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Semantic Analysis of the Prefix *ZA*- in Russian

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Goals of the talk:

(i) to show that the verbal prefix *ZA*- is an aspectual shift operator that applies to imperfective activity verbs and yields three distinct types of perfective accomplishment *ZA*-prefixed verbs: locative, resultant and inchoative.

(ii) to illustrate that the prefix *ZA*- acts as a measure function that restricts the extent of change of the incremental argument of an accomplishment.

(iii) to propose a formal semantic analysis of the prefix *ZA*- that allows reducing the three types of *ZA*-prefixed accomplishments to a single invariant meaning and explains the correlation between a particular type of a *ZA*-prefixed accomplishment and a lexical argument structure of its imperfective correlate.

Part I: Background - Verbal Prefixation and Grammatical Aspect in Russian

- In the verbal system of Russian, all lexical verbs are divided into either perfective or imperfective aspectual verb forms, which are semantically and morphologically distinct.
- Semantically, the perfective verbs have completed events in their denotation, while the imperfective verbs normally denote progressive, iterative or, in some cases, completed events.
- Morphologically, most imperfective verbs in Russian are basic (Isačenko 1960, Forsyth 1970). Most perfective verbs are morphologically complex, derived from the imperfective ones by the verbal perfectivizing prefixes.

Initial Assumption:

Prefixes are not grammatical operators of perfectivity (Filip 2003).

Arguments against Prefixes Being Grammatical Operators of Perfectivity:

- There are 18 different perfectivizing prefixes in Russian.
- Each of the perfectivizing prefixes may change a lexical meaning and/or lexical argument structure of the basic imperfective verb it attaches to (i.e.; the input verb).
- One and the same prefix behaves differently with different imperfective verbs. It may not affect a lexical meaning and/or argument structure of one input verb, while completely changing a lexical meaning and/or argument structure of another.

Part II: Verbal Prefixation and Lexical Aspect in Russian

Lexical verbs are divided into four lexical aspectual classes - activities, states, achievements and accomplishments - distinguished by various grammatical tests (Dowty 1979). This distinction is known as the Vendlerian classification of lexical verbs in English (Vendler 1967), and some studies argue that it is also relevant for Russian (Bulygina 1982, Mehlig 1985, Padučeva 1996, 2004, Braginsky & Rothstein 2008, among others). The Vendlerian classes reflect different **types of events** with respect to: a) their temporal properties; b) their internal structure.

Lexical Aspect (i.e. a division into Vendler classes):
Accomplishments, Activities, Achievements, States (Vendler, 1967).

States: *love, know, believe* **extended and homogeneous**
Activities: *run, walk, push* **extended and homogeneous down to minimal parts**
Achievements: *arrive, die, notice, realize, reach* **instantaneous change**
Accomplishments: *read (a book), build (the house)* **extended change**

Activities occur with *for X time*, while accomplishments occur with *in X time*. Also, accomplishments occur with the incremental modifiers like *gradually* and *step-by-step*, while activities do not.

(1) a. John gradually built a house in a year / (* for an year).
b. John (* gradually) ran for an hour / (* in an hour).
c. Ivan pročital [PRF] knigu stranitza za stranitzej za chas / (* chas).
Ivan read book page after page in hour hour
'Ivan read the book page-by-page in an hour.'

Hypothesis #1:

Some prefixes change a lexical aspectual class of the imperfective base verbs they apply to (Brecht 1985, Janda 1985). In particular, the prefix *ZA-* shifts activities into accomplishments.

(2) a. Korabl' (* postepenno) plyl [IMP] v buxtu čas / (* za čas). [Activity]
ship gradually sailed in harbor hour in hour
'The ship gradually sailed to the harbor.'
b. Korabl' postepenno zaplyl [PRF] v buxtu (* čas) / za čas. [Accompl.]
ship gradually *ZA*-sailed in harbor hour in hour
'The ship gradually sailed into the harbor in an hour.'
(3) a. Boris (* postepenno) mučil [IMP] košku Murku čas / (* za čas) [Activity].
Boris gradually *ZA*-tortured cat Murka hour in hour
'Boris was torturing Murka the cat for an hour.'
b. Boris postepenno zamučil [PRF] košku Murku (* čas) / za čas. [Accompl.]
Boris gradually tortured cat Murka hour in hour
'Boris gradually tortured Murka the cat in an hour.'

Three types of accomplishments derived by the prefix *ZA*-:

a) **locative *ZA*-prefixed accomplishment** – denotes an event of the incremental change in the goal location. More parts of the goal location gradually become accessible in the course of the locative accomplishment event.

(4) a. Ivan zabil ^{PRF} gvozd' v stenu.
Ivan ZA-hit nail in wall
'Ivan hammered the nail into the wall.'
b. Ivan zašel ^{PRF} v les.
Ivan ZA-went in forest
'Ivan went into the forest.'

b) **resultant *ZA*-prefixed accomplishment** – denotes an event of the incremental change in the theme argument.

(5) Oleg zasypal ^{PRF} jamu peskom.
Oleg ZA-poured hole sand.INSTR
'Oleg covered the hole in the ground with sand.'

c) **inchoative *ZA*-prefixed accomplishment** – denotes an event of incremental change in the running time of the input verb. The onset stage of the event, described by the input verb, is gradually constructed in the course of the inchoative accomplishment, resulting in that event coming into existence.

(6) Computer zarabotal ^{PRF} za 10 minut
Computer *ZA*-worked in 10 minutes
'The computer started working in ten minutes.'

<u>Part III: Prefixes as Measure Functions</u>

Prefixes are extensive measure functions, which apply to some measured entity *X* (e.g., object, location, temporal trace of event) and yield a range of values for *X* with respect to some relevant ordered measure scale, so that the value of *X* is equal to (or exceeds or falls short of) some contextually predetermined value on the scale. (Filip 2003, Filip & Rothstein 2006].

(7) **Meaning of a Prefix as Extensive Measure Function**
$\lambda P \lambda$ x. P(x) $\wedge$ $MEAS_{DIM}(x)$ R N_C,
where N a contextually determined norm, R is a mathematical relation (=, $\geq$, $\leq$),
and x is a variable over individuals, events and times.

For instance, the attenuative prefix *PO*-$_{ATN}$ in Russian, defined in (8a), applies to an imperfective verb *guljat'* ^{IMP} (to walk) in (8b) and yields a delimited activity *poguljat'* ^{PRF} (to walk for a while) by restricting the running time of an input to a short temporal duration (where what counts as short is contextually determined).

(8) a. *PO*-$_{ATN}$: λPλx P(x) ∧ $MEAS_{TIME}$ (x) ≤ C_C, where C_C is relatively low value]
b. Guljal: λe.WALK(e)
PO(guljal): λe.WALK(e) ∧ t(e) ≤ C_C
c. Ivan poguljal ^{PRF}.
Ivan PO-walked
'Ivan walked for a short time'
∃e [WALK(e) ∧ Agent(e) = Ivan ∧ τ(e) ≤ C_C]

Thus, *PO-walk* in (8b) means that a walking event had a relatively short temporal duration.

Hypothesis #2:

The prefix *ZA-* sets the condition that the extent of change of an affected argument – location, object, time – is, in some sense, substantial (where what counts as substantial is contextually dependent).

(9) a. Ivan (* nemnogo) / (* blizko) / daleko zašel ^{PRF} v les
Ivan a little bit close far ZA-went in forest
'Ivan went far into the forest.'
b. Boris (* slegka) / (* čut'-čut') / do smerti zamučil ^{PRF} košku Murku.
Boris slightly a little bit till death ZA-tortured cat Murka
'Boris tortured Murka the cat to death.'
c. # Ivan zagorovil ^{PRF} i skazal ^{PRF} polslova.
Ivan ZA-talked and said half-word
'Ivan started talking and said half a word.'

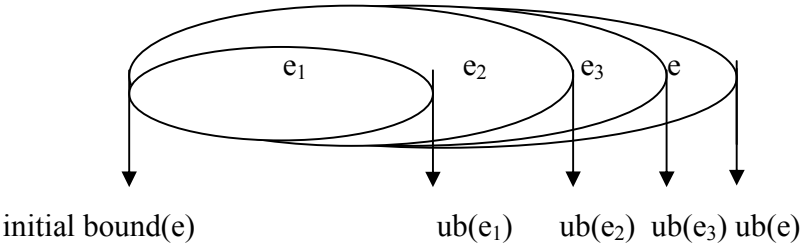
Part IV: Rothstein 2004 Theory of Accomplishments

- Accomplishments are complex events that consist of an activity subevent and event of change (extended BECOME event) that run simultaneously. The process of change is used to 'measure' the progress of the activity event.
- An activity event and an extended BECOME event are linked via an incremental relation. The incremental structure of the BECOME event is imposed on the activity, and determines the incremental structure of the event as a whole.
- An incremental structure consists of a contextually determined incremental chain, $C(e_2)$, imposed on the event of change, via the *stage of* relation holding between its subevents. A function μ maps the elements of the incremental chain onto the activity event, so that each element of e_2 is mapped onto that part of e_1, which shares its running time.

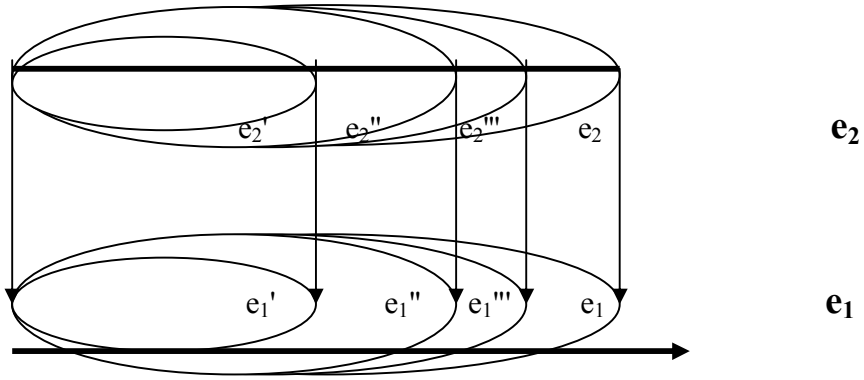
(10) **Accomplishment Template**

$$\lambda e \lambda x.\exists e_1, e_2[\ e =^{S} (e_1 \sqcup e_2) \wedge P_{ACTIVITY}(e_1) \wedge Th(e_1) = x \wedge \text{BECOME-P-ed}\ (e_2) \wedge Arg(e_2) = Th(e_1) \wedge INCR(e_1, e_2, C(e_2))]$$

(11) **An incremental chain C(e)**



(12) **Accomplishment event structure:**



(13) John built the house.

$\exists e \exists e_1,e_2[\ e =^{S} (e_1 \sqcup e_2) \wedge \text{BUILD}(e_1) \wedge \text{Agent}(e_1) = \text{John} \wedge \text{Th}(e_1) = \text{the house}$
$\wedge\ \text{BECOME BUILT}\ (e_2) \wedge \text{Arg}(e_2) = \text{Th}(e_1) \wedge \text{INCR}(e_1, e_2, C(e_2))]$

there was a single accomplishment event of building with John as its agent and the house as its theme, which is the sum of two subevents: an activity of building and an event of becoming built, which are incrementally related, and the theme of an activity event is the argument of BECOME BUILT event.

The basic accomplishment template in (10) can be extended to account for additional subtypes of accomplishment events. Rothstein 2004 provides the following examples of derived resultative accomplishments in English.

(14) a. John sang for an hour. [Activity]
b. John sang the baby asleep in an hour. [Accomplishment]
c. John danced for an hour. [Activity]
d. John danced himself sick in an hour. [Accomplishment]

In the examples above, accomplishment events are derived from activity events by adding the result state at the culmination of an event (such as baby being asleep) that allows constructing an incremental chain of stages for the BECOME event of change.

Another modification of Rothstein 2004 accomplishment theory allows accounting for the cases of failed-attempt accomplishments in Russian, as illustrated in Tatevosov & Ivanov 2007.

(15) a. Ivan otkryval [IMP] zamok.
Ivan opened lock
'Ivan was opening the lock.'
b. Ivan pootkryval [PRF] zamok.
Ivan PO-opened lock
'Ivan tried to open the lock for some time.'

In examples like (15a), the activity subevent and the BECOME event of change do not share their running times, and the actual change occurs at the last instant of the activity event. Thus, the failed attempt interpretation arises in (15b) with the prefix PO-.

Part V: Formal Analysis of *ZA*-prefixed Accomplishments

The semantic analysis of *ZA*-prefixed accomplishments in Russian is based on the following modifications of the Rothstein 2004 theory of accomplishments:

- The prefix *ZA*- adds a general extended incremental event of change - BECOME ESTABLISHED - to the input activity event.
- The incremental chain of the BECOME ESTABLISHED event of change is not entirely contextually constructed, but is rather associated with a closed linearly ordered measure scale. The dimension of the scale and the units of measure are determined both contextually and from the lexical meaning of the input verb.

Definition of the Closed Measure Scale

S_A is a scale along a dimension DIM_A, if S_A is a set of degrees DEG_A, such that:

a. $\forall d_1 d_2 \in |DEG_A| (d_1 < d_2 \vee d_2 < d_1 \vee d_1 = d_2)$

For every two degrees which are in the set of degrees DEG_A, either d_1 preceeds d_2 or d_2 preceeds d_1 or d_1 is equal to d_2.

b. $\exists d \exists d' [(d \in |DEG_A| \wedge (d < d' \vee d' < d)) \rightarrow d' \in |DEG_A|]$

if a degree d is in the set of degrees DEG_A and stands in a partial order relation with d', then d' is also in the set of degrees DEG_A.

c. $\exists d \in |DEG_A| : d = 0 \wedge \neg \exists d'\ d' < 0$

The smallest degree on the scale is zero.

d. $\exists d\ \forall d' [d' \in |DEG_A| \wedge d' \leq d]$

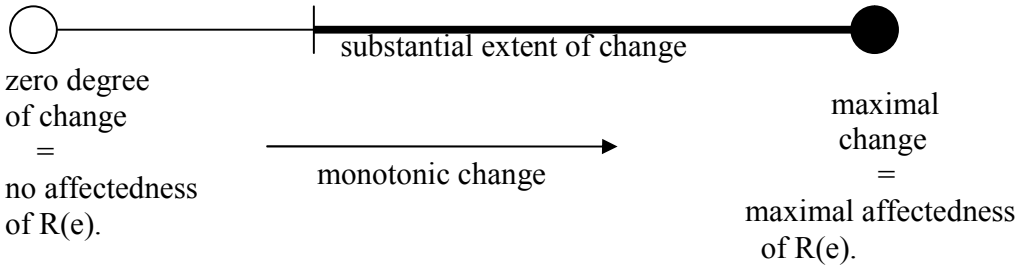
There is a maximal degree on the scale (i.e., the scale is closed).

- the prefix *ZA*- restricts the extent of affectedness of the argument of BECOME ESTABLISHED event to a relatively high value on the scale.
- The BECOME ESTABLISHED event of change takes three different arguments: (i) a theme (in resultant accomplishments); (ii) a goal (in locative accomplishments) (iii) a temporal trace of an event (in inchoative accomplishments).

(16) **Establishment Accomplishment Template**

$\lambda R \lambda x_{1....} x_N \, \lambda P \lambda e. \exists e_1, e_2 [\, e =^S (e_1 \sqcup e_2) \wedge P_{ACT./STATE}(e_1) \wedge \theta_{1...N}(e_1) = x_{1.....} x_N$
$\wedge$ BECOME ESTABLISHED(e_2) $\wedge$ Arg(e_2) = R(e_1) $\wedge$ INCR (e_1, e_2, C(e_2))
$\wedge$ $MEAS_{CON}$R(ub(e)) = SUBSTANTIAL],
where R(e_1) is either Goal(e_1) or Theme(e_1) or $\tau(e_1)$.

(17) **A Closed Measure Scale of the BECOME ESTAB Event of Change**



(18) ***Establishment*** **Accomplishment Shift**
ZA-SHIFT ($\lambda R \, \lambda x_{1....} x_N \, \lambda P(P_{ACT./STATE}(e) \wedge \theta_{1...N}(e) = x_{1.....} x_N) \wedge R(e)) =$

$= \lambda R \lambda x_{1....} x_N \, \lambda P \lambda e. \exists e_1, e_2 [\, e =^S (e_1 \sqcup e_2) \wedge P_{ACT./STATE}(e_1) \wedge \theta_{1...N}(e_1) = x_{1.....} x_N$
$\wedge$ BECOME ESTABLISHED(e_2) $\wedge$ Arg(e_2) = R(e_1) $\wedge$ INCR (e_1, e_2, C(e_2))
$\wedge$ $MEAS_{CON}$R(ub(e)) = SUBSTANTIAL],
where R(e_1) is either Goal(e_1) or Theme(e_1) or $\tau(e_1)$.

(19) Ivan zašel ^{PRF} v les
Ivan ZA-walked in forest
'Ivan walked into the forest'.

$\exists e \exists e_1, e_2 [\, e =^S (e_1 \sqcup e_2) \wedge$ WALK(e_1) $\wedge$ Agent(e_1) = Ivan $\wedge$ Goal(e_1) = forest
$\wedge$ BECOME ESTAB(e_2) $\wedge$ Arg(e_2) = Goal(e_1) $\wedge$ INCR(e_1, e_2, C(e_2))
$\wedge$ $MEAS_{DISTANCE}$GOAL(ub(e)) = SUBSTANTIALLY FAR]

there was an *establishment* accomplishment event with Ivan as its agent and forest as its goal, which consists of a sum of the incrementally related subevents: the walking activity and the incremental event of change, BECOME ESTAB, and a goal of the walking event is the argument of the BECOME ESTAB event, and the extent of going into the forest is big at the culmination of the given event.

(20) Varen'je zagustelo ^{PRF}.
Jam ZA-thickened
'The jam thickened.'

$\exists e. \exists e_1, e_2 [\, e =^S (e_1 \sqcup e_2) \wedge$ THICKEN(e_1) $\wedge$ Theme(e_1) = Jam
$\wedge$ BECOME ESTAB(e_2) $\wedge$ Arg(e_2) = Theme(e_1) $\wedge$ INCR(e_1, e_2, C(e_2))
$\wedge$ $MEAS_{DENSITY}$Theme(ub(e)) = SUBSTANTIALLY THICK]

there was an establishment accomplishment event with *jam* as its theme, which consists of a sum of the incrementally related subevents: the activity of becoming thicker and the incremental event of change, BECOME ESTAB, and the theme of the become thicker event is the argument of the BECOME ESTAB event, and the extent of jam thickening is substantial at the culmination of the given event.

(21) Computer zarabotal [PRF].
Computer ZA-worked
'Computer started working.'

$\exists e.\exists e_1,e_2[\ e =^{S} (e_1 \sqcup e_2) \wedge \text{WORK}(e_1) \wedge \text{Agent}(e_1) = \text{Computer}$
$\wedge\ \text{BECOME ESTAB}(e_2) \wedge \text{Arg}(e_2) = \tau(e_1) \wedge \text{INCR}(e_1, e_2, C(e_2))$
$\wedge\ \text{MEAS}_{\text{TIME}}\ \tau(\text{ub}(e)) = \text{SUBSTANTIAL}]$

there was an establishment accomplishment event with computer as its agent, which consists of a sum of the incrementally related subevents: the activity of working and the incremental event of change, BECOME ESTAB, and the temporal trace of the activity event is the argument of the BECOME ESTAB event, and the duration of the working event is long enough to be recognized as such.

Part VI: The Prefix *ZA*- and the Lexical Argument Structure of the Input Verbs

The BECOME ESTABLISHED event of change, introduced by the prefix *ZA*-, can take three different constituents of an event as its argument: goal, theme and a temporal trace of an event. This results in three various interpretations of *ZA*-prefixed accomplishments: locative, resultant and inchoative.

Hypothesis #3:

The choice of the argument by the incremental event of change is not random. The prefix *ZA*- is sensitive to the lexical argument structure of its input verb (Paillard 2004). The three elements – goal, theme and temporal trace – stand in a thematic hierarchy relation in (22). The BECOME ESTABLISHED event of change picks a highest element in the hierarchy, available in the lexical argument structure of a given input verb. The temporal trace element is available for all verbs, since all events have a temporal existence.

(22) **Thematic hierarchy:** GOAL > THEME > τ(e)

Predictions for the distribution of meanings of *ZA*-:

- A verb with an obligatory goal argument can only acquire a locative interpretation with *ZA*-. Examples of this category of verbs are determinate motion verbs, such as *bežat'*(to run) in Russian.

(23) Ivan zanes [PRF] rubašku v komnatu.
Ivan ZA-carried shirt in room.GOAL
'Ivan carried the shirt into the room.' Locative Interpretation

- A verb with an obligatory theme argument (and which does not allow a goal argument) can only acquire a resultant interpretation with *ZA*-. Examples of this category are the C*hange of State* class of verbs, such as *ržavet'* IMP (to become rusty).

(24) Gvozd' zaržavel PRF.
Nail.THEME ZA-became rusty
'The nail became rusty.'

- A verb that does not allow either Goal or Theme argument in its lexical argument structure can only acquire an inchoative meaning with *ZA*-. Examples of this category are verbs of sound, such as *govorit'* IMP (to speak), and verbs of color, such as *zelenet'* IMP in Russian.

(25) a. Ivan zagovoril PRF.
Ivan ZA-talked
'Ivan started talking.'
b. Les zazelenel PRF na gorizonte.
Forest ZA-looked green on horizon
'Forest looked green on the horizon.'

- A verb that allows alternations in its lexical argument structure also acquires alternative meanings with *ZA*-.

(26) a. Ivan zasypal PRF pesok v jamu.
Ivan ZA-poured sand in hole.GOAL
'Ivan poured all the sand into the hole.'
b. Ivan zasypal PRF jamu.
Ivan ZA-poured hole.THEME
'Ivan filled the hole up by pouring.'
c. Zasypal PRF sneg.
ZA-poured snow.AGENT
'It started snowing.'

(27) a. Ivan zabil PRF gvozd' v stenu.
Ivan ZA-hit nail in wall
'Ivan hammered the nail into the wall.'
b. Ivan zabil PRF sobaku palkoj.
Ivan ZA-hit dog with stick
'Ivan beat the dog to death with a stick.'
c. Ivan zabil PRF po gvozdju molotkom.
Ivan ZA-hit in nail with hammer
'Ivan started hammering the nail with the hammer.'

Part VII: Conclusions

1) the prefix *ZA*- is a lexical shift operator, which derives a subtype of accomplishment events in Russian - *establishment* accomplishments. The incremental event of change, BECOME ESTABLISHED, introduced by the prefix *ZA*-, comes with a closed measure scale, which governs the construction of an incremental chain.

2) the prefix *ZA*- acts as a measure function, requiring that the incremental argument is substantially affected at the culmination point of an event. For locative accomplishments, it is interpreted as going far into the given location; for resultant accomplishments, the theme is significantly affected in the course of an event; and for inchoative accomplishments, the temporal duration of a given event is long enough for it to come into existence.

3) The *establishment* accomplishments are divided into three particular cases – locative, resultant and inchoative accomplishments, depending on the lexical argument structure of an input verb. The prefix *ZA*- is sensitive to the hierarchy of the goal and theme arguments and in their absence applies by default to a temporal trace of event.

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