Telicity effects of prefixes on degree achievements in Czech

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1 Introduction

We, as the authors of this article, are happy to be in the Festschrift which celebrates Petr Karlík's birthday. And we are both happy and obliged to thank Petr for many good things which would not exist without him. Among those things are for sure many linguistic influences that are pretty much visible in this book and in many other linguistic articles, books, and other artifacts created by Petr's students, friends, and colleagues. Particularly this article owes very much to the debates about adjectives, semantics of scales, linguistics of gradation, and many connected phenomena which one of the authors listened to in Petr's seminars 20 years ago.[1]

2 Background

Degree achievements (DAs) are especially challenging both for the compositional approaches to aspect in natural languages and to degree semantics of scalar expressions. While it is widely acknowledged (at least since Dowty 1979) that degree achievements like *dry* can have either so-called telic or atelic interpretation[2] (independently of the cumulative/divisive nature of their arguments), this seems to be the case only for degree achievements derived from adjectives with at least a partially closed scale (lower-bounded like *wet*, upper-bounded like *straighten* and totally closed like *empty*), while it was observed that open-scale adjectives give rise to degree achievements with only atelic interpretation (e.g., *widen, deepen*). The most successful current approach to degree achievements (Kennedy & Levin 2008) derives these basic facts via the *Interpret-*

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1. Some echoes of those 20-year-old interests can be found in Karlík & Hladká (2004) a.o.

2. Alternative—and possibly somewhat more intuitive—terminology used in the literature is a 'positive' ($\approx$ telic) and a 'comparative' ($\approx$ atelic) interpretation of degree achievements, but for the sake of cohesion, we will be using uniform labels.

ive Economy principle: the degree semantic computation takes into account the lexical meaning of the source adjectives and Kennedy & Levin (2008) operationalize the *Interpretive Economy principle* via **pos** null degree morpheme. Kennedy & Levin's (2008) approach gets the majority of English data right. Nevertheless, it does not scale up correctly to cross-linguistically broader data: by way of example, Japanese open-scale degree achievements seem to be interpreted only as telic (Kawahara 2017). Slavic languages add another twist: degree achievements with at least partially closed scale are not ambiguous, but their telic/atelic interpretation depends predictably on the semantic properties of their prefix (or bare stem). Moreover, lower-bounded Slavic degree achievements seem to be challenging Kennedy & Levin's (2008) theory, which predicts them to be only atelic, contrary to the observed facts discussed below, as confirmed by empirical evidence of Czech and Slovak native speaker judgments and corpora. Serious problems also arise for totally closed scales and open scales. In this paper, we will first present the challenging data patterns and then offer a partial extension of Kennedy & Levin's (2008) approach, which can deal with this kind of data.

The article is organized as follows: in Section 2.1, we give a crash introduction to degree achievements and the typical problems they pose for their formal semantic analysis. Section 2.2 summarizes the formal instruments generally used to deal with the meaning and inferences concerning degree achievements. Section 2.3 discusses measure phrases and their integration with the degree achievement semantics and Section 2.4 finishes the theoretical background with an overview of the algebraic approach to prepositional/prefix meaning and their telicity. Then we focus on Czech data and in Section 3 we show, building on extensive corpus research, that they are highly problematic for the current standard approach to degree achievements (Kennedy & Levin 2008). The section is divided into four sub-sections corresponding to four classes of degree achievements. Section 4 introduces a proposal where we amend the theory of Kennedy & Levin (2008) in a way which makes it applicable to Czech degree achievements. Sections 4.1 and 4.2 discuss further consequences of our reasoning for degree achievements with differentials and parallel cases of directed motion verbs. Section 5 summarizes the article.

2.1   Approaches to degree achievements

Degree achievements attract a lot of linguistic attention because they demonstrate telicity patterns which are very different from the more studied and described classes of aktionsart as accomplishments, activities, etc. Degree achievements show telicity behavior which is independ-

ent of the properties of their arguments (or the absence of arguments). Observe the contrast between (1a) and (1b), where the standard *in/for*-adverbial modification test shows that the absence of a path in (1a) gives rise to an atelic interpretation and the bounded path to a telic interpretation (we will discuss more cases of directed motion verbs in Section 4.2).

But degree achievements like *cool* can be both telic and atelic without any argument change (as noted already by Dowty 1979) and demonstrated by (2). The telicity status is a reflex of the interpretation: if (2) is understood as describing a process that reached a goal (the tea cooled, presumably, to the room temperature), the lexical aspect is telic, but if the sentence is understood only as a temperature change without any result in a sense that there was a change in temperature but no contextual standard was reached, the atelic interpretation is yielded. In Slavic languages, the difference would be morpho-syntactically signaled with different prefixes (as we will discuss in the following sections). Nevertheless, English allows the telic/atelic ambiguity, since in the case of degree achievements, the lexical aspect does not depend on the argument type/realization (as in (1a) vs. (1b)), the usual ingredient in the English type of aktionsart composition.

(1)   a.   John walked for/#in one hour.   ATELIC
      b.   John walked to the pub in/#for one hour.   TELIC

(2)   a.   The tea cooled for one hour.   ATELIC
      b.   The tea cooled in one hour.   TELIC

The behavior of English degree achievements demonstrated with (2) led some researchers like Abusch (1986) to claim that all degree achievements are ambiguous between the telic and atelic reading. But this is not empirically correct even in English, as the following examples in (3) from Kearns (2007: ex. 36–38) show. The examples demonstrate that degree achievements like *quieten, darken* and *ripen* strongly prefer the telic interpretation because if atelic interpretations were available, the *but* continuation would not be degraded in acceptability. Consequently, a simple ambiguity story like in Abusch (1986) cannot be correct, at least not for all degree achievements.

(3)   a.   The room quietened in a few minutes #but it wasn't quiet.
      b.   The sky darkened in an hour #but it wasn't dark.
      c.   The fruit ripened in five days #but it wasn't ripe.

The same type of problem arises also with open-scale degree achievements like *widen* and *deepen* in (4) from Kennedy & Levin (2008: ex. 6). They can be interpreted only as atelic, which is witnessed by the adverbial modification pattern. This, again, is totally unexpected if degree achievements were simply ambiguous between a telic and an atelic reading.

(4) a. The gap between the boats widened for/#in a few minutes.
     b. The recession deepened for/#in several years.

The problems mentioned above give rise to new approaches to degree achievements like Hay, Kennedy & Levin (1999), Kennedy & Levin (2008) and Kennedy (2012), where instead of ambiguity proposal, the telicity/atelicity is related to the scalar structure of degree achievements. The relevant facts about English degree achievements are at least the following:

- open-scale degree achievements are by default interpreted as atelic (with only one known exception in English: *cool*);
- upper-bounded degree achievements strongly prefer telic interpretations;
- lower-bounded degree achievements (like English *bent*) prefer atelic interpretation;
- totally closed scale degree achievements are reported to behave as upper-bounded (see Kennedy & Levin 2008).

The scalar approaches to degree achievements try to address these issues and some others like the proper treatment of differentials. The main idea behind the scalar approach is the following one: all of the data can be described by an analysis which combines two factors: (i) a unified analysis based on a function measuring the degree to which an object changes (during an event) relative to an appropriate scale (by way of example: the scales of *width* and *depth* and *the gap* and *the recession* as objects in (4)); (ii) the nature of the scale (plus some independent mechanisms like the *Interpretive Economy principle* discussed below).

The scalar reasoning, then, approximates the degree achievements to comparatives because comparatives (at least in such approaches to comparatives and gradation as Kennedy & McNally 2005; Neeleman, Van de Koot & Doetjes 2004; Rotstein & Winter 2004; Svenonius & Kennedy 2006) are semantically based on a difference function and not on the general measure function used commonly to model the positive form of the adjective.

The typological support for this theoretical analysis, which builds on the similarity between comparatives and degree achievements, can be

found in Bobaljik (2015). Bobaljik claims that, generally, we can find the following correlation between comparatives and degree achievements: if an adjective shows suppletion, the base of the degree achievement is the comparative suppletive allomorph, not the positive form of the adjective, see Table 1 from Bobaljik (2015: Table 5). We will illustrate the formalization of this idea in the next section.

Language	positive	comparative	DA	Gloss
English	good	bett-er	(to) bett-er	NA
English	bad	worse	(to) wors-en	NA
German	gut	bess-er	ver-bess-er-n	'good'
Russian	plox-oj	xuž-e	u-xud-š-ať	'bad'
Finnish	hyvä	pare-mpi	para-ntaa	'good'
Georgian	cud-i	u-ar-es-i	a-u-ar-es-ebs	'bad'
(Late) Latin	bon-us	mel-ior	mel-iō-o	'good'

Table 1: Suppletion in degree achievements

2.2 Formalization of the meaning of degree achievements

As foreshadowed above, the main idea of the scalar treatment of degree achievements (Hay, Kennedy & Levin 1999; Kennedy & Levin 2008; Kennedy 2012) is to formalize their core meaning as a measure of change function. A natural language example (5) would be true iff the shadow at the beginning of an eventuality had a degree of length lesser than his degree (of length) at the end of the eventuality. Which is exactly what the formula in (5b) states in formal terms. We follow Henderson (2013) in extending Kennedy & Levin's (2008) notation, which allows the verbal measure function to access its arguments via theta-roles.

(5) a. The shadow lengthened.

    b. $\exists e[\text{LONG}_{\Delta}^{\theta_1}(e) \geq \textbf{stnd}(\text{LONG}_{\Delta}) \wedge \theta_1(e) = \sigma x.{}^{*}\text{SHADOW}(x)]$

We will unpack the formalization starting with the $\geq \textbf{stnd}(\text{LONG}_{\Delta})$ part. As discussed above, English open-scale degree achievements like *lengthen, widen,* etc. do have (by default) just an atelic reading. Kennedy & Levin (2008) encode this pattern via the standard (the point of the particular scale which has to be reached in order to make a sentence like (5) true) being taken from the (below defined) measure of change function LONG_{Δ}, not from the general measure function LONG (which

would lead to the telic interpretation expressed by a predicate *become long* but not by the degree achievement *lengthen*). And because there is no maximal degree neither on the LONG nor on the LONG$_\Delta$ scale, the **stnd**(LONG$_\Delta$) picks up the minimum standard, which then leads to an atelic reading of (5a), since any degree increase above the minimum standard would make (5a) true.

The upper-bounded degree achievements like *darken* in (6) behave differently, though: the measure of change function DARK$_\Delta$ inherits from the DARK scale the maximum standard, which then becomes the actual standard in (6b), and a telic reading is obtained.

(6) a. The sky darkened.

    b. $\exists e[\text{DARK}_\Delta^{\theta_1}(e) \geq \textbf{stnd}(\text{DARK}_\Delta) \wedge {}_1(e) = \sigma x.{}^*\text{SKY}(x)]$

The general principle which connects the lexical meaning of degree achievements with the computation of truth-conditions is in (7) from Kennedy & Levin (2008: ex. 18). The effect of the *Interpretive Economy principle* is that the upper and lower-bounded scales provide the natural transition points; in the case of lower-bounded scales, the transition point is the minimum of the scale, for upper-bounded scales it is the maximum. The work in scalar semantics, especially in Kennedy & McNally (2005); Kennedy & Levin (2008); Kennedy (2012) can be seen as a careful and data-driven destruction of the borders between lexical and formal semantics, since the lexical information is incorporated into the truth conditions calculation of the sentence. In (6), there is not only a change of the sky along the scale of darkness, but a particular change of the scale, where the telic nature of the degree achievement comes from the lexical semantics in the source adjective *darken*. The transition points are (by default) used for fixing the standard of the scale in the truth-conditions, and no contextual manipulation of the standard is (sine qua non) possible.

(7) *Interpretive Economy*   Kennedy & Levin (2008: ex. 18)
    Maximize the contribution of the conventional meanings of the elements of a sentence to the computation of its truth conditions.

The measure of change function is based on the difference function in (8). The difference function serves as the formalization of a comparative meaning, and it works as follows: it converts the basic measure function (the meaning of the positive form of an adjective) into a difference function with a scale starting at 'derived zero', the degree of the comparative standard. Let us illustrate this with an example: the adjective *long* is represented with a regular measure function LONG returning the

degree of an object (and then type-shifted with **pos** or a measure head to a property of objects). But a comparative like *longer than John* denotes the difference function $\text{LONG}^{\uparrow}_{\text{LONG}(j)}$ returning values representing the degrees of those objects which exceed John's length, the difference function returns 0 for the shorter objects. The comparative, then, (as the positive form of the adjective) has to be type-shifted via **pos** (or a measure phrase) to end at the $\langle e, t \rangle$ type, because the difference function is of the type $\langle e, d \rangle$.[3]

(8) *Difference Function*   (Kennedy & Levin 2008: ex. 23)
     For any measure function **m** from objects and times to degrees on a scale S, and for any $d \in S$, $\text{m}^{\uparrow}_{d}$ is a function like **m** except that:
     a.   its range is $\{d' \in S | d \le d'\}$
     b.   and for any x, t in the domain **m**, if $\text{m}(x)(t) \le d$ then $\text{m}^{\uparrow}_{d}(x)(t) = d$.

The difference function is then utilized in the measure of change function in (9), the cornerstone of degree achievements meaning formalization in Kennedy & Levin's (2008) way. The idea is to build the similarity between comparatives and degree achievements into the formulas. The comparative (before **pos** type-shift) returns the difference between the comparandum and the comparative standard; the degree achievement measures the degree to which an object changes along a scalar dimension during an event e.

(9) *Measure of change*   (Kennedy & Levin 2008: ex. 25)
     For any measure function **m**, $\text{m}^{\Theta}_{\Delta} = \lambda e[\text{m}_{\text{m}\uparrow(\Theta(e))(init(e))}(\Theta(e))(fin(e))]$

The measure of change function is the verbal version for the more general difference function in (8), which is used as a formal tool for comparative meaning modeling. The meaning of degree achievements (and their contribution to sentence meaning) is the result of the **pos** applied to the measure of change function (analogically to the **pos** application to the $\langle e, d \rangle$ measure function in case of adjectives). The result for open-scale and upper-bounded English degree achievements is repeated below in (10). The formal definition of the verbal **pos**$_{v}$ from Kennedy & Levin (2008) is given in (11). The crucial part of **pos**$_{v}$ is the introduction of a contextual standard **stnd**(g); the degree achievement (like gradable adjectives) is interpreted as a pure measure function at type $\langle e, d \rangle$. The **pos**$_{v}$ turns the measure function into a set of objects. Because in both cases

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3. This approach to the meaning of adjectives is different from another common approach where the gradable adjectives are of the $\langle d, \langle e, t \rangle \rangle$ type. See Kennedy & McNally (2005) for empirical arguments in support of the $\langle e, d \rangle$ measure function treatment of gradable constructions (in our case, comparatives and degree achievements).

(the open scale degree achievement *lengthen* and the upper-bounded degree achievement *darken*) the $\mathbf{pos}_v$ is sensitive to the *Interpretive Economy principle*, the $\mathbf{stnd}(g)$ in picks up the minimum and maximum degree of the corresponding scale, respectively.

(10)   a. $\exists e[\text{LONG}_\Delta^{\theta_1}(e) \geq \mathbf{stnd}(\text{LONG}_\Delta) \wedge {}_1(e) = \sigma x.{}^*\text{SHADOW}(x)]$
       b. $\exists e[\text{DARK}_\Delta^{\theta_1}(e) \geq \mathbf{stnd}(\text{DARK}_\Delta) \wedge {}_1(e) = \sigma x.{}^*\text{SKY}(x)]$

(11) $[\![\mathbf{pos}_v]\!] = \lambda g \in D_{m_\Delta} \lambda x \lambda e.g(x)(e) \geq \mathbf{stnd}(g)$

But it is not the case that the scalar standard resolves the telicity/atelicity status of degree achievements in all types of constructions involving degree achievements. In cases where degree achievements combine with differentials like in (12), the resulting meaning is telic (as confirmed by the *in*-adverbial) but in a way different from the telicity/atelicity discussed above. (12) is telic, since no sub-event of the whole process of *cooling down 20 degrees* has the property of *cool down 20 degrees*. There is no standard (room temperature or any other contextual standard) involved. We will discuss these intriguing patterns of measure phrases with adjectives and degree achievements in the next section.

(12)   The tea cooled 20 degrees in 10 minutes.

2.3   Measure phrases and differentials

The description of measure phrases and differentials would need much more space than we can spend on its discussion here, so we will just have to sketch the situation. Nevertheless, the empirical generalization which seems to appear in those studies that go much deeper into the issue and look at cross-linguistic data more seriously (like at least Svenonius & Kennedy 2006; Sawada & Grano 2011; Grano & Kennedy 2012), is the following: degree achievements and comparatives are always able to combine with measure phrases, even in cases where the positive form of the adjective is incompatible with the measure phrase.

First, consider the adjective *long*, which even in English allows measure phrases in all three constructions in (13). The measure phrases in (14), taken from Grano & Kennedy (2012: ex. 17), show that the compatibility of the positive form of the adjective with the measure phrase is rather an exception than the rule, but the comparative is always compatible with the measure phrase.

(13)   a.   a 20 pages long article
       b.   an article 20 pages longer than the requirement
       c.   lengthen the article 20 pages

(14)   a.   *$200 expensive, *20° warm, *100 tons heavy, *60 kph fast
       b. $200 more expensive, 20° warmer, 100 tons heavier, 60 kph
   faster

This is true for comparatives and for degree achievements as well, as (15) demonstrates. Moreover, there is some cross-linguistic idiosyncrasy of the compatibility between measure phrases and positive forms of adjectives, as (16) and (17) show Grano & Kennedy (2012: ex. 19, 21). While some languages, like German in (16), are more liberal than English and allow the measure phrase even with those positive forms of adjectives where English does not; some, like Japanese in (17), are more restrictive. Japanese does not allow measure phrases even with the most liberal adjective that was tested in the literature so far. But even Japanese does allow comparatives to be modified with measure phrases.

(15)   a. *a 20 pages short article
       b.   an article 20 pages shorter than the requirement
       c.   shorten the article 20 pages

(16)   100 Tonnen schwer   German
       100 tons   heavy
       '100 tons (*heavy)'

(17) *2-meetoru segatakai   Japanese
     2-meter   spine.high
     '2 meters tall'

In face of these cross-linguistic differences, Svenonius & Kennedy (2006), Sawada & Grano (2011) and Grano & Kennedy (2012) claim that, in fact, measure phrases are generally not compatible with adjectives. The incompatibility follows from the type-clash: adjectives are measure functions of the $\langle e, d \rangle$ type and measure phrases denote degrees of the d type. Their combination as function/argument is then forbidden, sine qua non. This is the most clearly seen pattern in Japanese.

For cases where the compatibility between measure phrases and adjectives increases, Grano & Kennedy (2012) claim that there is a functional morpho-syntactic projection called μ, which language-dependently selects some of the adjectives for which it can mediate between the adjective and the measure phrase. An example of

such a syntactic approach is in (18). The idiosyncrasies of measure phrase/adjective combination are then blamed on the selectional properties of μ: while in English it selects for *tall* or *old,* it does not select for *segatakai* 'tall' in Japanese or *schwer* 'heavy' in German.

(18)

DegP

MP   Deg'

10 years   Deg   A

μ old
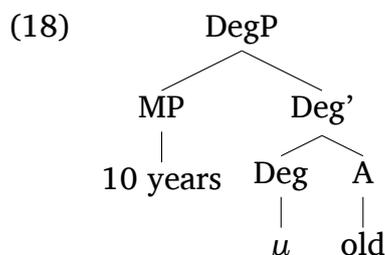
The semantic composition is then mediated by μ, which is defined in (19) Svenonius & Kennedy (2006: ex. 50). The type-shifter μ is relativized to times (which we ignore in the composition in (19b) for simplicity's sake) and if applied to a gradable adjective, it returns a set of objects which exceed the measure phrase on the pertinent scale. Note that there is no standard of the scale mentioned. The semantic composition of (18) is then illustrated in (19b). The resulting truth conditions do get the intuitive meaning: (19b) denotes a set of entities that are ten years old (or more, the strengthening to the equality interpretation happens most probably in pragmatics).

(19) a. $[\![\mu]\!] = \lambda g \in D_{\langle e,d \rangle} \lambda d \lambda x \lambda t . g(x)(t) \geq d$
b. $[\![\mu]\!]([\![\text{old}]\!])([\![10 \text{ years}]\!]) = \lambda x . \text{old}(x) \geq 10 \text{ years}$

Returning now to degree achievements, Kennedy & Levin (2008) propose that μ generally combines with difference functions, which gives a handle on the empirical observations discussed above—that differential measure phrases are always compatible with comparatives and degree achievements. Kennedy & Levin (2008: ex. 32) then propose a verbal version of μ which can be found in (20). The application to a degree achievement with a differential is in (21). The sentence in (21) is telic, unlike the atelic version without the differential in (5a). But as discussed above and now clearly visible in the formula, this telicity results from the differential itself, not the adjective/degree achievement and its corresponding scale (which even in this case is still open and atelic). In any case, adding a differential to a degree achievement produces a telic interpreted sentence no matter what the scalar meaning of the degree achievement is. This contrasts with the differential-free degree achievements discussed in Section 2.2, but is reminiscent of the cardinal numerals which do give rise to similar bounding effects: *John ran* is atelic, unlike *John ran twice.*

(20) $[\![\mu_v]\!] = \lambda g \in D_{m_\Delta} \lambda d \lambda x \lambda e.g(x)(e) \geq d$

(21) a. The shadow lengthened 1 meter.

b. $\exists e[\text{LONG}_\Delta^{\theta_1}(e) \geq \mathbf{1\ meter} \wedge \ _1(e) = \sigma x.^*\text{SHADOW}(x)]$

2.4   Telicity of prefixes

As we will discuss in detail below, our working hypothesis is that the telicity status of Czech degree achievements can be determined from the boundedness properties of prefixes and from the scalar denotation of the adjectival root. Our classification of the telicity (or boundedness) properties of prefixes builds on the seminal work in Zwarts (2005). We work with the common assumption about the linguistic identity of Slavic prefixes and prepositions (see already Matushansky 2002 and slightly more recently Asbury, Gehrke & Hegedűs 2006; Gehrke 2008).

Let us now illustrate the bare essentials of Zwarts's (2005) algebraic approach to the meaning of prepositions. As is known for some time (Piñón 1993; Krifka 1998; Rothstein 2004), different types of prepositions do have an impact on the telicity status of the sentences in which they occur. By way of example: in (22), the verb *walk* itself creates an unbounded trajectory resulting in an atelic reading. But if *walk* is combined with a so-called directional goal preposition *to*, the result is a bounded trajectory yielding a telic interpretation of the whole sentence. Finally, a directional preposition like *along* contributes an unbounded trajectory to the sentence meaning, and when combined with the verb *walk*, the resulting meaning is atelic.

(22) a. Peter walked *in/for two hours.   ATELIC/UNBOUNDED

b. Peter walked to the pub in/*for two hours.   TELIC/BOUNDED

c. Peter walked along the river *in/for two hours.
            ATELIC/UNBOUNDED

The overall framework of algebraic semantics for prepositions (and, in our case, prefixes) is beyond the scope of this article, but we will now illustrate the main tools which we used when working with the classification of prefixes involved in the formation of Czech degree achievements. The main idea is that the telicity status of prepositions can be determined from their lexical meaning, formalized as trajectories. The main criterion, which Zwarts (2005) then proposes (departing from the older approaches to similar problems, like Krifka 1998), is concatenation. Atelic prepositions are those that denote trajectories concatenable

in a way where the result is still in the denotation belonging to the meaning of the preposition. Consider the directional unbounded preposition *along*. Intuitively, the meaning of *along* denotes such trajectories that are near the so-called ground (the denotation of *river* in (23)). If we use a typographically spartan topological model of the river like in (23a), one of the possible denotations of the PP *along the river* is in (23b), where pluses are schematic diagrams of the trajectory of path **p**. The path is oriented (as marked with the arrow) and has a starting and a final point. Another such path, path **q**, in the denotation of *along the river* is in (23c). What is crucial is that if we concatenate both paths, as in (23d), the resulting trajectory still connects locations which are all near the river, consequently still in the denotation of the PP *along the river*. In a bit more formal terms, the paths denoted by the preposition *along* are closed under the concatenation operation. And such prepositions, then, are unbounded or atelic.

(23)   along the river
       a.   rrrrrrrrrrrrrrrrrrrr
       b.   +++++>   path **p**
       c.   +++++>   path **q**
       d.   ++++++++++>   path **p** + **q**

The formal definition of the meaning of the PP *along the river* is in (24) (taken from Zwarts 2005: ex. 52). The point **p**(0) is the starting point of the trajectory (the first '+' in (23b)) and **p**(1) is the final point of the trajectory (the '>' mark in (23b)), e.g., all the points between connect the two and are formalized as function **p** from the interval $i \in [0, 1]$ (the interval of rational numbers) to points (or vectors, see Zwarts 2005 for details) in space. Such paths are always oriented. The linear examples in (23) serve only as an illustration, the structure of paths can be much more fancy, see Zwarts (2005) for details. But the paths always start at the place **p**(0) and their final point is always at the point **p**(1).

(24)   ⟦along the river⟧ = {**p**: for all $i \in [0, 1]$ **p**(i) is near the river}

Bounded prepositions, like the goal directional preposition *to* in (22b), show telic properties. In Zwarts's (2005) algebraic approach, this follows from the non-concatenability of such prepositions. Consider the denotation of the goal PP *into the house* in (25) (Zwarts 2005: ex. 35). The meaning of the directional *into* has an inherently two-stage structure: as illustrated in (26a) or (26b), such paths always start in the area out of the ground (marked as '−'), and their final segment ends inside

the ground (marked as '+'). This is formalized as the constraint on including 1 in the *into* denotation in (25). But if the trajectory has two such phases, it is non-concatenable, since the beginning of the next path, path **q**, would have to start inside the house (the end of the first path, path **p**), which goes against the definition of the meaning of *into*. The telic behavior is then the result of the non-concatenability of the *into* denotation.

(25)   ⟦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}

(26)   into the house
  a.   ---+++++>   path **p**
  b.   -----+++>   path **q**
  c.   undefined   path **p** + **q**

When applying the algebraic framework to the denotation of Czech prefixes, we worked with the main results of Zwarts's (2005) work. Namely, Zwarts classifies goal and source directional prepositions (e.g., *to* and *out of*, respectively) as telic. Furthermore, he classifies English prepositions *towards* and *away* as atelic, similarly for *along* and *past*. Some prepositions, according to Zwarts, behave as ambiguous, yielding telic properties in some contexts and atelic in other environments, He classifies English *up* and *down* as such. He claims that if the meaning of *up the hill* is equal to *up to the top of the hill*, the PP is telic (non-concatenable), but if it means just some progression (a part of the trajectory to the top of the hill), the meaning is atelic. Here, he explicitly draws an analogy to degree achievements, namely to the ones that allow the telic/atelic ambiguity.

In English, the boundedness of the particular PP is then transferred to the telicity of the whole VP, as was shown in (22). Zwarts (2005) formalizes this correspondence as the constraint on the set of events (denoted by the VP) which are inherited from the PP. The formalization of the meaning of (22b) would be (27). The crucial ingredient is the locative core of the directional preposition, as exemplified in (27): the directional preposition *to* is based on the locative preposition *at*, where the final point of the path **p**(1) ends. For other directional prepositions, there are always corresponding locative prepositions (see again Zwarts 2005 for details). Nevertheless, the boundedness transfer is ensured by the PP constraining the denotation of the set of events: because the paths are bounded and they are directly composed into the meaning of the VP (the set of events), the boundedness of the VP results in the telicity of the VP.

(27) $\{e \in [\![\text{walk}]\!] : \text{TRACE}(e)(1) \text{ is at the pub and } \text{THEME}(e) = Peter\}$

In our work, we used these conclusions of Zwarts's (2005) algebraic approach to PPs. By way of example, the Czech degree achievement *do-hloubit* 'to-deepen' (more natural examples discussed below) shows a clearly telic behavior. We argue that this follows from the goal denotation of the prefix, which is identical with the goal preposition *do* 'to'. And since the goal preposition meaning is retained in the denotation of the prefix, the whole degree achievement *do-hloubit* 'to-deepen' is telic, unlike the English open-scale degree achievement *deepen*. Thus, in our reasoning, we follow Zwarts's (2005) approach to the transfer of boundedness from PPs to VPs, in our case the boundedness profile of the prefix predicts the telicity or atelicity behaviour of the verb to which it is added. Generally, we believe that Slavic prefixes in degree achievements provide a beautiful testing ground both for the theories of degree achievements and the algebraic approach to the preposition/prefix meaning.

3   Data

In this section, we bring Czech data into the debate. The main reason for doing that is that Slavic degree achievements allow us to see more clearly than in the case of English how the telicity profile of particular classes of degree achievements depends on their morpho-syntactic building blocks.

When we gathered the data, we worked mostly with the Czech national corpus (CNC, Křen et al. 2015), from which we extracted (via CQL/regular expression queries) the prototypical ways of prefixation and behavior of the four classes of Czech degree achievements. We focused on prefixed (perfective) degree achievements, as they represent the majority of Czech degree achievements (the regular expression search of $.+rovnat$ 'straighten' yields 13 946 CNC hits for prefixed perfective verbs, but the imperfective search for the lemma *rovnat* 'straighten' yields only 1 469).

We classified the telic/atelic interpretation of degree achievements based on the usual tests:

1. contradiction test: the telic interpretation of degree achievements leads to a contradiction in a schematic sentence *x degree-achievement, but it is not adj-degree-achievement* (where *adj-degree-achievement* is the source adjective), but the atelic interpretation does not (e.g., *The creek has widened, but it wasn't wide* and *The rod has straightened, #but it wasn't straight*);

2. progressive → perfect test: the atelic reading allows (non-deductive) entailment from progressive to perfect tense in English (e.g., *x is widening → x has widened*), the telic one does not (e.g., *x is straightening → x has straightened*); for the Czech data we used the imperfective → perfective test with an equivalent entailment pattern.

Based on the combination of the two tests, we discovered that Czech degree achievements behave very differently from the English ones, and hence the standard theory of Kennedy & Levin (2008) does not work for Czech.

In the following sub-sections, we discuss the degree achievement data we found in CNC and classified with respect to the telicity of the sentences where the particular degree achievement predicates appeared. The division into sub-sections corresponds to the nature of scales that underlie the particular sub-types of degree achievements. The proportion of telic and atelic degree achievements given in the examples in each sub-section roughly corresponds to the proportion of telic and atelic degree achievements found as natural examples in CNC, visualized in Figure 1.
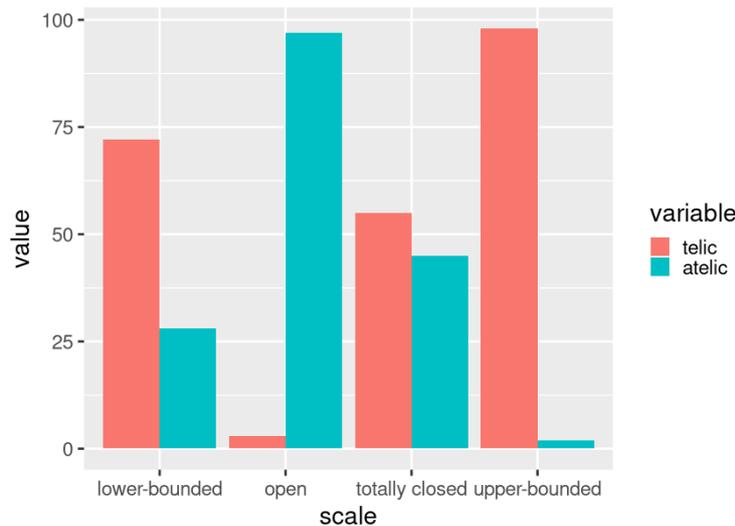

Figure 1: Czech DAs: scale type and their telic vs. atelic interpretation

3.1 Open-scale degree achievements

Open-scale degree achievements occur mostly with atelic (or ambiguous: route) prefixes with usually locative/*down* algebraic denotation. Typical examples include route prefixes like *pro-dloužit* 'through-lengthen' and

locative prefixes like *u-krátit* 'at-shorten', as seen in the examples (29)–(31). Locative prepositions are not in the center of Zwarts's (2005) attention, but he ascribes them all an atelic interpretation. There were many cases of ambiguous prefixes like *z-výšit* 'down-heighten', but we also found degree achievements with telic prefixes leading to telic interpretation (which, in accordance with Zwarts 2005, is in the majority of cases based on the source and target algebraic denotation), such as *do-hloubit* 'to-deepen' and *vy-hloubit* 'from-deepen', exemplified in (28).

(28) Táta nechá   vy-hloubit jámu   pro   bazén kvůli
      mere existence was   unbearable suffering that   must
        dětem.   TELIC
        quickly
      'Dad will have a hole dug out for the pool because of the kids.'

(29) Já se   jen snažím z-výšit   obrat.   ATELIC
      I   REFL only try   down-heighten sales
      'I am only trying to increase the sales.'

(30) Pouhá existence byla nesnesitelným utrpením, které musí
      mere   existence was   unbearable   suffering   that   must
        rychle u-krátit.   ATELIC
        quickly at-shorten
      'The mere existence was an unbearable suffering that he must quickly shorten.'

(31) Zaváhala jsem s   rukou na klice   dveří ve snaze
      hesitated am   with hand on handle door in effort
        pro-dloužit   ten okamžik.   ATELIC
        through-lengthen that moment
      'With a hand on the door handle, I hesitated, trying to lengthen the moment.'

To compare the empirical findings of this section with the predictions of the standard theory, even if the majority of Czech open-scale degree achievement follow the path predicted by Kennedy & Levin (2008) in being interpreted as atelic, it is by no means the only possibility. Czech open-scale degree achievements can be telic not only in the case of *cool*, which is the only case where such possibility is discussed by Kennedy & Levin (2008), but also in cases where the prefix has an unambiguously goal or source denotation like in the example (28).

3.2 Upper-bounded degree achievements

Upper-bounded degree achievements were mostly modified with prefixes with telic source/goal or ambiguous (route) semantics like *vy-rovnat* 'from-straighten' or *do-schnout* 'to-dry', as seen in (32)–(34). The only atelic prefixed degree achievements were rare *o-schnout* 'around-dry' and *o-zdravit* 'around-heal', as in (35).

(32) Uklidila a   vy-rovnala   mé přikrývky.   TELIC
       tidied-up and from-straightened my covers
       'She tidied up and straightened my covers.'

(33) Nakonec se   Erik navzdory všem předpovědím a   diagnózám
       finally   REFL Erik despite   all predictions and diagnoses
          u-zdravil.   TELIC
          at-healed
       'Finally, Erik has healed despite all predictions and diagnoses.'

(34) Říkal, že do večera by   to mohlo do-schnout a   zejtra
       said   that to evening would it could to-dry   and tomorrow
          už   má   pršet...   TELIC
          already should rain
       'He said it could dry up till the evening and tomorrow it should already
       rain...'

(35) ...kořeny se   o-zdraví   a   květiny lépe porostou. ATELIC
       ...roots   REFL around-heal and flowers better grow
       '...the roots will be healthier and the flowers will grow better.'

For upper-bounded degree achievements, we can say that Kennedy & Levin (2008) do get even the Czech data mainly right, because the degree achievements are mostly prefixed with telic prefixes and only sporadically we found atelic prefixation that leads to an atelic reading. In other words, the prefixation here mostly respects the lexical semantics of the source adjectives, but even here this tendency can be overridden by an atelic prefix like that in (35).

3.3 Lower-bounded degree achievements

In the case of lower-bounded degree achievements, we found telic *past* and ambiguous route prefixes, which lead to a telic interpretation in verbs like *pro-vlhnout* 'through-wet' and *za-špinit* 'past-dirty', exemplified in (36) and (37), respectively. There were also atelic degree achievements that are formed with locative or ambiguous *down* prefixation like *na-vlhnout* 'on-wet' or *z-kalit* 'down-muddy' in (38) and (39).

(36)   V   noci   byl   mráz, ale   teď   vzduch pro-vlhl.   TELIC
       in   night was   frost but   now   air   through-wet
       'It was freezing in the night, but now the air got wet.'

(37)   Čidla   a   radary se   za-špiní   a   může   nastat problém.
       sensors and   radars REFL past-dirty and   can   come   problem
       'The sensors and radars will get dirty and a problem can arise.'   TELIC

(38)   Papír je pomačkaný, jako   by   na-vlhl, text je rozmazaný.
       paper is crumpled   as   would on-wet   text is smudged
       'The paper is crumpled, as if it got wet, the text is smudged.'   ATELIC

(39)   Když si   vzpomněla, kde   je a   kdo je, z-kalila   její
       when REFL remembered where is and who is   down-muddied her
          spokojenost vina.   ATELIC
          satisfaction guilt
       'When she remembered where she is and who she is, the guilt spoiled
       her satisfaction.'

As Figure 1 and the examples above show, we found much more telic lower-bounded degree achievements than atelic ones (telic degree achievements like *pro-vlhnout* 'through-wet' outnumber the atelic ones like *z-vlhnout* 'down-wet'). But this observation is contrary to Kennedy & Levin's (2008) predictions that the lower-bounded degree achievements should only be atelic, since the *Interpretive Economy principle* picks up the minimum of the scale. The Czech data here are more dramatic than in the previous two sections, where Kennedy & Levin (2008) predicted at least the major tendency correctly.

3.4   Totally closed degree achievements

Totally closed degree achievements behave differently from the upper-bounded ones—only half of them are telic with telic source or ambiguous prefixes. The typical examples are verbs like *vy-prázdnit* 'from-empty' or *pře-plnit* 'over-fill', as demonstrated in (40) and (41), respectively. As for the atelic totally closed degree achievements, they comprise the second half with atelic *toward* prefixation and verbs like *při-plnit* 'toward-fill', exemplified in (42) and (43).

(40)   Dopil,   pak si   znovu nalil a   pomalu šálek vy-prázdnil.
       drank-up then REFL again poured and slowly cup   from-emptied
       'He drank up, poured himself another cup and slowly emptied it.'
                                                               TELIC

(41)   Rychle u-prázdní v albu   dvě místa na přední stránce. TELIC
        quickly at-empties in album two spots on front   page
        'He quickly empties two spots on the front page of the album.'

(42)   I   snaha při-plnit   stranickou kasu   je mu spíše
        also effort toward-fill party   cash-box is him rather
          sympatická.   ATELIC
          sympathetic
        'He has sympathies also for the effort to fill the party cash box.'

(43)   ...a ještě by   mohl ekologicky připlnit   nádrž.   ATELIC
        ...and even would could eco-friendly toward-fill tank
        '...and he could even fill the tank eco-friendly.'

Totally closed degree achievements constitute the second strong em-
pirical problem for Kennedy & Levin (2008), since their prediction is that
these should behave identically to upper-bounded degree achievements,
which clearly cannot be true for Slavic data.

Let us summarize the four sections, where we reported the telic/atelic
behaviour of Czech degree achievements based on open, lower-bounded,
upper-bounded and totally closed scales. In the first two cases, the theory
of Kennedy & Levin (2008) predicts the major tendency, but there are
counter-examples to their claims and they are not only some isolated
verbs. In the second two classes, the Czech data goes more dramatic-
ally against the predictions of the theory. For the lower-bounded degree
achievements, we found a majority of telic cases, contrary to the theoret-
ical expectations. For the totally-closed degree achievements, we found
an equilibrium, which again is unexpected, and, moreover, falsifies the
claim of similar behaviour of totally-closed and upper bounded degree
achievements.

4   Analysis

Following Kennedy & Levin (2008), we analyze the core meaning of de-
gree achievements as a difference function ($\mathbf{m}_\triangle$) which measures (on
an appropriate scale) how much an object changes as a result of an
event. The difference function yields a lower-bounded scale which is
type-shifted into the type of events. As summarized above, Kennedy &
Levin (2008) claim that there are two such type-shifters:

1. the verbal positive form $\textbf{pos}_v$, which via the *Interpretive Economy principle* produces an atelic reading for open scales and a telic reading for at least partially closed scales:
   $[\![\textbf{pos}_v]\!] = \lambda g \in D_{m_\Delta} \lambda x \lambda e.g(x)(e) \geq \textbf{stnd}(g)$
2. the verbal degree morpheme μ_v, which combines with differentials:
   $[\![\mu_v]\!] = \lambda g \in D_{m_\Delta} \lambda d \lambda x \lambda e.g(x)(e) \geq d$

Based on the data discussed above, we claim that even if in languages like English the pragmatic/contextual information is the main factor in the interpretation of degree achievements (as reflected via $\textbf{stnd}(g)$ in $\textbf{pos}_v$), at least for Slavic languages we have to add semantically much loaded type-shifters which are morpho-syntactically realized as prefixes. Based on the degree achievement pattern and the independent algebraic properties of prefixes/prepositions, we claim that there are (at least) two additional difference-function type-shifters.

First, for telic prefixes we propose the type-shifting telic semantics given in (44), following Kennedy & Levin's (2008) approach to telic modifiers. Second, for atelic prefixes we propose the atelic semantics given in (45). Ambiguous prefixes can pick up telic/atelic reading depending on their atomic/pluralized algebraic denotation or the telic/atelic interpretation as discussed by Zwarts (2005: pp. 766–768) for prepositions *up* and *down*.

(44) $[\![\mathrm{pref}_{tel}]\!] = \lambda g \in D_{m_\Delta} \lambda d \lambda x \lambda e.g(x)(e) = max(g)$

(45) $[\![\mathrm{pref}_{atel}]\!] = \lambda g \in D_{m_\Delta} \lambda d \lambda x \lambda e.g(x)(e) \geq min(g)$

Below, we give examples with the application of $[\![\mathrm{pref}_{atel}]\!]/[\![\mathrm{pref}_{tel}]\!]$ to the (simplified) examples from CNC. (46) illustrates the telic interpretation enforced by the bounded source prefix *vy-* 'from', whereas (47) illustrates the atelic interpretation caused by the route prefix *pro-* 'through'.

(46)   vy-hloubit   jámu   TELIC
       from-deepen pit
       $\exists e[\mathrm{DEEP}^{\theta_2}_\Delta(e) \geq max(deep_\Delta) \wedge {}_2(e) = \sigma x.{}^*\mathrm{PIT}(x)]$

(47)   pro-dloužit   okamžik   ATELIC
       through-lengthen moment
       $\exists e[\mathrm{LONG}^{\theta_2}_\Delta(e) \geq min(long_\Delta) \wedge {}_2(e) = \sigma x.{}^*\mathrm{MOMENT}(x)]$

Enriching the standard theory with the two new type-shifters promises an explanation of the Czech data discussed above. We have seen that

both lower-bounded and totally closed degree achievements defy the original predictions of Kennedy & Levin (2008). It seems to us that the discrepancy within lower-bounded degree achievements is easily explainable by the above introduced two types of telicizing/atelicizing type-shifters. In this case, it looks like the scalar semantics is definitely not the most important factor in the computation of the final telicity, but instead much more emphasis is placed on the type of the accompanying prefix. Similarly, the equilibrium of telic/atelic reading reported above within totally closed degree achievements can be accounted for with assuming that since the lexical scale supplies both the minimum and maximum point, they can be easily used by the atelic or telic prefixes in the same proportion.

In the following two sections, 4.1 and 4.2, we will summarize some observations concerning degree achievements with differentials and directed motion verbs. In both sections, we show how our approach scales up to a slightly fuller description of degree achievements and their closely connected predicates, namely verbs of directed motion.

4.1   Czech degree achievements and differentials

In this section, we will introduce our approach applied to Czech degree achievements with measure phrases functioning as differentials. This is one of the most complicated parts, since in these constructions, many different pieces of the puzzle are put together. We believe that we are on the right track in describing them the way we present, but our discussion must remain as an outline, as more serious empirical work is needed before we can proceed with a more refined theory.

First, we follow the approach to differentials as introduced in Section 2.3. Namely, we assume that there is the μ projection sandwiched between the degree achievement and the measure phrase. As to the particular linking of the projection to the morpho-syntactic elements of Czech degree achievements with differentials, we do not believe that there is a simple-minded linking of the μ projection to the prefixes within the degree achievement, e.g., consider the examples in (48): as (48a) shows, the differential prepositional phrase appears with a comparative form of the adjective, which itself is not prefixed. The prefix then appears on the degree achievement in (48b), but here, as we will discuss in more detail below, it signals the telicity of the differential construction in a sense discussed in Section 2.3. The measure phrase itself is headed by the preposition *o* 'around', but unlike in English, this *o* 'around' does not signal any imprecision. And we believe it is here for purely syntactical reasons; most probably, it functions as an accusative case assigner.

(48) a. starší o   10 let
          older around 10 years
          'older by 10 years'

      b. zestárnout o   10 let
          to.get.old   around 10 years
          'to get old by 10 years'

One of the crucial differences between degree achievements used without differentials and degree achievements with differentials concerns the variability of prefixes. Many Czech degree achievements allow a vast variety of different prefixes, consider the adjective *rovný* 'straight'—its corresponding degree achievement does allow at least the following prefixes (9 in total) found in CNC: *vy-rovnat* 'from-straighten', *s-rovnat* 'down-straighten', *na-rovnat* 'on-straighten', *po-rovnat* 'after-straighten', *při-rovnat* 'along-straighten', *u-rovnat* 'at-straighten', *od-rovnat* 'from-straighten', *do-rovnat* 'to-straighten', *za-rovnat* 'past-straighten'.

Contrasting with that, the first two most frequent CNC degree achievements with differentials, *roz-šířit o* 'away-widen by' and *pro-dloužit o* 'through-lengthen by', are only able to combine with the prefixes given here. It seems to us that this is an emerging pattern—while degree achievements in Czech allow many types of prefixes and it seems to us that some of them are used purely for boundedness marking, when the degree achievements are used with differentials, the variability of prefixation decreases drastically.

So we hypothesize that the limited variability of differential degree achievement prefixation can be a result of the telicity marking. As we explained above, degree achievements with differentials are always telic, irrespective of the nature of their scale. The empirical support for our claim comes from the fact that in the list of approximately 800 occurrences of Czech differential degree achievements we found in CNC, around 750 of them are degree achievements *roz-šířit* 'away-widen', *pro-dloužit* 'through-lengthen', *z-krátit* 'down-shorten' and *pro-hloubit* 'through-deepen', which are all prefixed with clearly telic or ambiguous prefixes with a goal or via denotation. We summarize that (unlike in the case of degree achievements discussed above) the differential degree achievements seem to be prefixed with bounded/telic prefixes.[4]

Let us now demonstrate one example of our analysis of Czech degree achievements. As we have shown, for various reasons, the most fre-

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4. We note that there were 10 occurrences of verbs like *o-chladnout* 'around-cool' where the prefix is atelic. But since the degree achievements based on the *cool/warm* scales are known to be very much idiosyncratic in terms of their behavior, we tentatively put them at the back burner of our future analysis.

quently used prefix in Czech differential degree achievements seems to be *roz-* 'away'. The meaning of the prefix can be paraphrased as 'to move away from the ground in different directions' (there are, of course, some more abstract and not strictly locative meanings of the prefix, but that is the usual situation with Slavic prefixes). The locative meaning is illustrated in (49). The subtle meaning of the prefix is probably not readily translatable by a single English preposition, but if we would formalize it, it would denote a plurality of paths moving in different directions farther away from the starting point and ending in different final points. Such a meaning is surely non-concatenable in the same way as source/goal prefixes, because no trajectory denoted by the prefix *roz-* 'away' can start at the end of another trajectory, since the starting point would be near the ground, which goes against the two-phase structure of this particular trajectory meaning.

(49) Vrabci   se   roz-létli.
      sparrows REFL   away-flew
      'The sparrows flew away.'

Let us now consider one example in (50) of the *roz-* 'away' prefixed degree achievement with a differential. The bounded meaning of the prefix corresponds to the telic interpretation caused by the μ_v type-shifter, which results in the truth conditions given below. Note, that in the formalization of (50), there is no space for minimal or maximal standards and the telicity comes solely from the differential, which is used as a measure of the changing event. That explains why all the differential degree achievements are always telic, independently from the nature of their scales.

(50) Jeho úsměv se   roz-šířil   o   6 cm.
      his   smile REFL away-widened around 6 cm
      'His smile widened by around 6 cm.'
      $\exists e[\text{WIDEN}^{\theta_1}_\Delta(e) \geq \mathbf{6\ cm} \wedge {}_1(e) = \sigma x.{}^*\text{HisSmile}(x)]$

4.2   Directed motion verbs

In this section, we offer some notes concerning the directed motion verbs. We discuss the directed motion verbs, since they are closely related to degree achievements, as shown already in the examples (1a)/(1b). Consider (51), where the unbounded path in (51a) leads to an atelic interpretation, as confirmed with the standard *in/for*-adverbial test. Unlike (51a), the bounded path in (51b) yields a telic interpretation.

(51) a. John walked along the river for two hours.   ATELIC
     b. John walked to the town in two hours.   TELIC

The directed motion verbs and the degree achievements share the meaning component of the change of an individual over the course of an event, but unlike degree achievements, directed motion verbs realize the change along an abstract path, not along a scalar dimension. In (51), John changes his location along the unbounded and bounded paths as he walks. The similarity of degree achievements with directed motion verbs and incremental theme verbs (like *eat, write*, etc.) lead many researchers to a general theory of scalar change aspiring to explain the three sub-classes (see Hay, Kennedy & Levin 1999; Kennedy & Levin 2008; Kennedy 2012).

Sine qua non, it can be expected that the patterns observed above in Czech degree achievements should be found in Czech directed motion verbs, too. But if we take a simple Czech directed motion verb like *běžet* 'run' and add to it a prefix like *při-* 'toward' in (52) (which with a degree achievement as in (42) leads to an atelic interpretation), the standard test seems to prove that the result is a sentence interpreted as telic. The same is true for a telic goal prefix like *do-* 'to' in (53), but there the result is expected.

(52) Petr při-běhl k věži za hodinu.   TELIC
     Petr toward-ran to tower past hour
     'Petr ran to the tower in an hour.'

(53) Petr do-běhl k věži za hodinu.   TELIC
     Petr to-ran   to tower past hour
     'Petr ran to the tower in an hour.'

Gehrke (2008) contains careful and systematic research concerning the Slavic verbs of motion and their integration into the algebraic path calculus of Zwarts (2005). She concludes that all internal prefixes[5] specify the upper bound of the traveled path, and they seem to result in a telic interpretation, no matter whether their source preposition meaning is telic or atelic. In other words, Gehrke (2008) claims that the pattern we observed in (52)/(53) holds universally for all Slavic prefixes and that all internally prefixed motion verbs are interpreted as telic. This is in contrast with the degree achievement data discussed above, where the correlation between bounded/unbounded profile of the prefix and telic/atelic behavior of the degree achievement was observed. There

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5. Those prefixes which roughly correspond to prepositions, but see Svenonius (2004) for a classic overview and Gehrke (2008) for a refinement.

can be many reasons for this, and discussing them would go far beyond the scope of our article, but we want to make some remarks about a few points.

First, it seems to us that the bounded vs. unbounded profile of the directional prepositions (unlike prefixes), in fact, has a direct impact on the telic interpretation of the directed motion verbs. The crucial data do not come from the singular path denoting verbs discussed above (and by Gehrke 2008) but from so-called indeterminate imperfective verbs of motion. Slavic verbs of motion come in pairs where both members are imperfective. Some Czech examples of such pairs are provided in (54), the first member is called a determinate, the second an indeterminate verb (the terminology is due to Forsyth 1970, the first steps to formalization can be found in Piñón 1997). The indeterminate verbs are a pluractional version of the singular path denoting determinate verbs.

(54)   a. *běžet* vs. *běhat*
           'to run'
       b. *jít* vs. *chodit*
           'to walk'
       c. *nést* vs. *nosit*
           'to carry'

And with indeterminate verbs, we can clearly see that unbounded prepositions like *podél* 'along' in (55) lead to an atelic interpretation. Here, the atelicity of the path denoted by an atelic preposition leads to the unbounded interpretation of the verb. The most salient interpretation is that each singular event of Petr's running along the river was one hour long. But in (56), the bounded path leads either to an interpretation where each run to the hill was one hour long (the adverbial *za hodinu* 'in an hour' measures the length of the atomic events) or there is an interpretation where the plurality of atomic events (of Petr's running up to the hill) was one hour long—the durative adverbial *hodinu* 'for an hour' is compatible only with the homogeneous interpretation which comes from the pluralization of the paths. Crucially, here we see the direct impact of the boundedness profile of prepositions on the verb interpretation.

(55)   Petr běhal podél řeky hodinu /#za   hodinu.
       Petr ran   along river hour   /#past hour
       'Petr ran along the river for/#in an hour.'

(56) Petr běhal na kopec hodinu /za   hodinu.
      Petr ran   on hill   hour   /past hour
      'Petr was running up the hill for an hour.'/
      'Petr used to run up the hill in an hour.'

Although we agree with Gehrke (2008) that in determinate verbs of motion, Slavic prefixes do not act in the same way exemplified with the prepositions in (55) and (56), we believe that if it were possible to find out the prefixed indeterminate verbs of motion, the pattern from (55)/(56) would be replicated. But there is an interesting confound here: the indeterminate verbs of motion do not allow internal prefixation. By way of example, the determinate verb of motion *běžet* 'run' can be prefixed with the source prefix *vy-* 'from' like in (57). But if the same prefix is used with the same but indeterminate verb, the result is an idiosyncratic interpretation 'to get rid of' like in (58) and the simple spatial meaning of the prefix is inaccessible. A similar situation seems to hold for all other verbs of motion. This itself is an interesting problem, but its existence, alas, barred us from testing the predictions of our approach directly on verbs of motion.

(57) vy-běhnout na kopec
      from-run   on hill
      'to run up the hill'

(58) vy-běhat #na kopec /kocovinu
      from-run #on hill   /hangover
      impossible: 'to run up the hill'
      possible: 'to get rid of hangover by running'

5 Summary

In this article, we made first steps to the description of degree achievements seen from the perspective of Slavic verbal prefixation. We discovered some promising correlations: the prefixes which denote bounded trajectories (usually with source or goal denotation) make Czech degree achievements telic, and this holds independently on the scale underlying the degree achievement. Consider the following: *pokoj se vy-hřál* 'the room warmed', *potok vy-schl* 'the creek dried', *místnost se vy-prázdnila* 'the room emptied' and *tričko pro-vlhlo* 'the T-shirt got wet' are all examples of degree achievements interpreted as telic. In the first three cases, the prefix has source semantics, in the last one, it has a route denotation. Contrast this with degree achievements prefixed with

unbounded prefixes (three times with the atelic *o-* 'around' prefix and one time with the locative prefix *u-* 'at'): *pokoj se o-hřál* 'the room was warming', *louže o-schla* 'the puddle was drying', *místnost se u-prázdnila* 'the room was emptying' and *tričko o-schlo* 'the T-shirt was drying'. We reported how this behaviour contradicts the current standard theory of degree achievements and offered a partial solution to the problem which consists in hard-wiring the minimum and maximum of the scale into the prefixes.

We consider our solution to be an improvement of the current standard theory, but, of course, there are many open issues left for future work. First, in some cases, the derivational morphology is not fully productive and it is not always possible to construct all (theoretically available) prefix-verb combinations. As an illustration, there is no Czech verb **o-prázdnit* 'around-empty' with an expected atelic reading. Similarly, there is no Czech degree achievement **vy-vlhnout* 'from-wet' with an expected telic interpretation. Generally, the parallelism between prepositions and prefixes breaks down in many cases. But we consider this a minor problem which can be blamed on the idiosyncrasies of derivational morphology. Another open problem concerns the directed motion verbs, as was discussed in detail in Section 4.2. The third open issue concerns the differential constructions, which are in a few cases lexicalised with unbounded prefixes, as pointed out in Footnote 3. And there has to be many other issues we are simply not aware of. But answering them is a future project.

References

Abusch, Dorit. 1986. *Verbs of change, causation and time*. Tech. rep. Center for the Study of Language & Information. Stanford University. 86–50.

Asbury, Anna, Berit Gehrke & Veronika Hegedűs. 2006. One size fits all: prefixes, particles, adpositions and cases as members of the category P. *Uil OTS yearbook* 2006. Available from: http://www.beritgehrke.com/uploads/1/0/6/4/106403025/psasbgehheg3011.pdf, 1–17.

Bobaljik, Jonathan David. 2015. Suppletion: Some Theoretical Implications. en. *Annual Review of Linguistics* 1(1). 1–18. https://doi.org/10.1146/annurev-linguist-030514-125157. http://www.annualreviews.org/doi/10.1146/annurev-linguist-030514-125157 (4 August, 2020).

Dowty, David R. 1979. *Word Meaning and Montague Grammar. Synthese Language Library, No. 7, Dordrecht, Boston, London.*

Forsyth, James. 1970. *A grammar of aspect: usage and meaning in the russian verb*. Cambridge University Press.

Gehrke, Berit. 2008. *Ps in motion: on the semantics and syntax of P elements and motion events*. Netherlands Graduate School of Linguistics dissertation.

Grano, Thomas & Chris Kennedy. 2012. Mandarin transitive comparatives and the grammar of measurement. en. *Journal of East Asian Linguistics* 21(3). 219–266. https://doi.org/10.1007/s10831-012-9090-y. https://doi.org/10.1007/s10831-012-9090-y (8 September, 2020).

Hay, Jennifer, Christopher Kennedy & Beth Levin. 1999. Scalar Structure Underlies Telicity in "Degree Achievements". In *Semantics and linguistic theory*, vol. 9, 127–144. Ithaca, NY: CLC Publications.

Henderson, Robert. 2013. Quantizing scalar change. In *Semantics and Linguistic Theory*, vol. 23, 473–492.

Karlík, Petr & Zdeňka Hladká. 2004. Kam s ním? (problém stupňování adjektiv). cze. In *Život s morfémy. sborník studií na počest zdenky rusínové*, 1st edn., 73–93. Brno: Masarykova univerzita.

Kawahara, Koji. 2017. Non-neutrality and setting of standards in degree of change and motion events. *Linguistica Brunensia* 65(2). 103–117.

Kearns, Kate. 2007. Telic senses of deadjectival verbs. *Lingua* 117. 26–66.

Kennedy, Christopher. 2012. The composition of incremental change. en. In Violeta Demonte & Louise McNally (eds.), *Telicity, Change, and State*, 103–121. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199693498.003.0004. http://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780199693498.001.0001/acprof-9780199693498-chapter-4 (3 April, 2020).

Kennedy, Christopher & Beth Levin. 2008. Measure of change: the adjectival core of degree achievements. *Adjectives and adverbs: Syntax, semantics and discourse*. 156–182.

Kennedy, Christopher & Louise McNally. 2005. Scale structure, degree modification, and the semantics of gradable predicates. *Language*. Publisher: JSTOR, 345–381.

Křen, M., V. Cvrček, T. Čapka, A. Čermáková, M. Hnátková, L. Chlumská, T. Jelínek, D. Kováříková, V. Petkevič, P. Procházka, H. Skoumalová, M. Škrabal, P. Truneček, P. Vondřička & A. Zasina. 2015. *SYN2015: Reprezentativní korpus psané češtiny*. Praha: Ústav Českého národního korpusu, FF UK. http://www.korpus.cz.

Krifka, Manfred. 1998. The origins of telicity. In *Events and grammar*, 197–235. Springer.

Matushansky, Ora. 2002. On formal identity of russian prefixes and prepositions. *MIT working papers in linguistics* 42. 217–253.

Neeleman, Ad, Hans Van de Koot & Jenny Doetjes. 2004. Degree expressions. *Linguistic review* 21(1). Publisher: Walter de Gruyter & Co., 1–66.

Piñón, Christopher. 1993. Paths and their names. In *Chicago Linguistics Society*, vol. 29, 287–303. Issue: 2.

Piñón, Christopher. 1997. *Verbs of motion in polish, i: parts and processes*.

Rothstein, Susan. 2004. *Structuring Events: A Study in the Semantics of Lexical Aspect*. Oxford: Blackwell Publishing.

Rotstein, Carmen & Yoad Winter. 2004. Total adjectives vs. partial adjectives: Scale structure and higher-order modifiers. *Natural language semantics* 12(3). Publisher: Springer, 259–288.

Sawada, Osamu & Thomas Grano. 2011. Scale structure, coercion, and the interpretation of measure phrases in Japanese. en. *Natural Language Semantics* 19(2). 191–226. `https://doi.org/10.1007/s11050-011-9070-1`. `https://doi.org/10.1007/s11050-011-9070-1` (7 September, 2020).

Svenonius, Peter. 2004. Slavic prefixes and morphology: an introduction to the nordlyd volume. *Nordlyd* 32(2).

Svenonius, Peter & Christopher Kennedy. 2006. Northern Norwegian degree questions and the syntax of measurement. *Phases of interpretation* 91. Publisher: Mouton de Gruyter Berlin, 133–161.

Zwarts, Joost. 2005. Prepositional aspect and the algebra of paths. *Linguistics and philosophy* 28(6). 739–779.