# The prepositional aspect of Slavic prefixes and the goal-source asymmetry

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**abstract**. The aim of this paper is twofold. First, I will apply the framework of prepositional aspect, proposed by Zwarts (to appear) for English locative and directional prepositions, to the semantics of Russian and Czech prefixes on motion verbs. Furthermore, I will extend the account of measure phrase modification with locative PPs provided by Winter & Zwarts (2000) and Winter (2004) to directional PPs. I will show that an apparent aspectual asymmetry between Czech goal- and source-oriented prefixes addressed in Filip (2003), namely that only the latter but not the former can be modified by measure phrases, is more fine-grained in that it follows from the semantics of spatial expressions rather than from an aspectual opposition between these two types of prefixes. Specifically, I will show that there is, in fact, no aspectual difference: both types are telic.

## 1    introduction

Matushansky (2000) convincingly argues for a single category P for Russian prefixes and prepositions and shows that they have the same morpho-phonological status; apparent semantic differences (i.e. aspectual prefixes vs. predicational prepositional phrases) are thus direct consequences of the immediate syntactic context – attachment to VP or DP/CP – rather than due to a difference between prefixes and prepositions per se. Furthermore, nearly all Slavic prefixes can be used as or are homophonous to prepositions. Their meaning is fairly spatially transparent in most cases and only occasionally there is a deviation from the prepositional meaning. This motivates a treatment of the semantics of Slavic prefixes in the framework of vector space semantics developed in Winter & Zwarts (2000), and more specifically, the proposal of prepositional aspect for directional prepositions in Zwarts (to appear). I will demonstrate this by focusing on Russian and Czech prefixes on motion verbs.

Section 2 outlines Zwarts' (to appear) framework for prepositional aspect. Section 3 presents apparent counter-examples to this model that have to do with an asymmetry between goal- and source-oriented prefixes in combination with measure phrase modifiers. After outlining some basic assumptions about aspect and Slavic in section 4, section 5 applies Zwarts' framework to Slavic goal- and source-oriented prefixes on motion verbs. This analysis leads to the conclusion that the asymmetry observed in section 3 is not aspectual in nature. Section 6 shows that it follows from the semantics of spatial expressions and specifically from the different nature of the particular result states.

## 2    prepositional aspect in Zwarts (to appear)

In exploring parallelisms with the nominal and verbal domain, Zwarts (to appear) divides spatial prepositions into locative (stative) and directional (dynamic) ones, where the latter can be telic, atelic or (a)telic.[2] The denotation of a directional PP is treated as an algebraically structured set of paths (see also Winter & Zwarts (2000)):

(1)    A **path** is a function of type iv *from the real interval* $[0,1] \subset \mathbf{R}$ *(type* i*) to vectors (type* v*).*

Directional Ps map the reference object (the complement of P, which is the GROUND in Talmy's terms) to a set of sequences of vectors (paths), where each of these sequences determines a potential change in position of the located object (the FIGURE).

Zwarts convincingly shows that the distinguishing property between telic and atelic reference in the prepositional domain is cumulativity (closure under sums) rather than

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[2] The semantics of locative prepositions is more precisely addressed in Winter & Zwarts (2000) (see also section 6). For the complete definitions for prepositional aspect and vector space semantics, the reader is referred directly to Zwarts (to appear), 34f., and Winter & Zwarts (2000), 208ff.

divisivity or quantizedness. A PP is bounded (telic) iff it does not have cumulative reference, which is defined in the following way (with **p** and **q** as variables over paths):

(2) *A set of paths* **X** *is* **cumulative** *iff*                    (Zwarts (to appear), p. 12)
   (i)   *there are* **p** *and* **q** ∈ **X** *such that* **p+q** *exists and*
   (ii)  *for all* **p**, **q** ∈ **X**, *if* **p+q** *exists, then* **p+q** ∈ **X**.

The crucial operation involved here is concatenation (closure under sums), which is a partial operation subject to the condition that the second path has to start where the first path ends. Atelic PPs are then closed under sums whereas telic PPs are not. Examples are:

(3)   a.   *bounded, telic*:          to, into, onto, from, out of, off, away from, past, via
      b.   *unbounded, atelic*:       towards, along
      c.   *(un)bounded, (a)telic*:   across, around, down, over, through, up

The route prepositions (in the sense of Jackendoff (1983)) in (3) c. together with *past*, *via* and *along* are not relevant for this paper, since I will only concentrate on source- and goal-oriented prepositions. Source- and goal-oriented prepositions specify where the path starts and ends, respectively. For example, Zwarts defines *into* as a transition from one phase to another:[3]

(4)   [[ into the house ]] = { **p**: there is an interval $I \subset [0,1]$ that includes 1 and that consists
      of all the indices $i \in [0,1]$ for which **p**($i$) is inside the house }

*To* and *onto* are defined in a parallel fashion where the result is AT and ON (instead of INSIDE), respectively. These three goal-expressions are not cumulative, as they contain no paths that can be concatenated. For example, there are no two paths in the denotation of *to* that can be concatenated, since the end-point of a *to*-path is always outside the reference object whereas the starting-point never is.

The source-oriented prepositions *out of*, *from* and *off* do not contain any paths that can be concatenated, either, and are thus non-cumulative as well; they are therefore defined as the reverse of the goal-oriented ones. A full list of these definitions is given in (5):

(5)   { **p**: there is an interval $I \subset [0,1]$ including…
      … 0 and consisting of all the $i \in [0,1]$ for which **p**($i$) is at x } = [[ from x ]]
      … 0 and consisting of all the $i \in [0,1]$ for which **p**($i$) is on x } = [[ off x ]]
      … 0 and consisting of all the $i \in [0,1]$ for which **p**($i$) is in x } = [[ out of x ]]
      … 1 and consisting of all the $i \in [0,1]$ for which **p**($i$) is at x } = [[ to x ]]
      … 1 and consisting of all the $i \in [0,1]$ for which **p**($i$) is on x } = [[ onto x ]]
      … 1 and consisting of all the $i \in [0,1]$ for which **p**($i$) is in x } = [[ into x ]]

To sum up, route prepositions are aspectually ambiguous, whereas *towards* and *along* are the only atelic (unbounded) prepositions. Hence, apart from *towards*[4], all goal- and source-oriented prepositions in Zwarts' system are telic. Such an account stands in sharp contrast to proposals by Nam (2004) and Filip (2003), who argue for an aspectual difference between source- and goal-oriented PPs. The next section will primarily focus on Filip's line of reasoning.

## 3   An apparent problem for Zwarts (to appear): the goal-source asymmetry

On the basis of certain syntactic behaviour and the compatibility with adverbials, among others, it has been observed that goal- and source-oriented prepositions, particles, and

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[3] Throughout the paper, I will confine myself to cases with simple definites as complements of P. Suggestions for how plurality and mass nouns can be handled in this approach are found in Winter & Zwarts (2000) and Zwarts (to appear).
[4] *Towards* is defined as the comparative of *to*: [[ towards the gate ]] = { **p**: **p**(1) is nearer to the gate than **p**(0) }.

prefixes display syntactic and semantic asymmetries. This led Nam (2004), for example, to claim that goal-oriented PPs like *into the store* are generated under the lower VP of the extended VP-structure (in Pustejovsky's (1991) sense) and compose a result state sub-event; Source-oriented PPs (e.g. *from the store*) in his system are generated under the higher VP, modifying a process sub-event. Thus, goal-oriented PPs induce telicity whereas source-oriented ones do not. Filip (2003) makes a similar claim based on the fact that Czech source-oriented prefixes combine with measure expressions such as *a metre* or the prefix *po-* with the meaning 'a bit', whereas both are ungrammatical on verbs with goal-oriented prefixes:

(6) a. ***Po-vy-táhl***        *káru*    *z*    *příkopu.*       (= (49) b. in Filip (2003), p. 94)
       PO-OUT-drag.PF.PAST cart.ACC from ditch.GEN
       'He dragged the cart out of the ditch a bit.'

     b. ***\*Po-do-táhl***       *káru*    *do příkopu.*       (= (50) b. in Filip (2003), p. 94)
       PO-(IN)TO-drag.PF.PAST cart.ACC (in)to ditch.GEN
       'He dragged the cart (in)to the ditch a bit.'

As a result, she claims that only goal- but not source-oriented prefixes yield telic predicates:

(7)    **Goal-Source Telicity Asymmetry**: The spatial orientation of directional modifiers determines the telicity status of a derived predicate. Source-modifiers form atelic (homogeneous) predicates. Goal-modifiers form telic predicates.    (Filip (2003), p. 79)

In the spirit of Rothstein (2003), Filip defines telicity in a way that presupposes the criterion of contextually determined atomicity:

(8)   *A verbal predicate is **telic** if it denotes either*             (Filip (2003), p. 61)
     (i)   *a set* $P_C$*, i.e., a set of single atomic events contextually restricted by* t *(a time index) and* M *(a measure statement for* P*), or*
     (ii) *a plural set of atomic events of a definite cardinality.*
     *Otherwise the predicate is atelic.*
     M: $\forall e\,[\,P(e) \wedge Q(e) \rightarrow |e| = 1]$*, where* Q *is a context-dependent variable.*

Hence, telicity involves the identification of atomic events relative to a given context of use.

     There is obviously a crucial difference in the definitions of telic and atelic predicates between Zwarts and Filip. Zwarts defines atelicity in a strictly semantic way, where the crucial property of atelic prepositions is cumulativity; Filip, on the other hand, provides a positive definition for telicity, which is largely determined by pragmatics.[5] To contribute to the general discussion about the nature of telicity, the following sections will outline some basic assumptions about aspect and Slavic before proposing several diagnostics for telicity.

## 4   Basic assumptions

### 4.1   Inner and outer aspect

     I will follow a standard assumption about the distinction between two different aspectual levels, namely inner aspect and outer aspect (e.g. Smith (1991/97)). Inner aspect is associated with predicates that are atelic or telic (lexical aspect), whereas outer aspect is responsible for a temporal boundedness reading at the sentence level (grammatical imperfective vs. perfective aspect). I will assume that telicity is syntactically represented in terms of a result state sub-event in a tripartite event structure, as given in Ramchand (2004)[6]:

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[5] Nam even has a third approach to telicity in not defining it strictly semantically but linking it to resultativity and thus to the structure of events, where telic events contain a result state sub-event.

[6] To be more precise, for Ramchand, a result state sub-event in the event structure is just one way to bring about telicity; other means include verbs of creation and consumption in combination with a quantized DP, among others. The Slavic verbs described in this paper will be argued to involve a result state sub-event so I will not further go into cases where a telic interpretation arguably arises in a different way.

(9)     (causing sub-event) → [process sub-event → (result state)]
                vP                          VP                      RP

DPs in the specifier positions of the phrases vP, VP and RP have the interpretation of INTIATOR, UNDERGOER and RESULTEE (holder of the result state), respectively, where one and the same DP can appear in various of these positions via movement. For example, the structure of a sentence like *he threw the dog out the door* could be described as *he caused the dog - by throwing - to be outside the door*. Telicity is thus a property of the VP, which constitutes an event. Grammatical aspect, on the other hand, is located higher in the tree and so is any further aspectual modification by adverbs and the like.

An open question is whether the kind of boundedness at the VP level (telicity) is semantically the same we obtain at the level of outer aspect (temporal boundedness, i.e. perfectivity). There are approaches that view both as semantically distinct (e.g. Filip (1993/99), Borik (2002)) and others postulating a mere syntactic but not semantic difference (e.g. Borer (2005), Arsenijević (2004)). I will follow the intuition that both are syntactically and semantically distinct where telicity is crucially atemporal in nature and rather related to contingency along the lines of Moens & Steedman (1988).

## 4.2    Slavic grammatical aspect[7]

All Slavic languages have an obligatory grammatical verbal category of aspect in the sense that each Slavic verb form is either perfective or imperfective. There are at least two criteria to set Russian (and Czech) perfective verbs apart from imperfective ones. First, only imperfective but not perfective verbs can combine with phase verbs such as *start* or *stop*:

(10)    *On      načal         pisat'        / *na-pisat'    / *po-pisat'   pis'mo.*    Russian
          he.NOM begin.PF.PAST write.IPF. INF / *ON-write.PF  / *PO-write.PF letter.ACC
          'He began writing a / the letter.'

Second, only imperfective but not perfective verbs derive periphrastic future forms:

(11)    *On      budet pisat'      / *na-pisat'    / *po-pisat'   pis'mo.*               Russian
          he.NOM will   write.IPF. INF / *ON-write.PF  / *PO-write.PF letter.ACC
          'He will write a / the letter.'

Perfectivity, an instance of grammatical aspect, is clearly different from telicity since predicates described by perfective verbs can be either telic (resultative) or atelic, a point which will become clearer in the next section.

Aspectual information on the verb can be provided by perfectivizing prefixes or imperfectivizing suffixes (less often imperfectivizing vowel alternation), with most morphologically simple verbs being imperfective (but see the first example in (12) b.):

(12)    a.    ipf. ***spat'*** > pf. ***po-spat'*** – 'to sleep'                            Russian
              ipf. ***pisat'*** > pf. ***po-pisat'*** – 'to write'
              ipf. ***pisat'*** *pis'mo* > pf. ***na-pisat'*** *pis'mo* – 'to write a / the letter'
        b.    pf. ***dat'*** > ipf. ***da-va-t'*** – 'to give'
              pf. ***pod-pisat'*** > ipf. ***pod-pis-yva-t'*** – 'to sign (lit. under-write)'
              pf. ***iz-dat'*** > ipf. ***iz-da-va-t'*** – 'to edit (lit. out-give)'
        c.    ipf. ***vy-da-va-t'*** *knigi* > pf. ***po-vy-da-va-t'*** *knigi* – 'to give out / distribute (the) books'

As can be seen from these few examples, there is no uniform marking of the perfective or the imperfective aspect, in the sense that not every imperfective verb form contains a suffix and not every perfective verb form contains a prefix. Rather, there are a variety of possible combinations of verbal affixes, including the stacking of several prefixes or the co-occurrence

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[7] This section concentrates on Russian data but the same holds for Czech unless explicitly stated otherwise.

of prefixes and suffixes on one and the same verb form.[8] This fact defies the picture of Slavic prefixes as either grammatical perfectivity markers or telicity markers. The suffixes, on the other hand, always mark grammatical imperfectivity, which – again – does not mean that all imperfective verb forms contain a suffix (see (12) a.).

### 4.3 Testing telicity in Slavic

The various tests for the telicity value of a predicate that have been proposed in the literature are all restricted in isolation. Nevertheless, they can be used as a good indication and taken together should be efficient in testing whether a predicate is telic or not, in particular if one controls for coercion and other meaning effects. I will use two telicity tests for Slavic: the (in)compatibility with temporal adverbials of the type *for an hour* and *in an hour* and an entailment test of the sort *x Ved (y)* as (not) entailing *x no longer Vs (y)*.

Probably the most common diagnostics to show whether a predicate is telic or not, is the compatibility with temporal adverbials. Atelic predicates are only compatible with *for*-adverbials but not with *in*-adverbials, whereas the opposite holds for telic predicates. So a predicate containing the Russian perfective verb *ot-kryt'* – 'to open, dis-cover' behaves like a telic one and is only compatible with *in*-adverbials[9]:

(13)   *On **ot-kryl**        okno          *(za) dva časa.*                    **telic**
        he  open.PF.PAST window.ACC  *(in) two hours

This is not necessarily the case with all perfective or all prefixed verb forms, which I will take as an indication that the temporal adverbial test in Slavic is in fact sensitive to inner rather than outer aspect (but see Filip (2003) for a different view):

(14)   *On **po-spal**           (*za) dva časa.*                                **atelic**
        he  PO-sleep.PF.PAST (*in) two hours

Another test used in the literature for English is the fact that with atelic but not with telic predicates, a sentence in the present progressive entails the same sentence in the simple past; e.g. the atelic *he is sleeping* entails *he slept*, whereas the telic *he is drawing a picture* does not entail *he drew a picture*. In order for such a test to be applicable to Slavic languages, which do not have a progressive tense, it has to be reversed (see Borik (2002)): A sentence with a telic predicate describing a situation in the past entails that the situation does not hold anymore in the present. This is true for all predicates with telic prefixes but not for those with atelic ones as (15) shows for Russian:

(15)   a.   *Ja **na-pisal**[p] pis'mo.*   **entails** *Ja (uže) ne **pišu**[i] pis'mo.*                    **telic**
              I ON-write.PAST letter.ACC      I (anymore) not write.PRES letter.ACC

        b.   *Ja **po-pisal**[p] pis'mo.*   **doesn't entail** *Ja (uže) ne **pišu**[i] pis'mo.*            **atelic**
              I PO-write.PAST letter.ACC                 I (anymore) not write.PRES letter.ACC

Equipped with these diagnostics, we can now apply Zwarts' ideas about prepositional aspect to Slavic spatial prefixes and test whether the apparent goal-source asymmetry is aspectual.

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[8] A Czech example of stacking where a prefix applied to an already perfective verb was given in (6). Applying a prefix to a perfective verb without first imperfectivizing it is not possible in Russian.
[9] This is so only if such verbs are not further modified at a higher level by the imperfectivizing suffix, which derives a SECONDARY IMPERFECTIVE. SECONDARY IMPERFECTIVES are compatible with both types of adverbials depending on the context, the structural position the adverbial attaches to and thus the particular scope facts. However, this is a topic of another paper.

## 5 Applying Zwarts (to appear) to Slavic goal- and source-oriented prefixes

The following table contains the Russian and Czech counterparts to most of the English goal- and source-oriented prepositions dealt with in Zwarts (to appear):

**(16) Russian and Czech goal- and source-oriented prepositions:**

| Russian | Czech | |
|---|---|---|
| *do* (+ GEN), *k* (+ DAT) | *do* (+ GEN), *k* (+ DAT) | to, towards |
| *v* (+ ACC) | *do* (+ GEN) | into |
| *ot* (+ GEN) | *od(e)* (+ GEN) | (away) from |
| *iz* (+ GEN) | *z* (+ GEN) | out of |

The only apparent difference between Russian and Czech is the preposition used for *into*, since Czech does not make a difference between *to* and *into*. Apart from Russian and Czech *k* (+ DAT) 'to(wards)' and Russian *v* (+ ACC) 'into', all of these prepositions can appear in directional or locative contexts; moreover, Russian *v* conveys the locative meaning of 'in' when it selects prepositional case[10], and in this case Czech also uses *v(e)* (+ PREP).

In combination with motion verbs, there are direct prefixal counterparts to all prepositions that can have a locative meaning but not to the only purely directional one, *k*. Furthermore, there are other prefixes, which are in some cases preferred over the direct counterparts to render the particular meaning of goal and source:

**(17) Russian and Czech goal- and source-oriented prefixes:**

| Russian | Czech | |
|---|---|---|
| *do-, pri-, *k-* | *do-, při-, *k(e)-* | to |
| *v(o)-* | *do-* | into |
| *ot-, u-* | *od(e)-, u-* | (away) from |
| *iz-, vy-* | *vy-* | out of |

The prepositional counterparts of these other prefixes convey a different meaning though. For example, the prefix *u-* with the meaning 'away (from)' has the prepositional counterpart *u* (+ GEN) 'at', and the prepositional counterpart to the prefix *pri-* (*při-*) 'to' is *pri* (*při*) (+ PREP) 'by'. This is quite interesting in the light of the fact that Zwarts (to appear) integrates the locative preposition *at* in the definition of the directional PPs *from x* and *to x* in (5). I will come back to this point in the sections 6.2 and 7. In combination with verbs with a directional meaning (also metaphorically), these prefixes always convey the meaning 'away' (*ustupit'* 'step away / aside') or 'to' (*privyknut'* 'to get used to').

With respect to the diagnostics for telicity discussed in the previous section, VPs containing verbs with either source- or goal-oriented prefixes behave like telic ones. This is shown for Russian *pri-* 'to' and *u-* 'away' in (18), as well as for the predicates in Filip's Czech examples (6), which contain *vy-* 'out' and *do-* 'into, to' in (20).

First, let us consider the compatibility with *in-* and *for-*adverbials in Russian:

(18)   a.    *On    **pri**-letel<sup>P</sup>   v Moskvu    **\*den' / za den'** (do prazdnika).*    Russian
             he.NOM TO-fly.PAST in Moscow.ACC \*day.ACC / in day.ACC to holiday.GEN
             'He arrived in Moscow (by plane) \*for a day / a day before the holiday.'

        b.    *On    **u**-letel<sup>P</sup>     iz Moskvy       **\*den' / za den'** (do prazdnika).*
             he.NOM AWAY-fly.PAST out-of Moscow.GEN \*day.ACC / in day.ACC to holiday.GEN
             'He left Moscow (by plane) \*for a day / a day before the holiday.'

For some reason, the *in-*adverbial is only acceptable with the additional PP *do prazdnika* and the meaning we get is something like 'within a day before the holiday'. However, in this case

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it is not the time of the event itself anymore that gets measured. This is due to the fact that Slavic motion verbs prefixed with either *pri-* 'to' or *u-* 'away' describe punctual events (achievements) of arriving or leaving. There is a general problem of achievements in combination with temporal adverbials, and the same effect arises in English: *He left / arrived in a day*. However, predicates involving such events are generally taken to be telic; in any case, they meet both Filip's and Zwarts' definitions of telicity as either involving atomicity or non-cumulativity, respectively. Furthermore, both Russian goal- and source-oriented prefixes in (18) behave exactly the same in this respect so there is no asymmetry. That these predicates should be considered telic is indicated by the fact that they are incompatible with *for*-adverbials. In addition to this, they pass the telicity entailment test:

(19)  a.  *On **pri**-letel$^P$ v Moskvu.* **entails** *On **uže ne**    **pri**-letaet$^i$   v Moskvu.*    Russian
          he  more not TO-fly.PRES in Moscow
      b.  *On **u**-letel$^P$ iz Moskvy.* **entails** *On **uže ne**   **u**-letaet$^i$        iz Moskvy.*
          he  more not AWAY-fly.PRES out of Moscow

The entailments should be understood in the sense that the unique event of arriving in / leaving Moscow mentioned in the past tense sentence no longer takes place (in the present).

The Czech examples display telic diagnostics with respect to both tests due to their describing accomplishments rather than achievements:

(20)  a.  ***Vy-táhl$^P$***       *káru    z    příkopu    *(za) hodinu.*              Czech
          OUT-drag.PAST cart.ACC from ditch.GEN *(in) hour.ACC
          'He dragged the cart out of the ditch (in / *for) an hour.'
      a'. ***Do-táhl$^P$***       *káru    do    příkopu    *(za) hodinu.*
          (IN)TO-drag.PAST cart.ACC (in)to ditch.GEN *(in) hour.ACC
          'He dragged the cart (in)to the ditch (in / *for) an hour.'

      b.  ***Vy-táhl$^P$** káru z příkopu.*    **entails**  *Už **ne-vy-tahuje$^i$** káru z příkopu.*
          anymore not-OUT-drag.PRES cart out of ditch
      b'. ***Do-táhl$^P$** káru do příkopu.* **entails**  *Už **ne-do-tahuje$^i$** káru do příkopu.*
          anymore not-(IN)TO-drag.PRES cart into ditch

Hence, I conclude that both source- and goal-oriented prefixes in Russian and Czech are telic. This in turn means that the asymmetry in Filip's example (6), namely that only source- but not goal-oriented prefixes are compatible with the prefix *po-*, functioning as a measure phrase modifier, cannot be related to a general aspectual asymmetry anymore. However, this asymmetry still needs to be addressed and this will be done in the next section.

## 6  The nature of the goal-source asymmetry

Winter & Zwarts (2000) and Winter (2004) address measure phrase modification of locative but not directional PPs. For example, a locative PP like *behind the house* is associated with the set of vectors that go from the house to points behind it by a process called the location function (of type *e(vt)*). This function derives sets of located vectors for locatives, mapping an e-type denotation of the reference object to a vector that describes its location or dimension. The modified PP *5 metres behind the house*, then, is a simple composition, namely the intersection of two sets of vectors (those that are five metres long and those that are behind the house).

In the following, I will extend Winter & Zwarts' (2000) account to directional PPs and relate the asymmetry in Filip's example to a difference between the kinds of result states we get with source- and goal-oriented prefixes in Slavic. A crucial assumption underlying this approach, therefore, is that all telic VPs have a result state sub-event in their event structure. It is this sub-event that the asymmetry will be related to.

## 6.1 The modification condition (Winter & Zwarts (2000))

Following Winter & Zwarts (2000), for a locative preposition to be modified by a measure phrase it has to be both upward and downward monotone:

(21) **Modification Condition:** *A set of located vectors $W \subseteq V \times V$ satisfies the modification condition iff W is* VMON↑, VMON↓ *and non-empty.*

This condition incorporates the fact that modification using measure phrases is possible only if the modified set of non-zero vectors and the intersection of the two sets does not lead to an empty set.

The relevant notion of monotonicity is defined as follows (with **u** and **v** as variables over located vectors):

(22) **vector monotonicity:** *Let P be a prepositional function and $X \subseteq D_{pt}$.*
a. *P is* **upward vector-monotone** *over x* (VMON↑) *iff*
$\forall A \in X \ \forall \mathbf{u}, \mathbf{v} \in D_v \ [\mathbf{u} \leq \mathbf{v} \rightarrow (P(A)(\mathbf{u}) \rightarrow P(A)(\mathbf{v}))].$
b. *P is* **downward vector-monotone** *over x* (VMON↓) *iff*
$\forall A \in X \ \forall \mathbf{u}, \mathbf{v} \in D_v \ [\mathbf{u} \leq \mathbf{v} \rightarrow (P(A)(\mathbf{v}) \rightarrow P(A)(\mathbf{u}))].$

The intuition behind this definition is that of truth preservation when the located object gets further from / closer to the reference object. Furthermore, Winter & Zwarts (2000) state the following universal:

(23) **Universal:** *All simple locative prepositions in natural language are downward monotone.*

Thus, to determine, whether a locative PP can be modified by a measure phrase or not, it is enough to concentrate on upward monotonicity.

Examples for upward monotone locative prepositions and those that are not upward monotone are the following:

(24) VMON↑: in front of, behind; above, over, below, under; beside; outside
not VMON↑: near, on, at; inside, in; between

For example, *outside* is upward monotone: when a vector that points to x is in the denotation of outside A, then also any lengthening of this vector is in the denotation of outside A. This does not hold for *inside* though, and thus it is not upward monotone and does not meet the Modification Condition. In the following, I will argue that this is the crucial difference underlying the asymmetry in Filip's Czech example (6).

## 6.2 Czech *po-* as a modifier of the result state

Winter & Zwarts (2000) note that many of the directional prepositions are related to locative ones in a systematic way, since the relevant path must overlap an internal point of the reference object. For example, the source- and goal-oriented pair *from* and *to* is related to the locative *at*; *out of* and *into* are related to the locative *in*. This is also captured in the definitions for the directional PPs *into x* and *out of x* in Zwarts (to appear) in (5), which make use of the locative *in*. Therefore, Winter & Zwarts (2000) define an operator *dir* for the mapping between a locative preposition and the corresponding directional preposition. Furthermore, there are situations where places can be formed from paths. Cresswell (1978), for example, mentions examples like *across a meadow a band is playing* and defines a function, which he paraphrases as *at the end of a journey across the meadow*. Similarly, Jackendoff (1983) suggests an operator for cases where a directional preposition is used to refer to a place rather than a path (e.g. *the train is through the tunnel*): [PLACE] → [$_{Place}$ ON ([$_{Path}$ x])].

Crucial for the topic of this paper now is that telic VPs contain a result state sub-event in a tripartite event structure in the sense of Ramchand (2004). This sub-event is thus stative

in nature and is predicated over an event participant. In the case of motion verbs with directional PPs as, for example, *he dragged the cart into the ditch*, the event structure involves something like *he caused the cart to be in(side) the ditch by dragging*. Likewise, for *he dragged the cart out of the ditch*, we get *he caused the cart to be outside the ditch by dragging*. If these sentences combine with measure phrases, such phrases apply to the result state of the cart being **inside** or **outside** the ditch, and therefore modify a locative PP; hence, an analysis of these examples seems to involve something like Jackendoff's ON-operator or Cresswell's path-to-place function to account for the locative nature of the result state.

So the asymmetry in Filip's example (6), repeated here as (25), where only source- but not goal-oriented prefixes can be modified by the measuring prefix *po-* 'a bit', receives a natural explanation which does not rely on proposing an aspectual difference:

(25)  a.  ***Po-vy-táhl***          *káru    z    příkopu.*      (= (49) b. in Filip (2003), p. 94)
PO-OUT-drag.PF.PAST cart.ACC from ditch.GEN
'He dragged the cart out of the ditch a bit.'

b.  **Po-do-táhl*          *káru    do příkopu.*   (= (50) b. in Filip (2003), p. 94)
PO-(IN)TO-drag.PF.PAST cart.ACC (in)to ditch.GEN
'He dragged the cart (in)to the ditch a bit.'

The prefix *po-* modifies the result state, which can be treated as a locative PP. Since only the result state of the source-oriented VP, namely *outside the ditch*, is upward monotone under the definition of Winter & Zwarts (2000) in (22), only this VP can be modified by *po-*; the goal-oriented VP, however, cannot combine with *po-*, since its result phrase (*inside the ditch*) is not upward monotone and thus does not meet the Modification Condition in (21). Hence, the asymmetry in Filip's example is not an aspectual one, since both events are telic and contain a result state sub-event. It is rather related to the nature of the particular result states denoting an open or closed topology.

Finally, if this asymmetry were aspectual, as Filip claims, we would expect *po-* to be compatible with all imperfective verbs no matter whether they contain source- or goal-oriented prefixes. The particular imperfective verbs are secondary imperfectives (see footnote 9), and according to Filip, imperfective predicates are atelic (or homogeneous). Thus, with respect to her goal-source telicity asymmetry, all imperfective verbs should be compatible with *po-*. However, the opposite holds: Neither imperfective source-prefixed nor imperfective goal-prefixed verbs can combine with *po-*:

(26)  **po-vy-tahovat^p, *po-do-tahovat^p*      – pull + out / in (imperfective) with *po-*[11]
**po-od-skákat^p, *po-při-skákat^p*      – jump + away / to (imperfective) with *po-*
**po-od-sedět^p, *po-při-sedět^p*      – sit down + away / to (imperfective) with *po-*

These facts receive a natural explanation if we assume that the imperfective operator brings about that the result state sub-event cannot be accessed anymore (see, for example, a treatment of imperfectivity along such lines in Arsenijević (2004)). If the result state sub-event is not accessible anymore, it also cannot be modified by *po-*. Thus, we have independent support for the claim that *po-* modifies the result state sub-event with telic predicates. In general, Czech *po-* seems to need some state (either a result state with telic predicates or the state of a state verb itself) and if there is no state available, Czech *po-* is not applicable.

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[11] The (perfective) *dotáhnout* can also have the meaning 'wind' (when closing a bottle) and in this meaning the modification with *po-* is presumably possible. It also seems to be possible to derive secondary imperfectives of *povytáhnout* and *podotáhnout* (with this meaning), which look like the verbs in (26) (*povytahovat, podotahovat*). However, in these cases the imperfective scopes over the *po-*, whereas the point I want to make here is that *po-* can never apply to the secondary imperfectives *vytahovat^i* or *dotahovat^i* (and in addition perfectivizing these).

## 7    further outlook: How directional are the prefixes?

The analysis of measure phrase modification with predicates containing goal- and source-oriented prefixes proposed in this paper relies on their event structure containing a result state sub-event. It is possible then to treat the particular goal- and source-oriented prefixes as incorporated states and thus as directly providing the result state. Recall from section 5 that only those prepositions which could have a locative meaning had direct counterparts among the prefixes on motion verbs. So it might be that those prefixes used with directional motion verbs to render a source- or a goal-orientation are not directional but rather locative expressions, in which case the meaning of directionality only arises due to the composition with a motion verb which provides the path argument.[12] If this turns out to be true then they should rather be treated as locative PPs and we could dispense with an analysis involving either Jackendoff's ON-operator or Cresswell's path-to-place function.

This could also lead to the reanalysis of (at least some) prepositions, which have been treated as ambiguous between a directional and a locative meaning cross-linguistically, as unambiguously locative. One speculation could be that the difference might be related to case: purely directional prepositions then select either for accusative (*v* 'into') or dative case (*k* 'to(wards)'), whereas locative ones select the genitive. I will leave this open for future research.

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[12] A point that has not been addressed so far is that Slavic simple motion verbs (which are always imperfective) come in pairs of directed and non-directed (manner of) motion verbs. The prefixes on motion verbs I dealt with in this paper as well as 'directional' PPs only combine with the directed motion verbs and these verbs by themselves actually provide the directionality and the path.