https://doi.org/10.20378/irb-50630

Sandra Birzer and Daniela Mayer

Just Syntax? On the co-referential ambiguity of Adverbial Participles in Russian as Primary and Secondary Language

Keywords: adverbial participle, Russian, primary language, secondary language, ambiguity, co-reference, experiment

According to the norms of the contemporary Russian standard language, the covert first argument of the adverbial participle has to be co-referent with the first argument of its matrix verb. However, other co-reference choices are a frequent phenomenon, as numerous publications both descriptive (Rappaport 1984, Yokoyama 1984) and prescriptive (Ickovič 1982; Glovinskaja 2000) testify. Since the reasons for these divergent co-reference choices have been insufficiently addressed so far, we conducted an experiment that tested the influence of semantic and (morpho)syntactic factors on the co-reference choices made by speakers of Russian as a primary and secondary language.
The paper is structured as follows: The first section gives a survey of the divergent co-reference choices discussed in the literature and identifies linguistic factors that may influence a speaker's choice. Section 2 discusses possible sociolinguistic factors affecting the co-reference choice. How these factors are considered in the design of our experiment is described in section 3.In section 4 we apply logistic regression to our data and discuss its results, to be followed by the conclusions in section 5.

1. Linguistic factors influencing the co-reference choice for adverbial participles

According to the normative rules of Modern Russian, the covert subject of the adverbial participle (henceforth AP) has to be co-referent with the first argument of the matrix verb (1).

(1) *Razgovarivaja*$_j$, *on*$_j$ *nervno priglažival volosy*.
talk-AP he nervously smooth-PST.3SG hair-ACC.PL
'While talking, he nervously smoothed his hair.'
(RNC. S. Dovlatov. 1986. *Čemodan*.)

Yet ever since the adverbial participle came into existence, "deviant" co-reference choices have been attested (cf. among others Ickovič 1982, 130). On the one hand, this has led to an intensive discussion of the AP in literature concerned with normativization (Ickovič 1982, 129-153; Glovinskaja 2000, 276-289, to name the most comprehensive works). These publications are descriptive in the sense that they try to capture all types of "deviant" APs, but the semantic and syntactic description they offer is rather superficial, as their aim is not to explain the functioning of the APs being analyzed, but rather to rate them on a scale of (non-)normativity. On the other hand, "deviant" APs have drawn the attention of formal linguists (Yokoyama 1984; Rappaport 1984; Babby and Franks 1998), who are mainly interested in the deep syntactic structure and in

contextual factors that influence co-reference choice. For reasons of space, we will not discuss all types of "deviant" APs, but only those leading to ambiguity.

Glovinskaja states that both syntactic and semantic criteria play a role in AP co-reference, namely, "семантический субъект деепричастия должен совпадать с семантическим субъектом глагола главного предложения, а этот последний должен выполнять функцию подлежащего [the semantic subject of the AP should coincide with the semantic subject of the matrix verb, and the latter should fulfill the function of syntactic subject. Translation – S.B.]" (2002, 278); ideally, both factors should be satisfied (cf. 2002, 278).

Note that a violation of the syntactic criterion hardly ever leads to an ambiguous sentence, as the dative subject in the matrix clause of (2) illustrates.

(2) *Uznav* *ėtu* *novost',* *mne* *stalo* *grustno*.
learn_about-AP.PF this-ACC news-ACC I-DAT become-PST.3SG.N sad-PRD.N
'Having learned about this news, I felt sad.'

A violation of the semantic criterion leads to ambiguity if the matrix verb features two arguments that both fulfill the semantic restrictions imposed on the AP subject (cf. Glovinskaja 2000, 287-289); thus, in (3) both the unnamed person and the foreman could have eaten in the cafeteria, and in (4) both the speaker and Michalkov are grown-ups. In (5), however, only the speaker is animate and therefore able to return home.

(3) *Poobedav* *v* *zavodskoj* *stolovoj,* *k* *nemu* *podošel*
have_lunch-AP.PF in factory-ADJ.LOC cafeteria-LOC to him come-PST.3SG
master *cecha*.
master-NOM production_unit-GEN
'Having had lunch in the factory cafeteria, to him came the foreman.'
(cited in Rappaport 1984, 50)

(4) *Buduči* *uže* *sovsem* *vzroslym* *čelovekom,* *menja* *vymanil*
be-AP already entirely grown_up-INSTR person-INSTR me cajole-PST.3SG
Michalkov *igrat'* *Oblomova*.
Michalkov-NOM act-INF Oblomov-ACC
'Being already an entirely grown up person, Michalkov cajoled me to act Oblomov.'
(TV, cited in Glovinskaja 2000, 287)

(5) *Vozvraščajas' domoj,* *menja* *zastal* *dožd'*.
return-AP home-ADV me catch-PST.3SG rain-NOM
'Returning home, the rain caught me.'
(cited in Rappaport 1984, 50)

Yokoyama (1980; 1984) was the first to formulate a third criterion for establishing co-reference choices, namely that the first argument of the matrix clause has to be in the theme (6), not in the rheme (6') in order to function as referent for the covert AP subject (Yokoyama 1984, 375; 377).

(6) *Ešče podchodja k igornoj zale, ... so mnoju*
still approach-AP to gambling-ADJ.DAT hall-DAT with I-INSTR
delajutsja sudorogi.
do-PRS.PASS.3PL convulsion-NOM.PL
'Only approaching the gambling hall, I get the fits.'
(Dostoevskij, cited in Yokoyama 1984, 375)

(6') **Ešče podchodja k igornoj zale, ... sudorogi*
still approach to gambling-ADJ.DAT hall-DAT convulsion-NOM.PL
delajutsja so mnoju.
do-PRS.PASS.3PL with I-INSTR
'Only approaching the gambling hall, the fits get me.'
(cited in Yokoyama 1984, 375)

Taking up Yokoyama's idea, Rappaport (1984, 50-68) suggests prominence control as the decisive factor for co-reference choice: if a possible referent is the matrix verb subject or the theme of the sentence or has the semantic role of agent (and is thus animate), it may function as referent of the AP; the more of these three criteria are fulfilled, the more likely it is to function as referent. However, Rappaport himself has to admit that there are exceptions to his rule (1984, 61-66), and none of the explanations adduced so far can account for sentences of type (7).

(7) *Priechav v gorod, menja vstretili rodnye*.
arrive-AP.PF in town-ACC me meet-PST.3PL relative-NOM.PL
'Having arrived in town, my relatives met me.'
(cited in Glovinskaja 2000, 277)

Glovinskaja claims that (7) is ambiguous since it remains unclear who has come to town – the speaker or his relatives (2000, 277). Unfortunately, Glovinskaja does not elaborate on what exactly makes the sentence ambiguous. In our eyes, the basic contradiction is that between the normative co-reference rule for the AP, which calls for the first matrix verb argument, i.e. the relatives, to be the referent of the AP, and the semantics of the matrix verb: *vstretit'* 'meet' prototypically implies that its second argument is the arriving person to be met by the first argument. Note that the AP clause is adjacent to *menja* 'me', the second argument of the matrix verb, i.e. the argument that the matrix verb semantics imply is the most likely referent of the AP. Consequently, there is reason to assume that the co-reference choice for the AP is (at least partially) determined by the sentence semantics and the linear closeness between the AP and its likely referent.

Quite interestingly, none of the authors puts forward the question of whether the linear closeness of the AP clause and the second argument of the matrix verb fosters the ambiguity of the sentences (3-4) and (6-7). In (3' and 6'), the movement of the AP clause to sentence-final position leads to linear closeness between the first argument of the matrix verb and the AP clause, which makes it more likely that the AP co-reference relates to the first matrix verb

argument. In (4'), however, the sentence-final position does not help to resolve the ambiguity. Two reasons might account for this: firstly, the sentence-final position does not add to the linear closeness between the first matrix verb argument and the AP clause, but rather adds to the closeness between Oblomov, the object of *igrat'* 'act', and the AP clause. Secondly, *vymanit'* 'cajole' is an object control verb, so the covert first argument of the infinitive *igrat'* 'act' is again the speaker. Assigning the AP co-reference to him would be in concord with both the semantic and the syntactic criterion suggested by Glovinskaja. Consequently, for (4') three possible co-reference choices arise, namely co-reference with *menja* 'me', Michalkov and Oblomov.

(3') *K nemu podošel master cecha,*
to him come-PST.3SG master-NOM production_unit-GEN
poobedav v zavodskoj stolovoj,
have_lunch-AP.PF in factory-ADJ.LOC cafeteria-LOC
'To him came the foreman, having had lunch in the factory cafeteria.'

(4') *Menja vymanil Michalkov igrat' Oblomova*
me cajole-PST.3SG Michalkov-NOM act-INF Oblomov-ACC
buduči uže sovsem vzroslym čelovekom
be-AP already entirely grown_up-INSTR person-INSTR
'Michalkov cajoled me to act Oblomov, being already an entirely grown up person.'

(7') *Menja vstretili rodnye, priechav v gorod.*
me meet-PST.3PL relative-NOM.PL arrive-AP.PF in town-ACC
'Having arrived in town, my relatives met me.'

Note also that in (6'), which is deemed inacceptable by Yokoyama (1984), the AP clause is adjacent to *sudorogi* 'fits'. *Sudorogi* is the first argument of the matrix verb, but does not fit semantically as referent for the AP. This is another indication that the linear closeness of the AP and its possible referent does play a role in establishing co-reference.

Let us now consider another example (8) adduced by Glovinskaja (2000, 287), who claims this example to be ungrammatical, as the two arguments of the matrix verb are both inanimate and non-metonymic and thus cannot function as referent for the AP. Glovinskaja does not take into account that *pomeščenie* is a nominalization of the verb *pomeščat'* 'place', which prototypically features an animate, agentive first argument. From a semantic point of view, *pomeščat' čeloveka v komičeskuju situaciju* 'place a person into a comical situation' may be considered an evaluative interpretation of the actual action of sticking out one's leg. It is quite common that one of the two verbs in an interpretative relationship is encoded as an AP (cf. Birzer 2010, 62-69), so we may take (8) as an indication that the AP subject can also be co-referent with a non-finite verb form.

(8) *Komičeskoe sozdaetsja s pomošč'ju ... pomeščenija*
comicalness-NOM create-PASS.PRS.3SG with help-INST placing-GEN
čeloveka v komičeskuju situaciju (naprimer, podstavljaja

person-ACC in comical-ACC situation-ACC for_example stick_out-AP *emu nožku)*…
him leg-ACC
'The comicalness is created with the help of placing a person into a comical situation (for example, by sticking out a leg for him to stumble) …'
(I. M. Suslov, cited in Glovinskaja 2000, 287)

Ickovič (1982, 141-146) is the only one to discuss APs occurring in sentences featuring an infinitive. He distinguishes between sentences with *sub-ektnyj* 'subjective' and *ob-ektnyj infinitiv* 'objective infinitive'; the cited examples make clear that these terms coincide with subject and object control verbs respectively. Ickovič states that in these constructions the infinitive features as matrix verb for the AP (1982, 141) and also addresses the syntactic position of the AP. For subject control verbs, he claims both the sentence-initial and -final position of the AP to be normative (1982, 141). For object control verbs Ickovič states the following:

Примыкание деепричастия к инфинитивному обороту, а не к сказуемому, как следовало бы ожидать, определяется как характером самого оборота, представляющего собой свернутое предложение, так и постпозицией деепричастия, тем, что позиционно оно ближе к инфинитиву и отделено инфинитивом от сказуемого. С другой стороны, в таких конструкциях нельзя исключить и поддерживаемую основным условием употребления деепричастий его ориентированность на глагол-сказуемое, что создает возможность двоякого чтения названных построений. [...] Сказанное позволяет охарактеризовать построения с постпозитивным деепричастием при объектном инфинитиве как находящиеся на периферии нормы.
The adjacency of the AP to the infinitive clause, and not to the predicate [i.e. the matrix verb – S.B.], as one should expect, is determined both by the characteristics of the infinitive clause as such, which represents a reduced sentence, and by the postposition of the AP, i.e. by the fact that from the view of syntactic position it is closer to the infinitive and detached from the predicate by the infinitive. On the other hand, in such constructions one cannot exclude the orientation of the AP towards the verb-predicate, which is fostered by the basic condition for the usage of APs, which raises the possibility of an ambiguous reading of the previously mentioned constructions. […] The aforesaid allows to characterize object control verb constructions with a postponed AP as located on the periphery of the norm. [translation – S.B.]
(Ickovič 1982, 142-143)

His verdict on object control verbs with the AP in sentence-initial position is even stricter:

[П]ри препозиции деепричастия глагольной силы инфинитива недостаточно, чтобы нейтрализовать влияние сказуемого, от которого деепричастие обычно зависит. В таких построениях деепричастие испытывает двойное влияние – сказуемого (с его субъектом действия – подлежащим) и инфинитива (с иным субъектом действия), в них возникает конфликт между чтением, которое предписывается замыслом автора ... и двояким чтением, допускаемым основынм принципом употребления деепричастий

... . Это противоречие ставит описанную конструкцию если не за пределы литературной нормы, то, в лучшем случае, на границе допустимого.

In case of the preposition of the AP, the verbal force of the infinitive is insufficient to neutralize the impact of the predicate, on which the AP usually depends. In such constructions the AP experiences a twofold influence – of the predicate (with its subject of action, which is also the syntactic subject) and of the infinitive (with another subject of action); in these constructions a conflict arises between the reading that is mandated by the author's intention, […] and the ambiguous reading licensed by the basic principle for the usage of APs […]. This contradiction locates the described construction if not outside the norms of Standard Russian, so, at best, on the verge of the permissible. (translation – S.B.)

(Ickovič 1982, 144)

Obviously, the linear closeness between the AP and its possible referent does play a role with object control verbs, which is reason enough to hypothesize that the issues discussed above for verbs with "plain" semantics are possibly due to the same phenomenon.

Our findings can be summarized in three hypotheses to be tested in an experiment.

The first hypothesis (H1) is that the co-reference is assigned to the matrix verb argument that is closer to the AP in terms of syntactic linearity, i.e. is adjacent at best.

Our second hypothesis (H2) says that the special semantic structure of subject and object control verbs also influences the co-reference choice for the AP: With object control verbs, the assignment of co-reference to the second matrix verb argument is more likely than for verbs with "plain" semantics and for subject control verbs.

Finally, the third hypothesis (H3) is that sentence semantics also plays a role: we understand semantically "neutral" as sentences in which the context makes it equally probable that the activity conveyed by the AP is conducted by either the first or the second matrix verb argument. We hypothesize that this semantic neutrality also fosters ambiguous co-reference.

2. Sociolinguistic parameters possibly influencing the co-reference choice for APs

Without doubt, the status of Russian as PL and SL constitutes the most important sociolinguistic parameter.

Our group of RSL speakers in German speaking countries is formed by two subgroups, namely migrants of the first generation and heritage speakers. During the last two decades, both groups have been researched on quite intensively, as their language usage differs from that of RPL speakers in several respects, due to attrition among the first generation migrants and due to incomplete acquisition by the heritage speakers. For reasons of space, we cannot give an account of all the aspects of RSL that have been in the research focus so far and will mention only those issues that might be of relevance for the co-reference choices of APs.

The AP as such is a construction from the realm of conceptual literacy, which is usually attrited or not fully acquired by RSL speakers (cf. Böhmer 2015, 194-197). Ritter (2019) shows that in comparison to their monolingual peers, Russian-German bilingual children read at a slower pace in both languages, i.e. it seems that processing linguistic information takes RSL speakers more time. Ritter's findings allow us to assume that the bias towards linguistically aware and culturally interested respondents in the group of RSL speakers, which has to be expected due

to the work with printed stimuli, will not distort the reaction times too much. Regarding the APs, we may assume that RSL speakers, especially if they received their education in a country with a dominant language other than Russian, are less aware of the normative co-reference rules for the AP and the intricate interplay between matrix verb semantics, sentence semantics and syntactic position of the AP poses a time-consuming processing problem to them. In contrast to semantics, the syntactic position of the AP is obvious and therefore a criterion that can be processed more easily. We deduce the following two hypotheses:

Fourth hypothesis (H4): RSL speakers have longer reaction times than RPL speakers, because it is more difficult and thus time-consuming for the former to make a co-reference choice.

Fifth hypothesis (H5): RSL speakers are more prone to use the syntactic position of the AP as criterion for their co-reference choices than RPL speakers.

Three more sociolinguistic parameters may be important for both respondent groups.

As described in section 1, the AP as such has been subject to intensive normativization. Therefore, educational background may influence the respondent's co-reference choice: the more time a person has spent in educational institutions, the more familiar they are with texts from the realm of conceptual literacy. Additionally, study subjects and professions concerned with language(s) and linguistic knowledge make us expect higher awareness of the normative rules of Russian.

Secondly, we have to keep in mind that since the second half of the 1980s, Russian has witnessed a process often described as "destandardization" (cf. Valgina 2003; Glovinskaja 2000), which has led to the intrusion of colloquial and substandard items into those registers of Standard Russian characterized by conceptual literacy. Therefore, the respondent's age may also play a role in co-reference choice. Older respondents from both groups have spent a considerable part of their lifetime in the highly standardized Soviet linguistic environment and are probably more aware of the normative rules than the younger generation, which has grown up either with rather liberal post-perestroika language usage (RPL speakers) or know and use mainly a spoken colloquial variety of Russian (RSL speakers).

Thirdly, gender may also play a role in the co-reference choice: since the language usage of women is characterized by the "склонность к употреблению «престижных», стилистически повышенных форм, клише, книжной лексики [proneness to the usage of "prestigious", stylistically elevated forms, clichés and bookish lexis – translation S.B.] (Kirilina and Tomskaja 2005; cf. also Vakhtin and Golovko 2004, 69-77), it is worth analyzing whether the co-reference choices made by women have a higher correspondency rate with the rules of Standard Russian, i.e. whether they opt for co-reference with the first argument of the matrix verb.

Hence our hypotheses:

Sixth hypothesis (H6): Respondents with a high level of education are more likely to establish co-reference with the first argument of the matrix verb.

Seventh hypothesis (H7): Respondents older than 40 years are more likely to establish co-reference with the first argument of the matrix verb.

Eighth hypothesis (H8): Women are more likely to establish co-reference with the first argument of the matrix verb.

3. Experiment design

Taking our hypotheses into account, our aim was to find three test sentences for each semantic verb class, i.e. subject and object control verbs, and other "plain" verbs. Each group of test sentences had to contain sentences with "neutral" and "biased" sentence semantics.

Since verb semantics determines which lexemes can serve as arguments of a verb, co-referential ambiguity prototypically arises if the matrix verb has two arguments that share the same (semantic) features. As APs are formed predominantly from activity verbs (cf. AG 1980, § 1589), ideal test sentences have two animate arguments (or, less prototypically, one animate and one anthropomorphized argument).

As resources for our test sentences we used the literature on APs with ambiguous co-reference and the Russian National Corpus (RNC), where we restricted our search to all texts from the main corpus written after 1950. We are thus dealing with natural language data, not construed sentences.

The corpus matches were post-processed manually, i.e. syntactically highly complex sentences were stripped of non-defining relative clauses and subordinate clauses not functioning as matrix verb argument; some morphosyntactically complex adjuncts were also simplified. The aim was not to distract respondents from the relationship between matrix and AP clause. All post-processed prospective test sentences from the corpus were then rated for their naturalness by two native speakers of Russian residing in Russia. The rating scale ranged from 1-5; only sentences with rating 5 were accepted for inclusion in the experiment.

For the group of "plain" verbs, two sentences with "neutral" sentence semantics (9-10) and one with "biased" semantics (11) were included in the experiment.

(9) *Usaživajas' za stolik, tovarišči družeski obraščalis' k dedu.*
sit_down-AP behind table-ACC comrade-NOM.PL friendly address-PST.3PL to old_man-DAT
'Sitting down at the table, the comrades addressed the old man in a friendly way.'

(10) *Vernuvšis' domoj pozdno, čto ty skažeš' žene?*
return-AP to_home late-ADV what-ACC you say-FUT.2SG wife-DAT
'Coming home late in the evening, what will you tell your wife?'

(11) *Zametiv, čto ėta informacija malo komu interesna, Ivan Vasil'evič prerval suprugu.*
remark-AP COMPL this-NOM information-NOM little-ADV who-DAT interesting-NOM Ivan-NOM Vasil'evič-NOM interrupt-PST.3SG wife-ACC
'Remarking that this information is hardly interesting to anybody, Ivan Vasil'evič interrupted his wife.'

The group of sentences containing a matrix verb with subject control consisted of two sentences with "biased" (12-13) and one sentence with "neutral" sentence semantics (14).

(12) *Bezropotno rasstavajas' s cennostjami, taksisty*
without_protest-ADV part-AP with valuable-INSTR.PL taxi_driver-NOM.PL
valuable-INSTR.PL taxi_driver-NOM.PL take_care-PST.3PL
opasalis' perečit' banditam.
take_care_not_to-PST.3PL contradict-INF gangster-DAT.PL
'Parting with their valuables without protest, the taxi drivers feared to contradict the gangsters.'

(13) *Čerkes, obnaživ kinžal, grozil ubit' devušku.*
Cherkess-NOM unsheath-AP dagger-ACC threaten-PST.3SG kill-IN girl-ACC
'The Cherkess, unsheathing his dagger, threatened to kill the girl.'

(14) *Vagonetka, krenjas' v storonu, grozila oprokinut'sja*
minecart-NOM heel-AP on side-ACC threaten-PST.3SG topple-INF
na Michaila.
on Michael-ACC
'Heeling to one side, the minecart threatened to topple over Michael.'

Among the matrix verbs with object control, two have "neutral" (15-16) sentence semantics and one a "biased" one (17).

(15) *Predsedatel' poprosil tolpu i miliciju rasstupit'sja,*
leader-NOM ask-PST.3SG.M crowd-ACC and police-ACC step_aside-INF
dav prochod doverennym licam kandidata.
give-AP transit-ACC intimate-DAT.PL person-DAT.PL candidate-GEN
'The leader asked the crowd and the police to step aside, giving way to the candidate's intimates.'

(16) *Menjajas' drug s drugom, mošenniki zastavili*
take_turns-AP one-NOM with another-INSTR rogue-NOM.PL force-PST.3PL
devušek tancevat' poparno.
girl-ACC.PL dance-INF in_pairs-ADV
'Taking turns, the rogues forced the girls to dance in pairs.'

(17) *Ugrožaja oružiem, bandity zastavili pilota letet' k*
threaten-AP weapon-INSTR bandit-NOM.PL force-PST.3PL pilot-ACC fly-INF to
kolonii.
penal_colony-DAT
'Threatening with a weapon, the bandits forced the pilot to fly to the penal colony.'

The nine selected sentences were included in the experiment in two variants, namely with the AP in sentence-initial and -final position respectively. As a result, we had 18 sentences containing an AP (for a survey of the triggers and their semantic characteristics cf. Table 1), which were accompanied by 38 distractors. The distractors also addressed issues of morphosyntactic or semantic ambiguity, among others the binding of reflexives, the scope of adjuncts and the agreement of participles.

sentence pair	verb semantics	sentence semantics
38 vs. 39 'late homecoming'	plain	neutral
40 vs. 41 'interrupted conversation'	plain	subject-biased
42 vs. 43 'talking comrades'	plain	neutral
44 vs. 45 'taxi drivers'	subject control	subject-biased
46 vs. 47 'toppling minecart'	subject control	neutral
48 vs. 49 'unsheathed sable'	subject control	subject-biased
50 vs. 51 'election campaign'	object control	neutral
52 vs. 53 'flight kidnappers'	object control	subject-biased
54 vs. 55 'dancing rogues'	object control	neutral

Table 1: Semantic characteristics of the triggers containing an AP

So as to enable as many people as possible to take part in the experiment, the online platform SoSciSurvey was used to construct the experiment. The test design was adopted from Chernova, who conducted a similar experiment on the agreement of participles (Chernova et al. 2016). Informants were presented one sentence at a time and asked to answer a question afterwards, as (18) illustrates. The test items were presented randomly and the reaction time was measured for every test item.

(18) *Vernuvšis' domoj pozdno, čto ty skažeš' žene?*
return-ap to_home late-adv what-acc you say-fut.2sg wife-dat
'Coming home late in the evening, what will you tell your wife?'
Kto prišel domoj pozdno?
'Who came home late in the evening?'
a) sobesednik b) žena
'a) interlocutor b) his wife'

After the experiment proper sociolinguistic information was collected.
Originally we wanted to focus on monolingual speakers only, so in the first version of the questionnaire the following information was collected:

- age
- L1
- country of residence
- sex
- education
- subject of study in case of higher education

In the first version of the survey, the possible answers for the question about the participant's education reflected the educational system in the Soviet Union and the Russian Federation. The information on L1 and the country of residence allowed us to identify whether Russian is the primary (RPL) or secondary language (RSL) for the given informant. Since RSL speakers from German speaking countries constituted roughly one sixth of all participants in the first round of the survey, we decided to start a second round, in which we tried to motivate RSL speakers to participate. In the second version of the survey, we added one question about the age of migration, and for education, options reflecting the educational system in Germany, Austria and Switzerland were added.
In both versions, obtaining information on the subject of study was important, since, as mentioned above, the co-reference choice for APs has been subject to intensive standardization. This might influence the answers of informants with a background in language studies, as this group of informants is assumedly more familiar with the normative rules of Russian than the other informants.
Before making the experiment accessible to the public, a pretest was conducted with three L1 speakers of Russian residing in Russia.
The experiment was open for participation in two waves from June 28 to July 31, 2017 (monolingual speakers) and from July 17 to September 8, 2019 (bilingual speakers).
The informants were acquired via personal contacts (also on WhatsApp), a call for participation on LinguistList, and postings on Facebook and VKontakte. In order to recruit Russian-German bilinguals, postings were made in respective groups of interest on VKontakte and Facebook. The distribution via personal contacts, Facebook and VKontakte was intended to cast a wider net that would include not just linguists and other language professionals, but also other professions and people with a lower level of educational attainment.

3. Data analysis

3.1. Participants

Overall, 209 informants from 24 countries finished the experiment.

In a first step, we removed from the sample informants with less than one second reaction time for any of the triggers. A very low reaction time may indicate “lucky guesses”; on the other hand, a very long reaction time implies that the answer is not spontaneous, as the informants likely tried to remember the normative rules and adapt their answer to the rules. As we plan to analyze other ambiguous phenomena tested in the survey in the future, we decided to take a mean reaction time > 35 sec across all 56 triggers (and not only the 18 items containing an AP) as a cut-off point for overlong reaction time. This allows to work with the same dataset for all tested phenomena and makes the results comparable across phenomena.

For the bilingual speakers, the length of stay in German speaking countries is another important variable. We decided to include into the sample only those respondents who have been residing in German speaking countries for at least ten years (Chart 1). To collect information on their age, the respondents were asked to tick the corresponding 10-year-interval, whereas for the migration age the exact figure was asked (Chart 2). Thus, to calculate the length of stay the migration age was subtracted from the middle of the age interval. The information about migration age is available only for participants of the second version of the questionnaire.

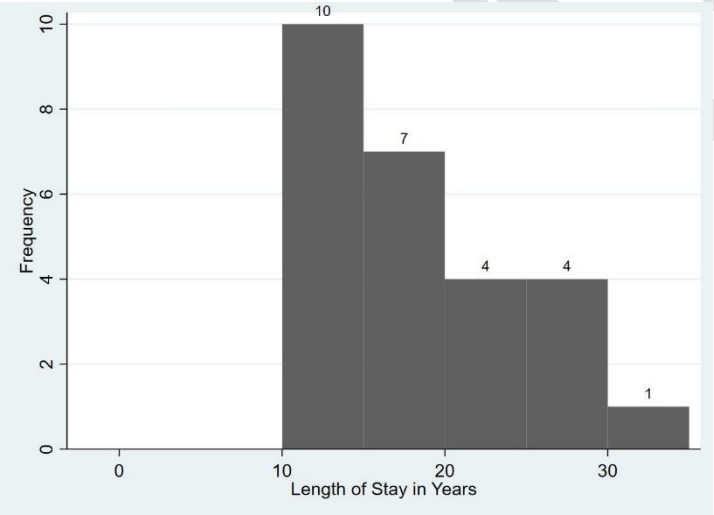

Chart 1. Length of stay (in years) of the RSL speakers in German speaking countries.

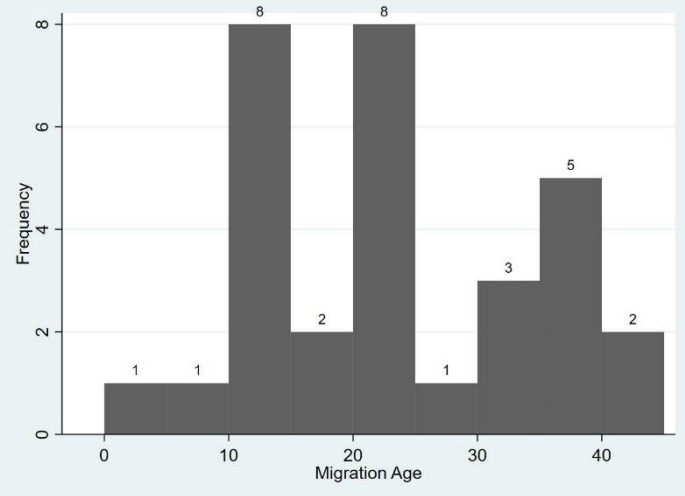

Chart 2. Migration age of the RSL speakers.

Eventually, we used the data of 67 RPL and 45 RSL speakers for our analysis. The RSL group is more heterogeneous in respect to country of origin; they come from Russia (23), Ukraine (9), Kazakhstan (4), Belorus (1), Estonia (1), Azerbaijan (1) and Moldova (1). Most monolingual participants come from Russia (60), only 6 come from Ukraine and one from Belarus.
With respect to the level of education (Table 2), both samples are biased towards persons with higher education, which makes the samples comparable, but does not reflect the general population structure.

	Russian as Primary Language	Russian as Secondary Language
Secondary School	6	4
Bachelor	18	20
Master	43	20
no information	-	1
total	67	45

Table 2. Level of education of RPL and RSL speakers.

Both samples are imbalanced regarding gender (Table 3); with the RSL speakers, the predominance of females is even more pronounced.

Gender	Russian as Primary Language	Russian as Secondary Language
male	25	9
female	42	35
no information	-	1
total	67	45

Table 3. Gender of RPL and RSL speakers

3.2. Co-references choices for the test items containing an AP

Table 5 shows in absolute numbers the co-reference choices RPL speakers made. The triggers coded D38 to D43 are the sentences with "plain" matrix verbs; the triggers D44 to D49 have subject control verbs as matrix verbs, and the triggers D50 to D55 have object control verbs as matrix verbs. The six triggers per group form three sentence pairs with the AP in sentence-initial and -final position respectively. For the triggers with "plain" and subject control verbs, the absolute numbers show that the respondents chose almost exclusively the co-reference of the AP with the first argument of the matrix verb, irrespective of the position of the AP. Among the object control verbs, however, we observe two sentence pairs where the respondents prefer the co-reference with the first argument of the matrix verb for the AP in sentence-initial position, and the co-reference with the second matrix verb argument for the AP in sentence-final position.

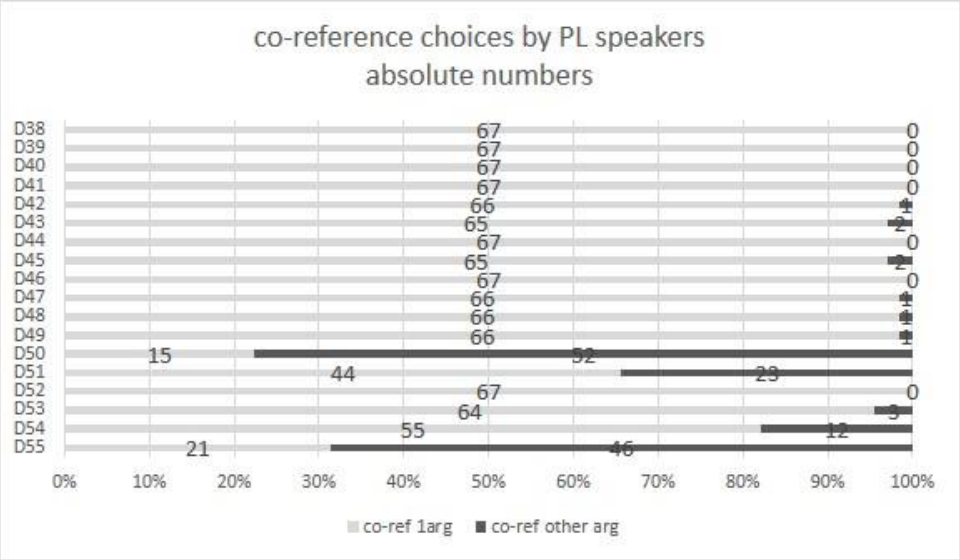

Chart 3. Co-reference choices in absolute numbers for each test item containing an AP; speakers of Russian as PL

The co-reference choices made by speakers of Russian as SL show a slightly different picture (Chart 4). As with the PL speakers, the object control verbs also show the highest number of instances where the informants assigned the co-reference of the AP to the second matrix verb argument. However, within the sentence pairs containing an object control verb, the numerical difference in the co-reference choice is not as pronounced as it is with the PL speakers, so the syntactic position of the AP seems to play a minor role for the SL speakers. Apart from that, for the SL speakers we observe a generally higher tendency over the other two verb classes to identify the second matrix verb argument as referent of the AP.

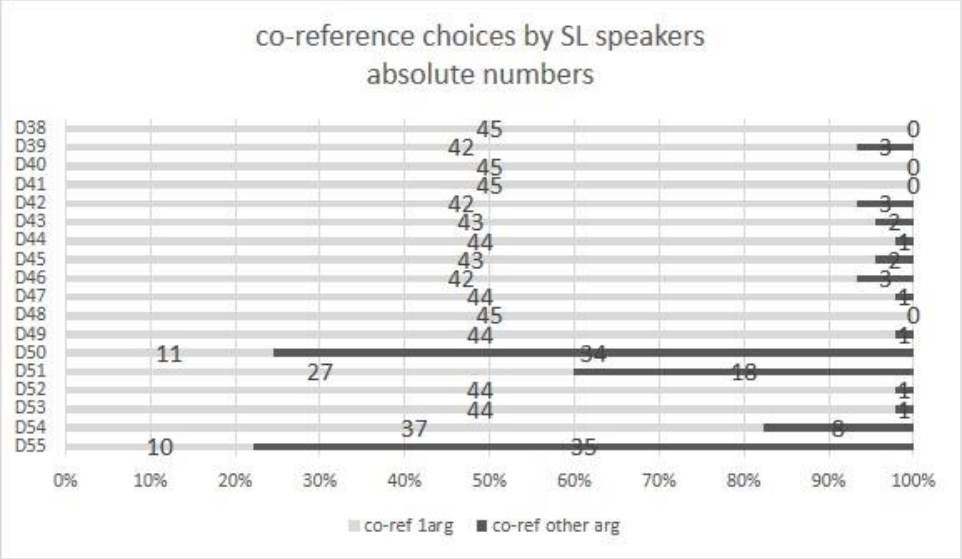

Chart 4. Co-reference choices in absolute numbers for each test item containing an AP; speakers of Russian as SL

Fisher's exact test showed that there is no significant difference in the co-reference choice which PL and SL speakers make for each sentence. The p-values were above 0.062 for all items. In the next step, we tested with the help of Fisher's exact test how significantly co-reference choices differ within the sentence pairs. This hold true for the sentence pairs 50/51 and 54/55. For both primary and secondary language speakers the differences are highly significant with $p \leq 0.001$.

Since H4 says that RSL speakers have longer reaction times than RPL speakers, reaction time is an important variable. In a first step we calculated the overall reaction time each respondent needed to process the 18 triggers containing an AP and established the mean reaction time per item per person (Chart 5). The differences are statistically not significant with p=0.152.

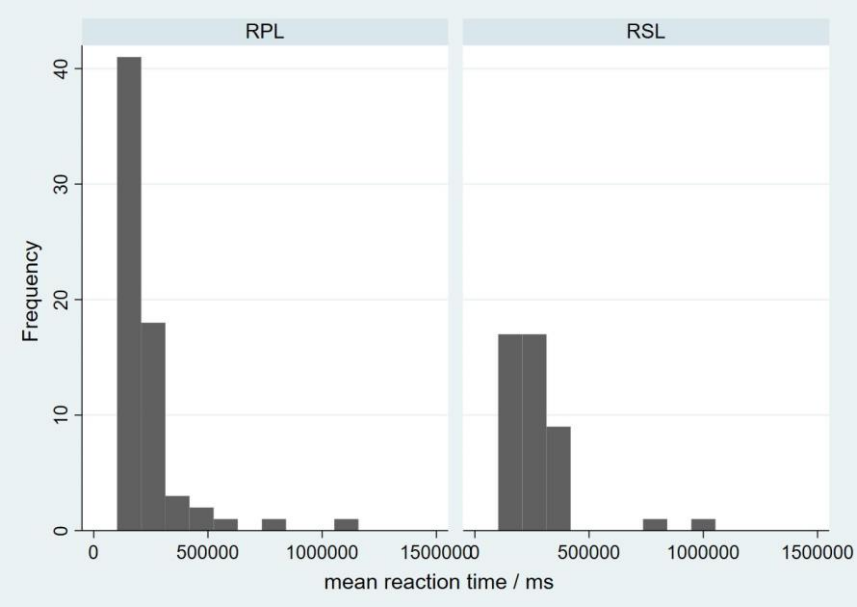

Chart 5. Mean reaction time per item of RSL and RPL speakers.

However, we have to be aware of the fact that the mean reaction time derived from all 18 triggers is not that robust, because the sentences are of different length; triggers with subject or object control verbs tend to contain more wordforms and thus due to sheer length require more processing time. In order to reduce the impact of outliers, we inspected the median reaction time per wordform (Chart 6) instead of the mean.

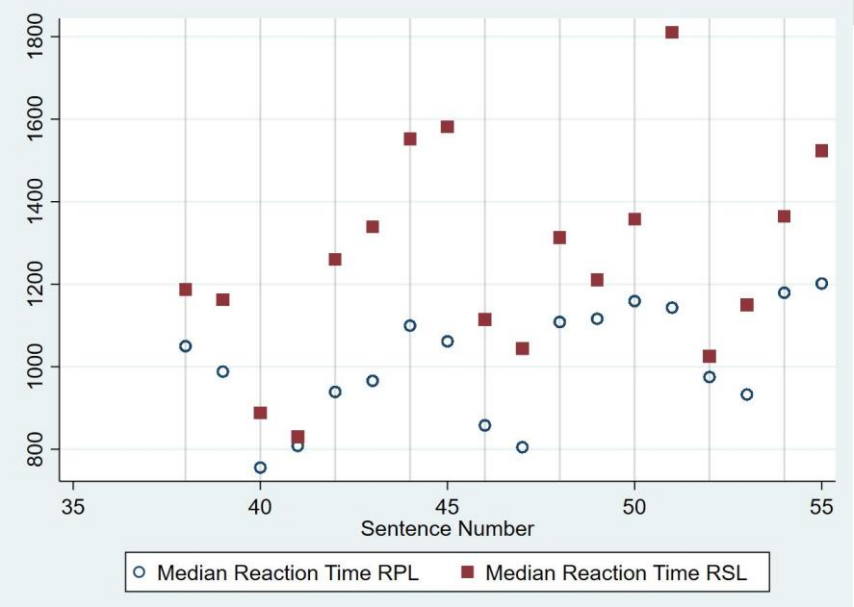

Chart 6. Median reaction time per wordform / sentence for RPL and RSL speakers.

Sentences 38-43 contain matrix verbs with “plain” semantics; sentences 44-49 contain a subject control verb as matrix verb, and sentences 50-55 feature an object control verb as matrix verb.

In general, object control verbs which are embedded into sentences with "neutral" sentence semantics (sentence pairs 50-51 and 54-55) show the longest reaction time, whereas with "subject-biased" sentence semantics (sentence pair 52-53) the reaction time goes down. This might be an indicator that co-reference of the AP with the 1 ARG of the matrix sentence is the default and contexts fostering this reading result in shorter reaction time, i.e. faster processing of the linguistic data.
On first inspection, we are facing incongruous results for the triggers containing subject control verbs: the reaction times are in general lower than those for object control verbs (and partially also lower than those for "neutral" matrix verbs), but the triggers with "subject-biased" sentence semantics display longer reaction times than those with "neutral" sentence semantics. Therefore, we tested the reaction times of the three matrix verb groups in each sample for significant differences. T-tests showed that triggers with object control verbs have a significantly longer reaction time than items with subject control or "plain" verbs. Comparing the reaction times of items with subject control verbs and "plain" verbs gave no significant result. We may interpret these results as another indicator that subject co-reference of the AP is the default reading and that any deviation from this pattern, albeit fostered by corresponding verb and / or sentence semantics, requires more processing effort and thus a longer reaction time.
Considering these results, we decided to choose the reaction time per wordform as variable to be included into the logistic regression.

Logistic regression is a statistic model that is typically applied for analyzing which factors influence a dependent variable with only two possible outcomes (cf. Baayen 2008, 214-215). Our model investigates the probability of choosing the object of the matrix clause as co-reference controller of the AP; the co-reference choice thus constitutes the dependent variable. The odds ratio is the "ratio of the probability of one event to the probability of another event" (Levshina 2015, 162). Thus, an odds ratio greater than 1 reveals a higher probability of the event to happen, while an odds ratio smaller than 1 indicates a lower probability (cf. Levshina 2015, 162) In our model this means that all included variables with an odds ratio greater than 1 make the choice of the second argument as co-reference more likely and variables with an odds ratio smaller than 1 reduce the probability of respondents choosing the second argument. With regard to the hypotheses stated above, we included the following factors into our model: 1) syntactic position of the AP; 2) matrix verb semantics; 3) sentence semantics; 4) median reaction time per wordform; 5) RPL vs. RSL speakers; 6) respondent's age; 7) country of residence; 8) sex; 9) education.

The total number of observations amounts to 1,998, because we consider the respondents' answers to all 18 triggers. Pseudo r-squared amounts to 0.472.
In our first model age does not have a statistically significant impact ($p>0.82$) on the co-reference choice, i.e. H6 is falsified. This means that either the destandardization processes after *perestroika* did not exert influence on the co-reference choices or that the normative rules for

the co-reference of the AP, which were propagated so intensively during the Soviet period, had in fact only a very limited influence on the actual language usage.
The model includes two more factors with an insignificant p-value, namely reaction time and gender. However, with p>0.06 gender is only slightly above the threshold, and even the p-value for reaction time is nearly four times lower than that of age. Therefore, we decided to remove only age in the second model.

	Odds ratio	z	P>|z|
Secondary language	1.3233	1.51	0.132
Linear closeness	5.8921	9.16	<0.001 ***
"Subjetct-biased" sentence semantics	0.0384	-10.42	<0.001 ***
Subject-control verbs	2.3316	2.00	0.045
Object-control verbs	59.8562	12.27	<0.001 ***
Reaction time / wordform	1.0000	-1.03	0.304
Gender	1.5383	1.91	0.057
High School	6.7793	3.48	0.001 ***
Bachelor	2.5507	2.04	0.041 *
Constant	0.0012	-9.59	<0.001 ***

Table 4. Logistic regression output

We will start our analysis with those factors that have significant p-values and large effect sizes, i.e. high impact on the co-reference choice. Verb semantics is a categorical variable with the three possible types plain, subject control and object control verbs. Plain verbs serve as a reference category and two dummy variables for subject and object control verbs are included. The odds ratios for these two variables can be understood as a difference in probability compared to the reference category "plain". Object control verbs have the highest impact on the choice of the second argument as co-reference controller, i.e. of all factors, the existence of an object control verb in a given sentence makes co-reference of the AP with the matrix verb object most likely. Compared to the reference group, "plain verbs", subject control verbs also make it more probable that the second argument of the matrix clause is chosen as co-reference controller,
For sentence semantics, neutral sentence semantics was used as a reference category. In line with our assumptions, "subject-biased" sentence semantics reduces the probability of respondents establishing the co-reference with the second argument. The impact is statistically highly significant.
Furthermore, the regression analysis shows that there is a statistically significant impact of linear closeness on the choice of the co-reference. Thus, if the AP occurs in close linearity with the second argument of the matrix verb, the probability of probands choosing the second argument as co-reference controller increases.

To summarize, the regression verifies our three hypotheses about the linguistic factors influencing the co-reference choice.

Let us now turn to the sociolinguistic factors. Among our informants more than half (63/112) have a master's degree. Compared to them, respondents with a bachelor's degree are statistically significantly more likely to establish co-reference with the second argument of the matrix verb and for high school graduates the odds ratio is even larger. This supports our hypothesis that people with higher education are more likely to establish co-reference with the first argument because of their higher awareness of the normative rules of Russian. Thereby H6 is verified.

Against our hypothesis, men show a higher likelihood to establish co-reference with the first argument than women, although this result is statistically not significant with p=0.057 and may be considered only a tendency.

RSL speakers are more likely to establish co-reference with the second argument of the matrix verb, but the difference is statistically not significant with p=0.126. We deduced the assumption that RSL speakers are slightly more likely to use the syntactic position of the AP as criterion for their co-reference choices, yet the interaction effect included into our model proved insignificant with p=0.581. Thus, H5 cannot be verified. For investigating the reaction time, we used the reaction time per wordform in order to adjust for various sentence length. This factor does not have a statistically significant impact on the co-reference choice, meaning that there is no evidence that participants considering the sentence for a longer time make a co-reference choice different from "fast answerers".

An overall view of our results and their comprehensive interpretation follows in the conclusion.

5. Conclusion

We conducted an online experiment with speakers of Russian as primary and secondary language in order to identify the factors which influence co-reference choice for AP clauses. The experiment aimed to test three linguistic (i.e. syntactic and semantic) and five sociolinguistic hypotheses:

1) the co-reference is assigned to the matrix verb argument that is closer to the AP in terms of syntactic linearity;
2) due to their special semantic structure, the assignment of co-reference to the second matrix verb argument is more likely for object control verbs than for verbs with "plain" semantics or for subject control verbs;
3) semantic neutrality of the matrix sentence fosters ambiguous co-reference.
4) RSL speakers have longer reaction times than RPL speakers, because it is more difficult and thus time-consuming for them to analyze ambiguous co-references.
5) RSL speakers are more prone to use the syntactic position of the AP as criterion for their co-reference choices than RPL speakers.
6) Respondents with a high level of education are more likely to establish co-reference with the first argument of the matrix verb.

7) Respondents older than 40 years are more likely to establish co-reference with the first argument of the matrix verb.
8) Women are more likely to establish co-reference with the first argument of the matrix verb.

For data analysis we used a logistic regression model based on the data of 67 RPL speakers and 45 RSL speakers.

The three linguistic hypotheses (H1-H3) have been verified for both speaker groups. We may conclude that the linear closeness between the AP and the second argument of the matrix verb – prototypically realized as sentence-final position of the AP – opens up the possibility to establish co-reference between the two. However, the possibility is made use of only if the sentence semantics is "neutral". Additionally, an object control verb in the "neutral" setting increases the likelihood of co-reference with the second argument of the matrix verb, so the ideal scenario for this co-reference choice is a sentence-final AP, accompanied by an object control verb as matrix verb and "neutral" sentence semantics. Thus, the syntactic position of the AP is the prerequisite, but sentence and verb semantics are the decisive factor for the co-reference choice.

For our two speaker groups we observed a statistically non-significant tendency of RSL speakers to choose the second argument of the matrix verb as co-reference controller more often than RPL speakers do. We could not find any evidence that RSL speakers are more prone to use the syntactic position of the AP as criterion for their co-reference choices than RPL speakers (H5). The mean reaction time of RSL speakers is higher compared to RPL speakers (H4); yet, the difference is statistically not significant.

Gender did not show a significant effect (H8). Therefore, education and age are probably the most telling sociolinguistic parameters. Education proved to be significant (H6), i.e. respondents with a master's degree opted for the first argument more often than respondents with a lower educational attainment, and age turned out to be non-significant (H7), i.e. respondents of all ages are equally likely to choose the second matrix verb argument as co-reference controller. So, judging from our data, the propagation of normative rules for the co-reference of the AP, which took place quite intensively during the Soviet period, may be regarded as a reaction on the persistent variation in co-reference choice. The reaction yielded only poor success, probably due to the fact that the AP is a phenomenon of conceptual literacy with low frequency in everyday speech. On the other hand, the register of academic writing is a very, if not the most prominent representative of conceptual literacy and is characterized by a striving for unambiguousness. Adherence to the normative rules for co-reference choice is also a means of disambiguation. Of our respondents those with a master's or even higher degree are definitely the ones trained best in academic writing, which may explain their predilection for the first argument of the matrix verb as co-reference controller.

Since all our triggers come from journalistic texts, in a last consequence, it might even be worth thinking about whether the occurrence of APs with ambiguous co-reference can be used as indicator of text register.

References

AG 1980 - Шведова Наталья Юльевна. и др. 1980. *Русская грамматика*. [Russian grammar.] 2 тома. Москва: Наука.

Baayen, R. Harald. 2008. *Analyzing Linguistic Data. A practical introduction to statistics*. Cambridge: CUP.

Babby, Leonard & Steven Franks. 1998. The Syntax of Russian Adverbial Participles Revisited. *The Slavic and East European Journal*, 43/3, 483-516.

Birzer, Sandra 2010. *Русское деепричастие: процессы грамматикализации и лексикализации*. [The Russian adverbial participle: processes of grammaticalization and lexicalization.] München: Otto Sagner.

Böhmer, Jule. 2015. *Biliteralität. Eine Studie zu literaten Strukturen in Sprachproben von Jugendlichen im Deutschen und im Russischen*. Münster, New York: Waxmann.

Chernova et al. 2016 – Чернова, Дарья Алексеевна, Слюсарь, Н. А., Прокопеня, В. К., Петрова, Т. Е., & Черниговская, Т. В. 2016. Экспериментальные исследования грамматики: синтаксический анализ неоднозначных предложений. *Вопросы языкознания*, 2016/6, 36-50. [Experimental studies of grammar: Syntactic analysis of ambiguous sentences. *Voprosy jazykoznanija*, 2016/6, 36-50.]

Glovinskaja 2000 – Гловинская, Марина Яковлевна. 2000. *Активные процессы в грамматике (на материале инноваций и массовых яызковых ошибок)*. [Active processes in grammar (on the basis of instances of innovation and massive language mistakes)] in: Земская, Елена Андреевна (ред.) *Русский язык конца XX столетия. (1985-1995)*. Москва: Языки русской культуры, 237-304.

Ickovič 1982 - Ицкович, Виктор Александрович. 1982. *Очерки синтаксической нормы*. [An outline of the syntactic norm.] Москва: Наука.

Kirilina & Tomskaja 2005 – Алла Кирилина, Мария Томская. 2005. Лингвистические гендерные исследования. [Linguistic gender studies.] *Отечественные записки,* 2005(2).

Levshina, Natalia 2015. *How to do Linguistics with R. Data exploration and statistical analysis.* John Benjamins Publishing Co.

Meindl, Claudia. 2011. *Methodik für Linguisten: Eine Einführung in Statistik und Versuchsplanung*. Tübingen: Narr.

Rappaport, Gilbert C. 1984. *Grammatical Function and Syntactic Structure: The Adverbial Participle of Russian. Columbus*: Slavica Publishers.

Vakhtin and Golovko 2004 - Вахтин Николай Борисович, Головко Евгений Васильевич. *Социолингвистика и социология языка.* [Sociolinguistics and the sociology of language.] *Учебное пособие*. Санкт-Петербург.

Ritter, Nelli. 2019. *Lesekompetenz im Kindes- und Jugendalter: Bilinguale und Monolinguale im Vergleich*. Presentation held at the conference Deutscher Slavistentag 2019, Trier on 26.09.2019.

Valgina 2003 – Валгина Нина Сергеевна. 2003. *Активные процессы в современном русском языке*. [Active processes in the modern Russian language.] M: Logos.

Yokoyama, Olga. 1980. The history of gerund subject deletion in Russian. in: Chvany, Catherine and Richard D. Brecht (eds.) *Morphosyntax in Slavic*. Columbus: Slavica Publishers, 260-272.

Yokoyama 1984 - Йокояма, Ольга 1984. *В защиту запретных деепричастий*. [In defense of forbidden adverbial participles.] // Flier, S. (ed.) *American Contributions to the Ninth International Congress of Slavists: Kiev, September 1983*. vol. I. 373-381.