

Telicity as a Semantic Parameter

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1. The Basic Idea: Telicity as Maximalization

The goal of this paper is to provide a framework for characterizing telicity in Germanic languages and the semantics of perfectivity in Slavic languages. We propose that their semantic intersection can be analyzed by means of the maximalization operator MAX_E , which allows us to formulate the semantic telicity parameter as in (1). The maximalization operator MAX_E on events is characterized in (2):

- (1) *The semantic telicity parameter.* In Germanic languages, the maximalization operator MAX_E applies at the level of VP (or V') denotations. In Slavic languages, it applies at the level of V denotations.
- (2) *The maximalization operator MAX_E is a monadic operator, such that $MAX_E(\Sigma) \subset \Sigma$.* It maps sets of events, (partially) ordered by an ordering criterion for objects on a scale, onto sets of maximal events.

As a point of departure, we take the empirical hypothesis that only a small number of verb roots (i.e., simple, underived verbs) lexically incorporates an ordering criterion with respect to which events in their denotation could be maximalized. It follows then that the vast majority of maximal predicates is endocentrically built from verb roots by combining them with expressions that impose an ordering on the unordered sets of events denoted by verb roots. Different languages will use different strategies for the expression of the ordering criterion. They will be partly dictated by what type of information a given language packages into verb roots and morphological operations on verbs. Hence, the telicity parameter proposed in (1) is an attempt at addressing the following question:

- (3) To what extent are the semantic components inducing the ordering on events, and which sanction the application of MAX_E , expressed by V-internal means, and to what extent are they expressed by V-external means at the level of VP (and possibly also IP)?

2. Background

We assume the general framework of event semantics with ontological domains structured by the mereological ‘part-of’ \leq relation, defined from the mereological sum operation ‘ \oplus ’ (see Link 1983, 1987, Bach 1986, Krifka 1986, 1998, Lasersohn 1990, Landman 1989, 2000, among many others). Verb meanings include an eventuality type (a set of eventualities), and the grammar of natural languages distinguishes two main types of root verbs, as given in (4). Atomic root verbs contain the atomic number measure function ‘#’ in their logical representation: If $\text{ATOM}(e)$, then $\#(e) = 1$; if $\neg e \otimes e'$, then $\#(e \oplus e') = \#(e) + \#(e')$ (see Krifka 2001); whereby ‘ \otimes ’ is an overlap relation and ‘ \oplus ’ a sum operation.

- (4) a. **atomic root verbs:** $\llbracket V_{\text{atomic}} \rrbracket = \{e \mid P(e) \wedge \#(e)=1\}$
b. **non-atomic root verbs:** $\llbracket V_{\text{non-atomic}} \rrbracket = \{e \mid P(e)\}$

Since atomic root verbs lexically specify what counts as one event unit in their denotation, they can straightforwardly be modified by adverbs of quantification like *three times*: cp. *John arrived three times (on time last semester)*. Non-atomic root verbs lack the atomic function, and they can be modified with various quantity expressions, just in case the context allows us to determine what counts as ‘one countable event unit’: cp. *John swam (*)three times yesterday*. Since this shift in interpretation requires reference to the discourse context, it is enforced at the level of *IP* interpretations (see Stalnaker 1978, Chierchia&McConnell-Ginet 1999, among others). As in Bach (1986), root verbs like *arrive* take their denotations from an atomic join semilattice, just like count nouns like *apple*. The ‘minimal’ events denoted by the predicates are the atoms and the ‘non-minimal’ events are the non-atomic elements (= plural sums). In contrast, the denotation of each atelic root verb like *run* is taken to have the form of a non-atomic (not-necessarily-atomic) join semilattice, just like mass nouns like *wine*. In so far as the non-atomic (mass) join semi-lattice structure is more general than the atomic (count) one, as Partee (1999) proposes, mass and non-atomicity are the *unmarked* case, whereas count and atomicity are the *marked* case.

3. Germanic Languages

3.1. Maximalization and root verbs

For Germanic, (1) predicts that MAX_E will fail to apply to the denotations at the *V* level. In this section, we will show that this follows, given that the requisite ordering criterion on events cannot be induced from the meanings of

expressions of the V category alone. Consequently, they will be unmarked with respect to maximality.

Generally, MAX_E picks out maximal events relative to a partial ordering imposed by some criterion. Different ordering criteria impose different kinds of ordering relations on an unordered set of events. Once the ordering relation is imposed on a set of events we may distinguish “separate stages, i.e. subevents” (see Dowty 1991, p. 568) that incrementally develop one into the other. We characterize ‘stages’ here in Landman’s technical sense, introduced in (1992) and defined in (2004) as follows:

- (5) If e_1 and e_2 are events and e_1 is a *stage* of e_2 ($e_1 \preceq e_2$) then:
- i. ‘Part of’: $e_1 \leq e_2$, e_1 is part of e_2 (and hence $\tau(e_1) \subseteq \tau(e_2)$).
 - ii. *Cross-temporal identity*: e_1 and e_2 share the same essence: they count intuitively as the same event or process at different times.
 - iii. *Kinesis*: e_1 and e_2 are qualitatively distinguishable, e_1 is an earlier version of e_2 , e_1 grows into e_2 .

Let us first consider the relation between MAX_E and *atomic root verbs* in Germanic languages. Atomic root verbs largely correspond to achievements in Vendler’s (1957) sense (see Kratzer 2004, for example), or verbs denoting ‘singular changes’ in Dowty’s (1979, *Chapter 3.8*) sense: cp. *arrive*, *leave*, *notice*; German *gewinnen* ‘to win’, *platzen* ‘to burst’. They denote unordered sets of singular events, each of which is conceptualized as instantaneous. Therefore, they fail to offer anything but a trivial part-whole structure at best. However, MAX_E generally requires as its input denotations with a non-trivial (partial) ordering on the members of a set. Hence, MAX_E fails to apply to verbs that denote sets of singular atomic events.

In Germanic languages, all the verbs *not* denoting achievements, are *non-atomic*. Cross-linguistically, the class of atomic root verbs is fairly limited, and the majority of root verbs is non-atomic. All non-atomic root verbs denote unordered sets of eventualities that are temporally extended. They can be divided into two large classes: those whose denotations comprise individual-level (IL) properties and those that comprise stage-level (SL) properties (see Carlson 1977). IL root verbs mainly denote *static states* (see Bach 1981, 1986) like *know*, *believe*, *love*. Since they describe ‘tendentially stable’ properties of individuals (see Chierchia 1995) that do not (easily) change throughout their life times, they have no distinguishable stages, temporally or otherwise, which could be subjected to ordering and maximalization. Hence, they are inherently non-maximal or atelic.

SL non-atomic root verbs comprise *dynamic states* (in the sense of Bach 1981, 1986) like *live, sit, stand, lie* and *processes* like *eat, walk* characterized by ‘indefinite changes of state’ (see Dowty 1979, *Chapter 3.8*). Their applicability freely changes over time, and events in their denotation can be homomorphically mapped to their run times by means of the temporal trace function τ (Link 1987, Krifka 1989, 1992, 1998). Since any of their stages (down to the relevant minimal ones) is qualitatively of the same nature as the whole, we cannot determine just by the nature of any given stage whether it counts as ‘one event (stage) growing into another.’ Rather, we need an externally given scale relative to which an event is maximal. Thus a particular running event may be maximal relative to a temporal measure of two hours (as in *run for two hours*), or a spatial path of five miles (as in *run five miles*). With verbs like *eat* the scale is provided by the referent of the argument that describes what is consumed. Thus stages of events in the denotation of *eat a breadstick* will be ordered with respect to the parts of a breadstick, and MAX_E will pick out the maximal event of eating of the whole breadstick, while stages of events in the denotation of *eat dinner* will be ordered with respect to courses of a dinner. In short, events can only be maximal relative to some independent ordering criterion, based on some scale of objects, as stated in our definition of MAX_E in (2). We understand ‘scale of objects’ in the wide of sense: namely, comprising concrete objects like the ordered parts of a single bread stick and also abstract objects like measuring scales based on extensive measure functions such as HOUR.

This proposal is closely related to arguments independently made elsewhere. For example, according to Zucchi (1999), events never culminate *per se*, but with respect to some participant related to them. Krifka (1989) argues that events can never be directly measured, because they have no measurable dimension *per se*. For example, *for an hour* in *John walked for an hour* indirectly measures the walking event by measuring the temporal trace standing in a homomorphic relation to it.

3.2 *Maximalization at the Level of VP Interpretations*

In the previous section, we propose that *no* members of the category V on their own can introduce MAX_E into the logical representation of sentences. It then follows that it is the lexical material introduced at the levels above the V level, possibly also interacting with world knowledge, which contributes towards specifying the ordering criterion on events and thus sanctions the application of MAX_E . Consequently, in Germanic languages, most telic/maximal predicates are syntactically constructed.

In the simplest case, the criterion that imposes a partial ordering relation on events can be recovered in a compositional way from the structure of a *VP*, or its containing sentence. The mechanism by which the scale of events is then induced from it, and which sanctions the introduction of MAX_E , into the logical structure of that *VP* directly follows the semantic composition of a sentence, and hence is a part of the grammar of natural languages. In this simplest case, the ordering criterion is incorporated in the lexical information constraining the Strictly Incremental (*SINC*) Theme relation, as characterized in (6).

- (6) MAX_E and STRICTLY INCREMENTAL (*SINC*) THEME relation: MAX_E maximalizes a set of events (partially) ordered by the ordering criterion derived from the lexical information constraining the *SINC* THEME relation on that set of events.

(6) is close, but stricter than a similar proposal of Landman (1998, p.243, also 2004, p.113) that regards maximalization effects in cumulative (plural) readings. The lexical semantics of *SINC* verbs is defined in (7), following Krifka (1992, 1998 and elsewhere) and Dowty (1988, 1991):

- (7) A part of the meaning of *strictly incremental* (*SINC*) verbs is characterized by a homomorphism entailment: a homomorphism between the lattice structure (part-whole structure) associated with the event argument e and the lattice structure associated with the Strictly Incremental Theme argument x . The thematic relation θ is *strictly incremental*, iff
- i. $MSO(\theta) \wedge UO(\theta) \wedge MSE(\theta) \wedge UE(\theta)$, and
 - ii. $\exists x, y \in U_P \exists e, e' \in U_E [y < x \wedge e' < e \wedge \theta(x, e) \wedge \theta(y, e')]$

Intuitively, i. and ii. in (7) ensure a strict *one-to-one mapping* between the proper parts of e and the proper parts of x . *UO* (uniqueness of objects) is related to a general requirement on thematic relations viewed as functions (cp. also Carlson's (1984) 'thematic uniqueness', and Dowty's (1987) 'uniqueness of role-bearers'). *UE* (uniqueness of events) applies to events involving instantiations of objects that can be subjected to at most one event instantiation of a given type. *MSO* (mapping to subobjects) prohibits a proper part of e from being mapped to the whole object x . *UO*, *UE* and *MSO* apply to verbs like *eat*, but not to *read*, *push*, *ride* or *see*. *MSE* (mapping to subevents) guarantees that no proper part of x be mapped to the whole event e . It applies to verbs like *eat* and *read*, but not to *push*, *ride* or *see*. In addition, the *SINC* relation only applies to events e and objects x which have non-trivial proper parts. For example, it cannot apply to *notice a dot*.

To illustrate how (6) and (7) work, let us consider (8). In (8), a part of the interpretation of the *SINC* Theme argument, the number phrase *at least three sandwiches*, is a scale of objects. This follows assuming that numerals are lexically associated with a scale of numbers (see also Landman 1998), and trigger scalar implicatures (Gazdar 1979, Levinson 1984).

(8) Mary ate at least three sandwiches in an hour/(*)for an hour.

The maximalization operator MAX_E cannot be directly applied to such a lexically derived scale of objects, but rather it operates on a scale of events which is induced from it. (For independent arguments see Landman 1998, 2004.) The scale of events is automatically induced when the verb *eat*, which is strictly incremental (see (7) above), is composed with *at least three sandwiches*, which incorporates the requisite ordering criterion and saturates its *SINC* Theme position. As a result, the verbal predicate $EAT(AT-LEAST-THREE-SANDWICHES)$ is associated with a scalar implicature, consisting of numerical statements describing events of differing sizes. For example, among them will be e_1 , an event of Mary's eating one sandwich, and also e_2 , an event of Mary's eating two sandwiches, and so on. Since *at least three sandwiches* has no lexically specified endpoint due to the contribution of *at least*, neither does $EAT(AT-LEAST-THREE-SANDWICHES)$. When MAX_E is applied to the denotation of $EAT(AT-LEAST-THREE-SANDWICHES)$, it singles out the largest unique event e_i , which leads to the most informative proposition among the alternatives in a given context. That is, when calculating what may count as such an event, we consider increasingly larger events as alternatives, eating of three sandwiches, eating of four sandwiches, and so on. Suppose that (8) can be verified by a situation in which e_5 is the maximal event. This means that e_1, e_2, e_3, e_4 and e_5 are now reinterpreted as its cross-temporally identical stages with the maximal event e_5 being the largest stage. The stages e_1, e_2, e_3, e_4 and e_5 are ordered with respect to the single scale of five sandwiches and its subparts.

Our analysis has four important consequences. First, e_1, e_2, e_3, e_4 and e_5 are not just summed up into a plural event sum, each of which involves an eating of a single sandwich, for example. Instead, MAX_E yields a predicate denoting a new type of event *sui generis*:

(9) The maximal event represents a new entity in the domain of events, instead of being merely a maximal sum of events.

Second, if e_i falls under $MAX_E(P)$, then it cannot have a proper part e_{i-1} that also falls under the same $MAX_E(P)$, given that MAX_E picks out the maximal

(unique) event out of a set of events that satisfy the property described by P at a given situation. But this means that $MAX_E(P)$ is quantized in the sense of Krifka's (1986, 1992 and elsewhere) definition, here given in (10):

- (10) $\forall X \subseteq U_P [QUA_P(X) \leftrightarrow \forall x, y [X(x) \wedge X(y) \rightarrow \neg y <_P x]]$
 A predicate X (e.g., *an apple*, *arrive*) is quantized iff no entity y that is X can be a proper subpart of another entity x that is also X .

Since all quantized predicates are telic (see Krifka 1998), our analysis predicts that (8) will be compatible with the time-span adverbial *in an hour*, one of the standard diagnostics for telicity, but not with the durative adverbial *for an hour*.

Third, when a verb denotes a process eventuality (or activity in Vendler's sense), none of its nominal arguments stands in a thematic relation to it that would allow it to provide an ordering criterion for the requisite scales of events. For example, *push three carts* cannot be taken to denote a set of maximal events (because, intuitively, the maximality depends on the length of the pushing and not the number of the carts), while *eat three apples* does denote such a maximal set.

Fourth, given that our analysis correctly predicts telicity of examples like (8), it points to a new solution of the 'quantization puzzle' (cf. Partee p.c. to Krifka, Zucchi&White 1996, Rothstein 2004, and others), which arises with predicates like *at least three sandwiches*, *a long/short distance*, *a large/small quantity*; *many x*, *a lot of x*, *(a) few x*, *some x*, *most x*; *the CN mass/plural*; *a ribbon*. On their own, they fail to be quantized, according to (10), but compose with strictly incremental verbs to yield VP 's that are quantized/telic with respect to the diagnostic adverbials, contrary to the principle of *aspectual composition* (see Krifka 1986, 1992 and elsewhere).

Our account also correctly predicts that MAX_E in (11a) amounts to the identity function, because the *SINC* Theme argument *exactly three sandwiches* lexically specifies the upper bound of the largest stage in the denotation of *eat exactly three sandwiches*. Moreover, it predicts that MAX_E fails to apply to the denotation of VP 's in (11b), as the compatibility with the diagnostic durative adverbial *for an hour* shows.

- (11) a. Mary ate exactly three sandwiches in / (*)for an hour.
 b. Mary ate bread/sandwiches *in / for an hour.

This follows given that mass (*bread*) and plural terms (*sandwiches*) generally have no scale lexically associated with them. Therefore, they cannot induce an ordering on the part structure of a VP denotation, when they saturate its

SINC argument position. Consequently, the question of what constitutes the maximal event stage (in its denotation at relevant situations) cannot arise, and *eat sandwiches* and *eat bread*, just like *eat* alone, are non-atomic and non-maximal (or atelic). This also clearly shows that (strict) incrementality of such predicates does not guarantee maximality (telicity).

Among the best examples of *SINC* verbs are verbs of consumption (*eat*, *drink*), creation (*build*, *write*, *construct*, *draw*) and destruction (*destroy*, *demolish*, *burn*), for example. Such prototypical members of the *SINC* class have a Theme argument whose referent undergoes a gradual and permanent change of state in its physical extent/volume and in this way determines the extent of the described event. As Krifka (1986, 1992, 1998), Dowty (1991), Filip (1993/99) and Rothstein (2004), among others, observe, there are many telic predicates denoting events whose extent is not determined by the physical extent/volume of the referent of one of their overtly expressed arguments. For example, in (12), *wash* describes changes in the degree of cleanliness, whereby certain degree segments on the implicit scale are lexicalized: cp. *dirty*, *half-clean*, *clean*. It is the parts of this scale (a kind of abstract ‘object’ with respect to the mappings defined in (7)), possibly in conjunction with the parts of a shirt (its collar, sleeves, etc.), which are correlated with the parts of the washing event.

- (12) a. John washed the shirt in an hour / for an hour.
b. John washed the shirt for an hour, but got only the collar clean /...
but none of its parts got (completely) washed.

Verbs like *wash* are traditionally classified as taking the Incremental (*INC*) Theme argument (see Krifka 1986, 1992; Dowty 1991). They differ from verbs with a Strictly Incremental (*SINC*) Theme argument in so far as only the mapping to subevents (*MSE*) applies to them, but not the other three mappings, defined in (7). Most importantly, the ordering criterion on events required by MAX_E cannot be determined in a compositional way from the structure of *VP*'s headed by *INC* Theme verbs alone (in contrast to *VP*'s head by *SINC* Theme verbs). Instead, the possibility of the telic interpretation of such *INC VP*'s presupposes that we can identify (i) a suitable ordering criterion in the domain of ‘objects’ (broadly construed), and (ii) a plausible incremental relation by which the ordering criterion induces a (partial) ordering relation on events; both (i) and (ii) heavily rely on the conventional information evoked by the lexical material within the *VP* and the context of use of its containing sentence. It is, therefore, not surprising that *VP*'s like *wash the shirt* easily alternate between a maximal (telic) and a non-maximal

(atelic) interpretation, depending on the context, as (12a) shows. Moreover, as (12b) shows, *wash the shirt* can be continued with a clause that explicitly denies the (possible, intended, expected or ‘normal’) final stage of the described event, which suggests that maximality (telicity) is here a matter of a conversational implicature. Given such observations, *VP*’s like *wash the shirt* are best viewed as unmarked with respect to telicity (our maximality), as also Partee (1999) proposes.

In contrast, *VP*’s headed by *SINC* Theme verbs are fully determinate with respect to maximality (telicity). This is clearly evident from their interaction with the diagnostic temporal adverbials in (8). (13) shows that negating the final stage of events they describe leads to a contradiction, which suggests that maximality (telicity) is *entailed* by such *SINC VP*’s. This follows if we assume, as we do, that the ordering criterion on events required by MAX_E is determined in a compositional way from their structure alone.

(13) Mary ate three sandwiches, ??but only finished two.

English has a large class of verbs like *wash* that head *VP*’s alternating between a telic and an atelic interpretation, depending on the context, as also Partee (1999) observes. Kratzer (2004) discusses many such verbs, among which are *read, iron, polish, examine, barbecue, roast, iron, bathe, massage, wash, comb, brush, fry, decorate, describe, drain, mop*.

Moreover, virtually any root verb can serve as a building bloc from which maximal (telic) predicates are endocentrically built, provided the described event can be understood as involving some conventionally and/or contextually determined scale with a well-defined final event stage. Examples are easy to find, let us just give two in (14a) and (14b), both of which are headed by not incremental verbs: namely, the non-atomic *see* in (14a), taken from Krifka (1989), and the atomic *discover* in (14b). Determining the ordering criterion crucially relies on the numerical phrase *seventeen clouds* in (14a) and the universal quantifier *all* in the DO-DP in (14b), while the incremental relation comes from the context of use and general world knowledge. The corresponding sentences (14a’) and (14b’) in which the direct objects contain no quantifiers have the non-maximal/atelic interpretation, at least in the most neutral circumstances. It is precisely because the English root verbs *see* and *discover* are unmarked with respect to maximalization that the *VP*’s they head can have the maximal or non-maximal interpretation.

(14) a. Mary saw seventeen clouds *for/in three minutes*.
a’. Mary saw clouds *for three minutes*.

- b. Albert discovered all his relatives living in Iowa *in six weeks*.
b'. John discovered crabgrass in his yard/fleas on his dog *for six weeks*.

Without going into further details here, we draw the following conclusions. First, the class of *SINC* verbs is quite restricted, and so is the number of *VP*'s whose telicity can be computed in a systematic way by applying compositional semantic rules to independently motivated syntactic structures. Second, we propose that MAX_E is a null operator, which relies on the ordering criterion working in tandem with incrementality. Telicity has no expression in any dedicated syntactic operation, and is not systematically correlated with any overt morphology like the accusative case or a quantifier, for example. Thus the same DP like *three apples* can be the direct object of a verb heading a maximal (telic) or a non-maximal (atelic) *VP*: cp. *I ate three apples* vs. *I carried three apples*. Third, often the requisite ordering criterion and/or the incremental relation cannot be determined by the lexical semantics of a head verb and its arguments alone, but also rely on inferences based on the linguistic or extra-linguistic context, world knowledge and cognitive principles of interpretation. Therefore, telicity in Germanic languages often arises from the interplay of syntactic, semantic and a variety of contextual and pragmatic factors, and often is not a matter of entailment, but instead a matter of conversational implicature. (See also Rappaport Hovav 2005.)

4. Slavic Languages

4.1. Maximalization and Root Verbs

If MAX_E is an operator that applies at the level of *V* denotations in Slavic languages, according to (1), then it is predicted that there will be verbs, both underived (root) and derived, whose semantic structure incorporates the ordering criterion with respect to which events in their denotation count as maximal.

In Slavic languages, root verbs manifest a systematic one-to-one correlation between atomicity and grammatical aspect: namely, non-atomic root verbs are imperfective, while atomic root verbs are perfective. (One of the most exhaustive lists of Russian perfective underived (root) verbs can be found in Isačenko 1962, §204, pp. 352-355.) In contrast to Germanic languages, most atomic root verbs in Slavic languages do not denote what is conceived of as punctual events. Traditional Vendlerian 'achievement' verbs are *derived perfectives*: cp. Czech *zpozorovat* 'to notice'/'to spot', *uvidět* 'to catch sight of', *poznat* 'to recognize', *dosáhnout* 'to reach (the summit)', *vyhrát* 'to win (the race)'. Most Slavic atomic root verbs denote events with some temporal

extent, including Vendler's accomplishments: cp. Czech *říci* 'to say', *obléci (se)* 'to dress (up)', for example. Such perfective atomic root verbs are compatible with incremental adverbials like 'gradually', which clearly indicates that they cannot be assimilated to the achievement class, as the Czech example (15) shows:

- (15) Postupně mi to řekl^P. Czech
 gradually me.DAT it.ACC said
 'He gradually told me about it.'

The perfective verb *říci* 'to say' introduces the abstract predicate SAY into the logical representation which relates three arguments. The relation holds between an Incremental Theme y (a statement, a kind of 'object of performance'), here realized as the accusative pronoun *to* 'it', and an event e if and only if e is an event of saying in which x (Agent) utters a complete statement y . Now, on its own and in its basic meaning, the perfective verb *říci* 'to say' is atomic, which means that it has a set of singular events in its denotation and introduces $\#(e)=1$ into the logical representation, and each single event is also maximal relative to exactly one complete statement. That is, *říci* 'to say' lexically determines the ordering criterion based on the part-structure of the referent of its incremental argument y , on which it imposes the requirement $\#(y)=1$. It also determines the maximality requirement, which motivates the presence of MAX_E in its logical representation. The logical representation of *říci* 'to say' is roughly as follows, leaving out information not relevant to the present purposes: $\llbracket \text{říci} \rrbracket = \lambda x,y,e[MAX_E(SAY(e)) \wedge Agent(e) = x \wedge Inc.Theme(e) = y \wedge \#(y)=1 \wedge \#(e)=1]$. In contrast, the English root verb *say* determines no ordering criterion, and consequently no maximality requirement. As we have seen, this generally holds for all Germanic root verbs.

4.2. Maximalization and Derived Verbs

As is well-known, derivational operators on Slavic verbs have effects on their grammatical aspect, lexical meaning and argument structure. In addition, we argue for a novel function of such derivational operators: namely, they add information to the denotation of a verb stem which sanctions the application of MAX_E to it, *provided they function as triggers of ordering criteria that induce scales of events*. Different derivational operators impose different part-of ordering relations on unordered sets of events denoted by verbs to which they are applied.

A paradigm example of such derivational operators is a subset of prefixes that have uses that incorporate vague cardinality or measure function, and whose domain is some (contextually determined) quantifiable dimension of events. The measure function induces a part-of ordering relation on events relative to the size of the measured event dimension. A distinguishing characteristic of such ‘measure’ prefixes is that they impose constraints on the occurrence of other expressions of quantity or measure in the same clause. Paradigm examples are the (ac)cumulative use of the prefix *na-* and its converse, the attenuative use of the prefix *po-*, illustrated in (16):

- (16) a. Vot ja vdóvol’ / *němnóžko **NA**-guljál’sja^P Russian
 well I enough / *a little CM-walk_{PAST.REFL}
 ‘Boy, did I walk a lot!’
- b. Ja (*)vdóvol’ / němnóžko **PO**-guljál^P.
 I (*)enough / a.little ATN-walk_{PAST}
 ‘I took a short walk’ / ‘I walked only a little.’

When *na-* and *po-* are applied to a root predicate meaning ‘walk’, they derive new predicates meaning approximately ‘to walk a lot’ and ‘to walk a little’, respectively. Following Filip (2000), the schematic meaning of prefixes used as expressions of a vague measure is given in (17a). Each prefix used in this way introduces an additional quantity entailment, as we see exemplified for *na-* (17b) and *po-* in (17c):

- (17) a. PREFIX $\mu \rightarrow \lambda x[\mu_C(x) = n_C]$
 whereby, $n_C \text{ r } C_C$, with C_C being a certain conventionally or contextually determined value of comparison.
- b. *NA_{CM}*: $n_C \geq C_C$ and C_C is considered to be a high estimate.
- c. *PO_{ATN}*: $n_C \leq C_C$ and C_C is considered to be a low estimate.

In (17), the variable x represents what is measured, which, in the simplest cases at least, are participants, times, locations, or event occurrences, depending on the context. We assume that the (contextually dependent) measure function μ_C maps entities x to some contextually determined number n_C . We assume that measure functions map entities to intervals on a scale (see also Schwarzschild 2002). The prefix *na-* requires that the amount of the measured entities n_C must meet or exceed a certain conventionally or contextually determined value C_C , while *po-* requires that it meet or fall short of it.

Suppose that the context of (16b) specifies that what *po-* measures is the temporal trace of events in the denotation of *poguljál*, and what counts as walking for a short time is at most 10 minutes in that context. The temporal

trace of 10 minutes provides the ordering criterion, represented as a temporal scale, and the homomorphism between it and the part structure of the associated event yields the corresponding scale of events. Among them will be an event of walking for 10 minutes, and an event of walking for 9 minutes, and so on, any of which counts as walking for a short time. This then sanctions the application of MAX_E to the denotation of a predicate that consists of the prefix *po-* and the root 'walk.' MAX_E singles out the unique event e_i , which leads to the most informative proposition among the alternative events of walking for a short time in a given context. Starting with the walking event whose temporal trace is 10 minutes, the interpreter considers increasingly smaller events as alternatives, walking for 9 minutes, and so on. Suppose that (16b) can be verified by a situation in which walking for 7 minutes took place. The event of walking for 7 minutes is the unique event of walking for a short time, and also the maximal event in this situation. Once MAX_E is applied, the surface perfective verb with its appropriate inflectional suffixes can be formed.

Our account of Slavic prefixed verbs is predicated on two important assumptions, in which the grammar of telicity in Slavic and Germanic languages overlap: First, the maximalization operator MAX_E is clearly separate from the ordering criterion. Second, MAX_E is a phonologically null operator that applies to denotations of expressions that lexically specify an ordering criterion. In Slavic languages, verbal prefixes are not overt exponents of MAX_E , but instead they lexically specify the ordering criterion. The advantage of this proposal is that it allows us to motivate certain puzzling properties of Slavic prefixes, which are intractable on most current approaches to Slavic aspect.

Most current approaches to Slavic aspect take prefixes to be systematically linked to telicity of verbs, and telicity to be the semantics of perfectivity, which amounts to prefixes being equated with perfective marking on verbs. In one syntactic implementation of this idea, prefixes phonologically spell out the telic head feature in a functional projection above the *VP* (see Borer 2004, Kratzer 2004, for example). According to Borer (2004), Slavic prefixes spell out perfectivity very much like the English inflectional suffix *-ed* phonologically spells out the past tense head feature. If this view were correct, then applying prefixes to perfective verb bases, simple or prefixed, ought to be excluded, because it would amount to perfectivizing what already is a perfective base, and be subject to the same general constraints that exclude progressives of progressives as ungrammatical, for example: cp. **John was being running*. However, this prediction is invalid, because

prefixes are not taken to be systematically linked to telicity of German verbs, then there is no more reason for Slavic prefixes to be. Take the Russian verb *vy-deržat* ‘to bear’, ‘to endure’ in (19b). Although it is prefixed and formally perfective, semantically, it cannot be telic, if we understand ‘telicity’ in terms of ‘maximalization on events’, as we propose here, or in terms of ‘culmination’ (see Kratzer 2004), ‘quantity’ (see Borer 2004), or some other notion in current accounts of telicity.

(19) a. *deržat*¹ ‘to (be) hold(ing)’ → b. *vy-deržat*^P ‘to bear’, ‘to endure’

The existence of non-maximal perfective verbs like *vy-deržat* ‘to bear’, ‘to endure’ in (19b) is fully consistent with the semantic telicity parateme (1): It requires that *all* lexical verbal predicates denoting (sets of) maximal events be realized as formally perfective; it does not require that *all* perfective verbs denote (sets of) maximal events.

The puzzles posed by the stacking of prefixes, as illustrated in (18), have constituted some of the most discussed data in Slavic linguistics since Filip (1993/99, 2000, 2004, and elsewhere) introduced them in connection with verbal aspect (see Svenonius 2003, 2004, Ramchand 2004, DiSciullo and Slabakova 2004, and many others). For example, not all the combinations of prefixes are admissible, as the contrast between (18) and (20a,b) illustrates. Admissible combinations of prefixes on the same verb must comply with the general semantic constraint on the grammar of measurement, as Filip (2004) argues, based on Bach’s (1981) intuitive insight that “we do not use the expressions that chunk up our experience with (singular) expressions that provide that experience already chunked up” (ibid., p.74). (For an alternative formulation of this constraint see also Rothstein 2004.)

(20) a. * <i>po-do-sednout</i> ^P <i>si</i> * _{MEAS-GOAL} <i>sit</i> _{INF} REFL * <i>small.distance-to-sit.down</i>	b. * <i>do-po-sednout</i> ^P <i>si</i> * _{GOAL-MEAS} <i>sit</i> _{INF} REFL * <i>to-small.distance-sit.down</i>
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Measure expressions of time like *for an hour* and space like the goal phrases such as *to the post office* trigger scalar implicatures (see also Krifka 1998), and hence are the paradigm examples of expressions that induce a partial ordering relation on events, which in turn sanctions the application of *MAX_E*. This can be seen as motivating the observation that measure prefixes cannot co-occur with goal prefixes on the same verb stem, because each specifies a separate ordering criterion and a separate upper bound for the potential maximal event (see Filip 2004).

4.3. Further supporting evidence

Verbal predicates that encode maximality in what the grammar of a language treats as formally perfective are more restricted in their syntactic distribution, interpretive possibilities and meaning shifts than verbal predicates that are not grammatically perfective. According to our main hypothesis given in (1), in Slavic languages, the maximality of *VP*'s is fully determined by maximal verbs already at the V level. Hence, for Slavic, the second main prediction is that a maximal verb, which is formally perfective, will constrain the semantic (and syntactic) properties of constituents within a *VP*, but no material within a *VP* can override the maximalization requirement of its perfective head verb.

The best examples confirming this prediction involve *VP*'s headed by maximal (perfective) verbs that take bare mass or plural Incremental Theme arguments. For example, (21) asserts that the event culminated when all the children constituting some specific group had their coats on.

- (21) *Za pět minut/*pět minut oblékl^P děti do zimních kabátů.* Czech
in five minutes /*five minutes dressed children_{PL,ACC} in winter coats
'He put winter coats on (all) the children in/??for five minutes.'

This means that the denotation of the bare plural noun *děti* 'children' undergoes a shift from its inherently property-denoting interpretation **children'** (predicative type $\langle e, t \rangle$) into the maximal individual interpretation σx .**children'**(x) '(all) the children' (argumental type e). In general, the perfective verb that is marked for maximality enforces the maximal interpretation of its Incremental Theme argument that is inherently unmarked in this respect. (See also Filip 2004. Arguments that are not Incremental Themes do not undergo this shift in perfective sentences, see *ibid.*, Filip 1993/99 and elsewhere.) We also see that (21) is incompatible with the durative adverbial *pět minut* '(for) five minutes', indicating that (21) has maximal events in its denotation. The perfective (maximal) verb *obléci* 'to dress (up)' cannot undergo a shift into a non-maximal interpretation, and in order to express non-maximal events of dressing, we have to use the morphologically related imperfective verb *oblékat* 'to (be) dress(ing) (up)'. Generally, in Slavic languages, a non-maximal *VP* will be headed by an imperfective head verb, in the majority of cases. In contrast, English atomic root verbs like *discover* are unmarked for maximality, therefore they may head maximal or non-maximal *VP*'s depending on the lexical material within a given *VP*, as we saw in (14b, b'). In (14b'), it is the non-maximal bare mass or a plural argument, which gives rise to a non-maximal interpretation of a *VP*.

The semantic telicity parameter does not preclude *imperfective* verbs, and *VP*'s from containing lexical material that specifies an ordering criterion for the application of predicates they express. However, verbal expressions headed by imperfective verbs are grammatically non-maximal, and any apparent maximality effects we observe in imperfective sentences are a matter of conversational implicature, arising due to their context of use as well as world knowledge, and are cancellable. For example, (22) can have the maximal interpretation meaning that Ivan ate and finished eating all the three pears, but it can also be continued without a contradiction with '... and he didn't finish eating them.'

- (22) Ivan jel^l tri gruši. Russian
Ivan ate three pear.SG.ACC
'Ivan ate three pears.'

5. Conclusion

This paper provides a general framework for capturing the similarities and differences in the encoding of telicity, understood as a maximalization operation in the domain of verbal denotations. Although we focused on a small segment of data from Germanic and Slavic languages, the presented framework should give us the basic tools for dealing with other telicity data not only in Germanic and Slavic languages, but also in typologically unrelated languages. Among the many questions that remain to be answered, let us conclude with the following one: Why does the maximalization operation on plural events (via MAX_E) differ from the maximalization operation on the denotation of plural nominal predicates like *sandwiches*? Recall that MAX_E maps sets of events (partially) ordered by an ordering criterion onto sets of maximal events. In contrast, the maximalization operation on the denotation of plural nominal predicates also applies to unordered sets.

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