 12–1, pp. 297–311.

15. *Kustova G. I.* (2007), Russian adjectives: forms, constructions, semantics [Russkie prilagatel'nye: formy, konstruktsii, semantika], in Nauchnye trudy Moskovskogo pedagogicheskogo gosudarstvennogo universiteta. Filologicheskie nauki [Proceedings of Moscow pedadogical statue university. Philology], Prometej Publ., Moscow, pp. 85–97.

16. *Kustova G. I.* (2009), Elektronnyj semanticheskij slovar' glagol'nyh prilagatel'nyh: struktura i tipy informacii [Electronic semantic dictionary of deverbal adjectives: structure and types of information], Computational linguistics and intellectual technologies. Proceedings of International Conference "Dialog", Vol. 8, pp. 271–277.

17. *Kuznetsov I. O.* (2015), Semantic Role Labeling for Russian Language Based on Russian FrameBank, in M. Yu. Khachay, N. Konstantinova, A. Panchenko, D. I. Ignatov, V. G. Labunets (eds.), Analysis of Images, Social Networks and Texts. Fourth International Conference, AIST 2015, Yekaterinburg, Russia, April 9–11, 2015, Revised Selected Papers. Communications in Computer and Information Science, Vol. 542, Springer, pp. 333–338.

18. *Liu B.* (2012), Sentiment analysis and opinion mining, Synthesis lectures on human language technologies, Vol. 5(1), pp. 1–167.

19. *Lyashevskaya O.* (2010), Bank of Russian Constructions and Valencies, Proceedings of the Seventh conference on International Language Resources and Evaluation (LREC'10), Valletta, pp. 1802–1805.

20. *Lyashevskaya O. N., Kashkin E. V.* (2015a), FrameBank: a database of Russian lexical constructions, in M. Yu. Khachay, N. Konstantinova, A. Panchenko, D. I. Ignatov, V. G. Labunets (eds.), Analysis of Images, Social Networks and Texts. Fourth International Conference, AIST 2015, Yekaterinburg, Russia, April 9–11, 2015, Revised Selected Papers. Communications in Computer and Information Science, Vol. 542, Springer, pp. 350–360.

21. *Lyashevskaya O. N., Kashkin E. V.* (2015b), Types of information about lexical constructions in Russian FrameBank [Tipy informatsii o leksicheskih konstruktsijah v sisteme FrameBank], Trudy Instituta russkogo jazyka im. V. V. Vinogradova [Proceedings of the V. V. Vinogradov Russian Language Institute], Vol. 6, pp. 464–555.

22. *Màrquez L., Carreras X., Litkowski K. C., Stevenson S.* (2008), Semantic role labeling: an introduction to the special issue, Computational Linguistics, Vol. 34–2, pp. 145–159.

23. *Paducheva E. V.* (2004), Dynamic patterns in lexical semantics [Dinamicheskie modeli v semantike leksiki], Jazyki slavjanskoj kul'tury, Moscow.

24. *Palmer M., Gildea D., Kingsbury P.* (2005), The Proposition Bank: An annotated corpus of semantic roles, Computational Linguistics, Vol. 31–1, pp. 71–106. https://github.com/propbank/propbank-documentation/raw/master/annotation-guidelines/Propbank-Annotation-Guidelines.pdf

25. *Palmer M. S., Wu Sh., Titov I.* (2013), Semantic Role Labeling Tutorial. NAACL 2013 tutorials. Available at: http://naacl2013.naacl.org/Documents/semantic-role-labeling-part-1-naacl-2013-tutorial.pdf, http://naacl2013.naacl.org/Documents/semantic-role-labeling-part-2-naacl-2013-tutorial.pdf, http://naacl2013.naacl.org/Documents/semantic-role-labeling-part-3-naacl-2013-tutorial.pdf

26. *Rakhilina E. V., Reznikova T. I., Karpova O. S.* (2010), Semantic shifts in attributive constructions: metaphor, metonymy, and rebranding [Semanticheskie perehody v atribultivnyh konstrukcijah: metafora, metonimija i rebrending], in Linguistics of Constructions [Lingvistika konstrukcij], Azbukovnik, Moscow, pp. 398–455.

27. *Shelmanov A. O., Smirnov I. V.* (2014), Methods for semantic role labeling of Russian texts, Computational linguistics and intellectual technologies. Proceedings of International Conference "Dialog", Vol. 13, pp. 607–619.

28. *Vol'f E. M.* (1978), Grammar and Semantics of Adjectives. Based on Ibero-Roman Languages. [Grammatika i semantika prilagatel'nykh. Na materiale ibero-romanskikh jazykov], Nauka, Moscow.