

The Semantics of Perfectivity

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The grammatical category of perfective (PFV) aspect is a highly heterogeneous category, both in terms of its expression and the ways in which it is semantically delimited in natural languages. I will examine two common perspectives on a uniform semantic analysis of PFV aspect, namely, what are dubbed here a CULMINATION perspective and a QUANTIZATION perspective. The former focuses on endpoints and results, while the latter, here recast in mereological terms, relates to the notion of ‘a single event seen as an unanalysed whole’. I will show that they are neither necessary nor sufficient, jointly or individually, to characterize the meaning of PFV aspect in natural languages. I will then outline a new proposal that allows us to do justice to the variety of interpretations associated with PFV forms, while at the same time identifying their shared meaning component. The proposal advocated here is that all PFV forms uniformly introduce a maximization operator MAX_E on events (originally proposed by Filip and Rothstein 2005). There is a typology of MAX_E operators in natural languages, all of which share the requirement of selecting the maximal STAGE (Landman 1992, 2008) of a certain eventuality type P leading to the most informative proposition in a given context; they differ, however, with respect to whether the maximal stage requirement is satisfied when stages of P-eventuality (a) culminate with respect to the culmination condition inherent in P, or (b) cease to develop at some contextually determined stage. One of the consequences of this proposal is that Landman’s (1992, 2008) ‘stage-of’ relation does not only underlie the semantics of the English PROG, for which it was originally proposed, but also the semantics of PFV in typologically distinct languages. Moreover, in so far as MAX_E yields what counts as one individuated event at a particular context, PFV turns out to be a grammatical category that is tied to one of our most basic cognitive abilities, namely our ability to individuate entities as singular discrete units.

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1. Introduction

A well-known challenge for a uniform semantic analysis of PERFECTIVITY (PFV¹) in natural languages is the great variation among languages in how they semantically delimit their PFV forms. Some of the meanings most commonly associated with PFV forms are discussed by Comrie (1976, pp. 16ff.) who concludes that neither individually nor jointly can they adequately characterize the semantics of PFV. As an alternative, Comrie (1976) argues that “perfectivity indicates the view of a situation as a single whole, without distinction of the various separate stages that make up the situation” (ibid. p.16),

which is inspired by traditional and structuralist studies, especially in Russian linguistics. Due to its intuitive appeal, it has served as the ‘go to’ characterization, enjoying a widespread use in descriptive and typological aspect studies. By the same token, as many observed (e.g., Klein 1994, 1995), its vague and suggestive nature makes it an unsuitable candidate for a uniform semantic analysis of PFV.

A different approach to the semantics of PFV is taken by Dahl (1985) in his large-scale typological study. Assuming that it cannot be reduced to a single semantic feature or property shared by all PFV forms in natural languages, Dahl proposes a cluster of meanings/uses that characterizes “the prototypical PFV” (ibid.), which subsumes Comrie’s (1976) ‘situation as a single whole’. It is delimited in the following way:

(3.7) A PFV verb will typically denote *a single event, seen as an unanalysed whole, with a well-defined result or end-state*, located in the past. More often than not, the event will be punctual, or at least, it will be seen as a single transition from one state to its opposite, the duration of which can be disregarded (Dahl 1985, p. 78). [emphasis mine]

Dahl’s semantic PFV prototype consists of three key semantic properties, which are highlighted in bold in the above quote. Dahl’s prototype also takes into account an affinity of PFV forms with past time reference (‘located in the past’), which is motivated by the observation that in a number of languages the formal PFV/IMPFV contrast is restricted to the past tense (e.g., Romance). However, at the same time, in a number of languages, aspectually marked PFV forms are realized in other tenses as well, and also in infinitival forms (e.g., in Slavic languages), and it cannot be accepted without a careful justification that aspectual systems that are (largely) orthogonal to tense categories are in some sense less typical or marked. Even if some languages exhibit an affinity between PFV and past tense, the feature ‘past’ is best not viewed as a constitutive feature of a cross-linguistic characterization of the semantics of PFV forms in natural languages, and therefore, in what follows, it will be set aside.

Apart from PUNCTUALITY, Dahl’s semantic PFV prototype includes two notions that characterize two widespread perspectives on the semantics of PFV in contemporary approaches to aspect. One perspective can be dubbed a CULMINATION perspective. On this perspective, PFV forms denote culminated events that have reached their inherent set terminal point at which a transition into “a well-defined result or end-state” (Dahl 1985, p.78) takes place. The other main perspec-

tive focuses on the idea that PFV forms describe “a single event, seen as an unanalysed whole” (Dahl 1985, p.78), roughly along the lines of Comrie’s uniform PFV meaning (Comrie 1976, p.16), see also above). We may call it a TOTALITY perspective, for simplicity’s sake. Let us now examine these notions in order to understand Dahl’s (implicit) claim that they are irreducible to one shared feature or notion.

The culmination view is most clearly reflected in the analyses of PFV aspect in terms of some culmination operator or predicate. For instance, Zucchi (1999) proposes the culmination predicate $Cul(e,t,P)$, which relates eventualities of type P to the time t at which they have culminated (based on Parsons 1990). In the simplest cases, the result or end-state with respect to which events are viewed as culminated is specified by the lexical content of a base predicate P (event-denoting stem, possibly with its arguments) in the scope of the PFV operator, also interacting with linguistic and extra-linguistic context. A paradigm example for the culmination perspective is a PFV operator taking scope over a base accomplishment predicate built with a quantized Incremental Theme argument (Krifka 1989, and elsewhere); such a combination denotes events that culminate when its whole referent has undergone the change specified by its governing verb. This is illustrated with the following PFV sentences in Hindi (1) and Russian (2):²

- (1) # *maya-ne biskuT-ko khaa liyaa, par us-e puuraa nahiin khaa-yaa.*
 # Maya-ERG cookie-ACC.eat take-PFV but it-ACC full not eat-PFV
 #‘Maya ate a/the cookie, but not completely.’ (Arunachalam & Kothari 2012) Hindi
- (2) *Masha s.jela^{PFV} prjanik.*
 Masha PREF.ate ginger.bread.cookie.SG.ACC
 ‘Masha ate (and finished eating) a/(all) the (whole) cookie.’ Russian

In both (1) and (2), the base predicate ‘eat a/the cookie’ is an accomplishment, which straightforwardly follows from the principle of aspectual composition (see Krifka 1989, 1992 and elsewhere), given that its Incremental Theme argument is a singular count DO-DP denoting a quantized predicate. The base accomplishment predicate ‘eat a/the cookie’ specifies the culmination condition (Parsons 1990, Kratzer 2004), namely what would have to be the case for eating events in its denotation to culminate, which is the state in which the whole cookie has been completely consumed. Specifying the culmination condition does not yet imply culmination requirement (*ibid.*). In both (1) and (2), the culmination requirement is contributed by the PFV operator which is introduced into their logical representation by their respective PFV verb forms. The PFV operator requires that they

have only culminated events in their denotation, that is, they only denote events during which a/the whole cookie was eaten. In (1), this is confirmed by the fact that the continuation denying the consumption of a whole cookie leads to an oddity, if not a contradiction. Similarly, (2) would be infelicitous in a situation in which a part of a cookie remained uneaten.

The Hindi PFV form in (1) is the so-called ‘complex PFV’ (see e.g., Singh 1998), which takes the form Verb1 Verb2, where Verb1 is a bare root form denoting some eventuality description, here ‘eat’, and Verb2 is the inflected light verb ‘take’ (bleached of its original lexical meaning),³ which contributes the aspectual perfective meaning to the whole sentence.

In Russian, the grammatical PFV aspect is a lexical property of verbs. In (2), it is introduced by the main lexical verb *s’jela* ‘she ate (up)’. (Note that the PFV aspect cannot be attributed to the prefix *s-* with which *s’jela* ‘she ate (up)’ is derived from the imperfective base form. Generally, Slavic verbal prefixes are not grammatical markers of PFV aspect, as Filip 1992, 1993/99, 2000 and elsewhere argues.)

The other main perspective, dubbed here the TOTALITY perspective, has a long tradition in Slavic PFV studies, for instance. Among many proponents are Koschmieder (1928) for Polish, *Maslov (1948) and Isačenko (1962) for Russian, and also more recently Dickey (2000)*. The totality perspective on the semantics of PFV may also be seen as related to the property of QUANTIZATION in formal mereological theories of aspect, which was defined by Krifka (1989, 1992) for the analysis of the mass/count distinction, and its parallels in the verbal domain of aspectual classes and grammatical aspect. He proposes that PFV forms in Slavic languages denote QUANTIZED predicates:

- (3) Krifka (1986, 1992, 1998 and elsewhere): QUANTIZATION
QUANT(P) $\leftrightarrow \forall e, e' [P(e) \wedge e' < e \rightarrow \neg P(e')]$, where $e \neq e'$
- In words: A predicate P is quantized iff, whenever it applies to some eventualities *e* and *e'*, *e'* cannot be a proper part of *e*, provided $e \neq e'$.
 - All quantized predicates are telic, but not vice versa.

Intuitively, events in the denotation of a quantized predicate have no proper parts that fall under that same quantized predicate. Implicit in Krifka’s characterization of the semantics of Slavic PFV is the idea that it at least overlaps with, if not amounts to, the semantics of telicity, given that all quantized predicates are telic.

The notions of culmination and totality are related in so far as culmination entails totality, but not vice versa. A culminated event is an event that has necessarily taken place in its entirety. Therefore, predi-

cates of culminated events are also predicates of ‘single whole events’, which can be made more precise by saying that they are quantized: namely, they have no proper part that is such that it contains their culmination, apart from the very last one. For instance, if a predicate denotes culminated events of eating of a whole cookie, then such events will have no proper parts during which that whole cookie was eaten.

Culmination is a stricter notion than totality. Not all quantized (total) predicates that denote (sets of) ‘single whole events’ necessarily entail culmination. Take, for instance, PFVs in Slavic languages that are derived with the semelfactive suffix from imperfective bases. In Russian, the suffix in question is *-nu*, as in *blesnut* ‘flash (once)’:

- | | | | | | |
|-----|--|----------------|--------------------|--------------|---------|
| (4) | <i>Bles'nu</i> ^{PFV} | <i>na nebe</i> | <i>serebrianyi</i> | <i>serp.</i> | Russian |
| | flashed | on sky | silver | sickle | |
| | ‘A silver sickle flashed (once) in the sky.’ | | | | |

Formally marked semelfactives in Slavic languages are PFV, but do not entail culmination, in the common sense of a well-defined result state. They entail a change from some initial state of affairs $\neg p$ to p , followed by another change back to the initial $\neg p$. At the same time, they denote quantized predicates of ‘single whole events’. For instance, *blesnut* ‘flash (once)’ cannot simultaneously describe an event and subevents of that same event.

Semelfactives, which are formally marked, as in Slavic languages, or formally unmarked in English (e.g., *hit*, *slap*, *blink*), and are taken to describe single PUNCTUAL events, that is, events conceived of as having their beginning and end fall into a single moment of time. This brings us to PUNCTUALITY, the third main semantic characteristics of Dahl’s prototypical PFV. Predicates of punctual events trivially satisfy the TOTALITY perspective (which can be formalized in terms of quantization), in so far as they are viewed as denoting events with no proper parts. However, they do not necessarily comply with the CULMINATION perspective, because not all the predicates of single punctual events entail a well-defined result or end-state, as we have seen in the case of semelfactives.

The above observations suffice to conclude that the three main semantic properties commonly associated with PFV forms in natural languages, and captured in Dahl’s (1985, p. 78) prototype cluster, cannot be reduced to a single semantic feature or property. CULMINATION (“a well-defined result or end-state”, *ibid.*) entails TOTALITY (“a single event, seen as an unanalysed whole”, *ibid.*), but not vice versa. The property of PUNCTUALITY can be subsumed under TOTALITY as its special, trivial, case, but it is incompatible with the property of CULMINATION.

There is another well-known, but often ignored, complication adding further sand into the gears of a unified semantic analysis of PFV in natural languages. In a number of languages that have a fully developed grammatical category of perfective aspect, we find bona fide PFV forms that entail neither completed events, nor single events ‘seen as an unanalysed whole’, nor punctual events. Such uses of PFV forms cannot be dismissed as exceptional outliers, because they constitute a systematic feature of their respective aspect systems. Yet they do not fit the expected semantic profile of a prototypical PFV in natural languages, along the lines proposed by Dahl (1985), for instance. Two salient examples of such uses of PFV forms are:

- (i) so-called ‘atelic perfectives’ (see e.g., *Kučera 1979*) or perfectives that pose a quantization puzzle (Filip 1992, 2000 and elsewhere);
- (ii) PFV accomplishments with a non-culminating, ‘partitive’ or partially completed, interpretation, or, for short PFV ‘non-culminating accomplishments’, which have been attested in a number of languages (South Asian and East Asian languages, American Indian languages, Austronesian languages, Turkic languages, see below).

In what follows, let us briefly introduce one example for each case. First, as far as ‘atelic perfectives’ in Slavic languages are concerned, a good case in point is the Russian perfective verb *my pojezdili* ‘we went for a ride’ in (5):

(5)	<i>My</i>	<i>po.jezdili</i> ^{PFV}	<i>po</i>	<i>našemu gorodu.</i>	Russian
	we	DEL.drive.PST	on	our town	DEL ‘delimitative’
	‘We went for a ride / took a ride around our town.’				

Such perfective verbs as *my pojezdili* ‘we went for a ride’ pose the following quantization puzzle, as Filip (1992, 2000) calls it. That is, they are puzzling on the widespread view that PFVs in natural languages denote predicates of ‘events [viewed] as single unanalyzed wholes’ (Comrie 1976, Dahl 1985), or put mereologically, quantized predicates (Krifka 1989, 1992), as defined in (3). The form *my pojezdili* ‘we went for a ride’ is uncontroversially PFV in so far as it satisfies most standard formal and semantic criteria of PERFECTIVITY in Slavic languages: it cannot be used as a complement of the future auxiliary and phasal verbs, such as ‘start/continue/finish’, it cannot form a present participle, its present tense form only gets a future interpretation, and it can never be used with reference to ongoing events ‘in progress’, among others. And yet, *my pojezdili* ‘we went for a ride’ fails to denote ‘single events as unanalyzed wholes’, or it fails to be quantized, according to (3) above,

because it can simultaneously describe an event of going for a ride as well as proper subevents of that same event (and also its superevents).

Given that *my pojezdili* ‘we went for a ride’ fails to denote quantized predicates, it also lacks the property of culmination, which is a stricter property than quantization. For *my pojezdili* ‘we went for a ride’, the question of culmination does not arise, because the verb does not lexically specify an upper bound or some end-state with respect to which events denoted by it could be viewed as culminated (and neither does its sentential context).

Filip (1992, 2000) shows that PFV verbs in Slavic languages induce the quantization puzzle due to the lexical semantic contribution of prefixes with which they are formed. As is well known, prefixation is one of the most common processes for deriving perfective verbs from imperfective base forms, but also from perfective ones. While prefixes as a whole class form verbs that are grammatically perfective (with a few negligible exceptions), each prefix has a variety of contextually determined meanings, and contributes modifications to its base form related to time, manner, space, quantity, affective connotations, and the like. Some combinations of prefixes with verb stems are compositional, while others fully lexicalized and non-transparent.

Most importantly, Slavic verbal prefixes induce the kind of lexical modifications that are difficult to reconcile with what is taken to be the typical meanings of PFV forms, including meanings subsumed under the notions of quantization and culmination, along the lines captured in Dahl’s (1985) empirical generalization, for instance. Specifically, as Filip (1992, 1996, 2000) argues, the lexical modifications in question concern measurement, vague quantity, or weak quantificational meanings that are akin to those expressed by lexical (word-internal) operators (“lexical A-quantifiers”, Bach et al 1995), which have been studied in a number of non-Indo-European languages (e.g., Warlpiri (Hale 1989), Haisla (Bach 1995), Chichewa (Dalrymple *et al.* 1994), West Greenlandic (Bittner 1995)). For instance, take the prefix *po-* in *my pojezdili* ‘we went for a ride’ (5), which has the effect of deriving perfective verbs that denote sets of temporally and/or spatially vaguely delimited singular events, but leaving it vague what exactly counts as ‘one’ event. This use of the prefix *po-* is labeled ‘delimitative’ in descriptive and structuralist grammars. In sum, for Slavic languages, one of the main puzzles and challenges for the semantic analysis of PFV has to do with the lexical semantic properties of prefixes used to form PFV verbs.

Let us now turn to the second case of PFVs that are unexpected from the point of view of the semantic profile of prototypical PFV in

natural languages, as, for instance, characterized in Dahl (1985): namely, so-called ‘non-culminating accomplishments’. These are predicates that correspond in their lexical content to accomplishment predicates in English, such as *eat a/the cookie*, and hence clearly specify the culmination condition on events in their denotation, which in our example would be the state in which the whole cookie is eaten. However, they do not necessarily have only culminated events in their denotation, because the PFV operator; in other words, they have PFV operators in question do not add the culmination requirement to the base accomplishment predicate. Consider the Hindi example in (6):

- (6) *maya-ne biskuT-ko khaa-yaa par us-e puuraa nahiin khaa-yaa.*
 Maya-ERG cookie-ACC eat-PFV but it-ACC full not eat-PFV
 ‘Maya ate a/the cookie, but not completely.’ (Arunachalam & Kothari 2012) Hindi

The PFV in (6) is what is called the simple PFV form (Singh 1991, 1998), the other of the two PFV forms in the grammar of Hindi, besides the complex PFV form, which is in (1). The simple PFV form is built with the suffix *-yaa* that is directly attached to the main lexical verb, ‘eat’ in (6). Both (1) and (6) have the same base accomplishment predicate ‘eat a/the cookie’ which specifies the culmination condition (in the sense of Parsons 1990, Kratzer 2004), which involves the state in which a whole cookie is eaten. Now, while the COMPLEX PFV in (1) requires that (1) have only culminated events in its denotation, that is, only events in which the whole cookie was completely eaten, the SIMPLE PFV in (6) allows for continuations explicitly denying the culmination requirement (‘... but not completely’). In contrast to (1), (6) is associated with a default inference or conversational implicature that the events it describes have culminated, but it also sanctions reference to events that need not have culminated (see e.g., Singh 1991, 1998; Kothari 2008; Arunachalam & Kothari 2010, 2012).⁴ That is, (6) may be used with reference to events that do not culminate at the absolute end point of denoted eating events, i.e. when the whole cookie was eaten, but rather terminate at some contextually determined point when only a part of the cookie was eaten. In this sense, accomplishments in the scope of the SIMPLE PFV are taken to have a ‘partitive’ or partially completed interpretation (Singh 1998, p.197). In sum, for Hindi, the main challenge is to motivate why the simple PFV form allows for a non-culminating (‘partitive’, or ‘partially completed’) interpretation of accomplishments, given that by default it leads to a culminating interpretation.

In Thai, according to Koenig and Muansuwan (2000), there are PFV constructions with base accomplishment predicates that never entail

culmination, but instead always denote parts of events, and pragmatic enrichment processes determine whether they are to be interpreted as having culminated. In Thai, PFV is traditionally taken to be expressed by serial verb constructions with a limited set of verbs that have ‘semi-perfective’ meanings: ‘ascend’ (*khûn*), ‘descend’, ‘exit’, ‘enter’, ‘go’ and ‘come’ (Thepkanjana 1986). However, such markers do not entail culmination, and in this respect they differ from ‘completive perfectives’ according to Koenig and Muansuwan (2000), even if they co-occur with perfect markers. Instead, for ‘semi-perfective’ markers culmination is merely a strong implicature (see *ibid.* p. 178). This is illustrated by (7), which has no culmination entailment (Koenig and Muansuwan 2000, p. 167). Neither has it an atelic interpretation. Moreover, it cannot have a progressive interpretation, which is one of the contextually determined uses of sentences with imperfective bare stem accomplishments, as in (8) (Koenig and Muansuwan 2000, p. 163).

- (7) semi-perfective marker (serial verb) *khûn* (Koenig and Muansuwan 2000:167, ex. (33))

Surii tɛ̀ɛŋ klɔ̀n khûn
 Surii compose poem ascend
 ‘Surii composed /will compose a/the poem.’

- (8) imperfective bare stem accomplishment (Koenig and Muansuwan 2000:163, ex.(29))

Surii tɛ̀ɛŋ klɔ̀n
 Surii composepoem
 ‘Surii is composing/was composing/composes (habitually)/will compose/composed a/the poem.’

According to Koenig and Muansuwan (2000), PFV non-culminating accomplishments in Thai have analogues in other languages of South and East Asia, citing Chinese (Talmy 1991; Smith 1997), Hindi (Singh 1991), Korean (Park 1993), and Tamil (Paramasivam 1977). Independently, they have also been observed in a number of other languages, for instance, in American Indian languages, Austronesian languages as well as in Turkic languages. The following more detailed list suffices to show that PFV accomplishments with non-culminating interpretations (aka non-culminating accomplishments) have raised much attention in aspectual studies:

- Salish languages (American Indian languages): St’at’imcets and Skwxwú7mesh (Lilloet Salish) (Bar-el, Davis and Matthewson 2005);
- Sino-Tibetan: Chinese (Talmy 1991, Smith 1991/97); Mandarin (Teng 1972);
- Dravidian languages: Tamil (Paramasivam 1977, Pederson 2007);
- Indo-European (Indic): Hindi (Singh 1990, 1991, 1998; Verma

- 1993, Kothari 2008, Arunachalam & Kothari 2012), Punjabi (Raja 2003);
- Korean (Park 1993);
 - Kadai languages: Thai (Koenig and Muansuwan 2000);
 - Japonic: Japanese (Ikegami 1985);
 - Austronesian languages: Tagalog (Dell 1987), Malagasy (Travis 2000);
 - Turkic languages spoken in the Caucasus: Karachay-Balkar (Tatevosov 2007, 2008).

PFV non-culminating accomplishments with non-culminating interpretations (aka non-culminating accomplishments) are not marginal outliers, but rather a systematic feature of their respective aspect system. Nevertheless, they are usually presented as puzzling and unexpected, which largely has to do with the fact that they are directly compared with what is taken to be a paradigm case of accomplishments, namely accomplishments in the simple past tense in English, such as the following one:

- (9) ?? Maya ate a cookie, but not completely.

With such English accomplishments in the simple past tense continuations like ... *but not completely* lead to an oddity or a contradiction, which indicates that culmination is a matter of entailment. In this respect, they pattern with ‘well-behaved’ PFV accomplishments, in languages with a grammatical PFV category, as we have seen in the Hindi COMPLEX PFV accomplishment (1) and the Russian PFV accomplishment (2).

While English has no grammatical PFV category, unlike Hindi or Russian, data like (9) lead to proposals to treat simple past tense sentences in English as aspectually perfective (e.g., Klein 1995; Zucchi 1999, among others), possibly also introducing a phonologically null PFV operator. Compositionally speaking, in examples like (9), the base accomplishment predicate *eat a cookie* specifies a culmination condition (in the sense of Parsons 1990, Kratzer 2004), but does not entail culmination requirement, which, in English, is taken to be introduced by the simple past tense (Parsons 1990).⁵ That is, compositionally speaking, in order to understand accomplishments, a special case of telicity, in English, it is useful to split the meaning of English simple past tense accomplishment (telic) predicates into (i) culmination condition expressed by uninflected predicates like *eat (Maya, the_cookie)*

and (ii) culmination requirement (entailment that culmination was attained in the actual or some possible world).

Now, from the point of view of English accomplishments in the past tense like (9), it may seem puzzling that there should be languages in which there are base predicates that correspond in their lexical content to English accomplishments, but which have no culmination entailment/requirement despite being in the scope of an *overt* PFV operator, like the Hindi example in (6) or the Thai one in (7). This may become less surprising, however, if one takes into account data like (10), which are rarely noticed, showing that also English accomplishments in the simple past tense may have non-culminating interpretations:

- (10) a. *She ate the sandwich but as usual she left a few bites.* (Hay et al 1999)
 b. *Bill ate the apple bit by bit for ten minutes (and still didn't finish it).* (Jackendoff 1996)

Given examples like (10), even for English accomplishments culmination is a cancellable default inference or conversational implicature, similarly as it is for 'deviant' PFV non-culminating accomplishments in languages with a grammatical PFV category, in Hindi or Thai. Contrary to what is often assumed, simple past tense accomplishments in English do not uniformly denote only culminated events, but also may have contextually induced non-culminating (partitive or partial) interpretations, as in (10).

What is also intriguing is that the wide range of meanings/uses that members of the PFV category may have within a particular language and across different languages subsumes meanings that also imperfectives have. This raises the question about the semantic (and pragmatic) delimitation of the PFV category from that of the IMPFV category, within a single language and also cross-linguistically. For instance, SIMPLE PFV accomplishments in Hindi, as in (6), or 'semi-perfective' serial verb constructions in Thai, as in (7), functionally overlap with Slavic IMPFV accomplishments, as in the Russian example (11), rather than with PFV accomplishments.

- (11) *Masha jela IMPFV prjanik.* Russian
 Masha ate ginger.bread.cookie.SG.ACC
 (i) 'Masha ate (up) a /the /some gingerbread cookie.' [possibly all of it] general factual
 (ii) 'Masha was eating a /the /some gingerbread cookie'. progressive
 (iii) 'Masha used to eat a /the /some gingerbread cookie'. habitual

Setting aside the progressive and habitual (generic) uses of the Slavic IMPFV category, IMPFV accomplishments like (11) may be used with reference to non-culminating events (without any further impli-

cations of progressive or habitual meanings), but also with reference to culminated events, for instance, when it is known that events described by it have culminated. If the ‘culminating’ use is intended, (11) is interchangeable ‘salva veritate’ with the corresponding PFV sentence, as in (2). PFVs like (2), by contrast, only have culminated events in their denotation, hence they cannot be used in all the contexts in which IMPFVs are sanctioned.

Of course, there are differences between the Russian IMPFV, the Hindi SIMPLE PFV, and the Thai ‘semi-perfective’, which follow from their place in the system of the aspectual oppositions in Russian, Hindi and Thai, respectively. For instance, the Hindi SIMPLE PFV, as in (6), is taken to denote culminated events by default or as a matter of conversational implicature, but it may also denote non-culminating (partially completed) events. In Slavic languages, contextually determined culminating and non-culminating (partially completed) interpretations of IMPFV accomplishments can be thought of as arising by pragmatic enrichment processes of the so-called ‘general factual’ or ‘simple denotative’ use of the Slavic IMPFV, which is one among its three most common uses: namely, “the speaker is simply interested in expressing the bare fact that such and such an event did take place, without any further implications, and in particular without any implication of progressive or habitual meaning; sentence-stress falls on the verb” (Comrie 1976, p.113). The general factual use of the Slavic IMPFV constitutes ‘the strongest evidence’ (Comrie 1976, p.113) for the unmarked status of the IMPFV in the Slavic PFV/IMPFV opposition, where the PFV is the marked member. The Slavic PFV enforces a culminating interpretation of accomplishments in its scope, as we have seen in (2) above. In Slavic languages, unlike in Hindi and Thai, for instance, non-culminating interpretations of PFVs systematically occur only with base process predicates, as in (5).

In sum, we have seen that the three main semantic properties – here labeled as CULMINATION, TOTALITY and PUNCTUALITY – that form Dahl’s (1985, p.78) semantic PFV prototype cannot be reduced to a single semantic feature or property, thus confirming what seems to be Dahl’s implicit suggestion. Second, taken jointly, they are insufficient to characterize the semantics of the cross-linguistic PFV category (*pace* Dahl), because there are languages with a fully developed grammatical category of perfective aspect in which bona fide PFV forms have common uses that do not neatly fit any of these three semantic properties. We examined two such cases: namely, ‘atelic perfectives’ in Slavic languages (Russian), and SIMPLE PFV accomplishments in Hindi non-culminating accomplishments in Hindi and many other lan-

guages. Most importantly, they cannot be viewed as marginal outliers in the PFV domain, but rather they are systematic features of their respective aspectual systems.

The above observations suffice to illustrate at least some problems that complicate any attempt at providing a uniform semantic analysis of PFV in natural languages. Given the wide variety of interpretations PFV verb forms may have, we may also ask why there should be this variety in the first place. This leads me to pose the following main questions:

- i. Is it possible to provide a uniform semantic characterization of PFV forms (denotation problem)?
- ii. What is the reason for the variety of interpretations associated with PFV forms (functional diversity)?

The main interest of this paper lies in the first denotation problem. When facing this problem, and in the light of the challenges such as those posed by the ‘misfit’ PFV forms introduced above, it has been proposed to define a third aspect category, in addition to the PFV and IMPFV, such as neutral aspect, as in Smith (1991:97). Another common strategy is to split the PFV category into distinct subtypes: namely, neutral perfective (Singh 1991, 1998), non-completive perfective (ter Meulen 1995), or semi-perfective (Koenig and Muansuwan 2000).

The perspective taken here is to assume that a uniform semantic characterization of PFV forms is possible, and also desirable, and that it should only be abandoned if there are compelling arguments against it.

3. Proposal

3.1 Theoretical Background

NEO-DAVIDSONIAN EVENT SEMANTICS. The theoretical background assumed here is that of Neo-Davidsonian event semantics enriched with mereological structures. Verbs are represented as one-place predicates of eventualities,⁶ that is, verbs are not relations, but denote sets of eventualities.⁷ Arguments are treated as conjuncts, and analyzed as two-place predicates denoting relations between an eventuality argument and some participant argument (Dowty 1991, p.551).⁸ Two examples are given below:

- (12) a. $[\textit{walk}] = \lambda x \lambda e [\textit{WALK}(e) \wedge \textit{AGENT}(e, x)]$
a set of eventualities e such that e is a walking by x (standing in an Agent relation to e)
- b. $[\textit{eat}] = \lambda y \lambda x \lambda e [\textit{EAT}(e) \wedge \textit{AGENT}(e, x) \wedge \textit{THEME}(e, y)]$
a set of eventualities e such that e is an eating by x (Agent participant) of y (Theme participant)

MERELOGICAL THEORY OF ASPECTUAL CLASSES. The basic assumptions regarding the meaning of verbs are summarized as follows:

- (13) a. $\llbracket V \rrbracket$ includes E_i , where 'Ei' eventuality type (a set of eventualities)
- b. $\Sigma = \{E_1, E_2, \dots, E_n\}$
- c. The mereological 'part-of' relation \leq : reflexive, transitive, and antisymmetric, hence a partial order relation, here defined from the mereological sum operation \oplus , which is a binary sum operation, idempotent, commutative, associative.
- d. $\Sigma = \text{STATES} \cup \text{PROCESSES} \cup \text{EVENTS}$
 Σ is the union of the set of STATES, the set of PROCESSES, and the set of EVENTS

Verbs, taken as basic lexical items, have an eventuality type (a set of eventualities) as a part of their meaning (13a). Eventuality types represent a part of our understanding of the nature of various states of affairs, how we classify them as eventualities of a certain type, for instance, as smiling, composing a poem, learning French, believing, noticing, drinking wine. The ontological domain of eventualities Σ (13b), from which verbs take their denotations, forms a complete join semilattice (or an upper lattice), ordered by the standard mereological 'part-of' \leq relation (13c). This key innovation was introduced into event semantics by Bach (1986) who extends Link's (1983) algebraic semantics of mass terms and plurals to the semantics of verbs. While Link (1983, 1987) and Bach (1986) assume that verbal (and nominal) predicates take their denotations from two ontological domains, one structured by an atomic lattice and the other by a non-atomic lattice structure, following Krifka (1986, 1998 and elsewhere), here we assume a single non-atomic domain of eventualities (and a single non-atomic domain of individuals), over which we define operations that allow us to derive the meanings of various types of verbal (and nominal) predicates.

Aspectual classes generalize over different types of eventuality descriptions (the term 'eventuality description' is coined by de Swart 1998). We assume three main aspectual classes: STATES, PROCESSES and EVENTS (Mourelatos 1978/81, Bach 1981, Parsons 1990) (11d). The term EVENTS is used here in the technical sense as subsuming accomplishments and achievements, following Bach (1981, 1986) or Parsons (1990); eventuality descriptions denoting EVENTS in this sense are telic.

ASPECTUAL CLASS, GRAMMATICAL ASPECT AND TENSE. Assuming that aspectual class is determined at the level of eventuality descriptions (as in de Swart 1998), the relation between an eventuality description of a certain aspectual class, grammatical aspect and tense in the logical structure of tensed sentences may be schematically represented as follows, adapted in a slightly modified way from de Swart (1998, p. 348):

- (14) $\llbracket \text{Tense} [\text{Aspectual_Operator}^* [\text{Eventuality_Description}]] \rrbracket^9$ (de Swart 1998, p. 348)

Tense operators introduce existential closure over the eventuality argument, and relate eventuality times to the speech time or some other contextually determined time.

Eventuality descriptions serve as input into tense and aspectual operators, they are denoted by uninflected predicates or atomic sentences like `EAT (MAYA, THE_COOKIE)` (de Swart 1998, and related assumptions in Zucchi 1999). A basic or an atomic eventuality description consists of an uninflected verb with all its argument positions filled by constants or variables.

Grammatical aspect operators, whose main categories are `PERFECTIVE` and `IMPERFECTIVE`, are interpreted as modifiers that apply to eventuality descriptions (building on Moens (1987, pp. 44f.), and de Swart (1998)). Among modifiers of eventuality descriptions are also *for-* and *in-*adverbials, Goal-PPs and resultative XPs. Generally, aspectual operators are interpreted as eventuality description modifiers yielding eventuality descriptions of possibly different aspectual type than the input (also de Swart 1998). For instance, taking the Russian perfective accomplishment sentence in (2), it can be semantically analyzed as consisting of (i) a base accomplishment eventuality description which specifies the culmination condition on events in its denotation, and (ii) a PFV operator that is applied to it and adds culmination requirement that events in its denotation have culminated in the actual or some possible world.

3.2 Proposal: A unified analysis of PFV via a maximization operator on events

In a nutshell, PFV forms uniformly denote sets of maximal singular events. Formally speaking, PFV forms uniformly introduce a maximizing operator MAX_E into the semantic representation.

- (15) The maximization operator on events MAX_E is a monadic operator, such that $\text{MAX}_E(\Sigma) \subset \Sigma$. MAX_E is applied to (a partially ordered set of) stages of a certain eventuality type P (interpreted at the type of predicates $\langle e, t \rangle$) and maps them onto sets of maximal stages $\text{MAX}_E(P)$ (type $\langle e, t \rangle$).

The ‘stage-of’ e relation (Landman 1992, 2006):

For events: e_1 is a stage of e_2 : $e_1 \leq e_2$.

Iff e_1 and e_2 are events, and e_1 is a stage of e_2 , then:

- i. Part of: $e_1 \leq e_2$, e_1 is part of e_2 (and hence $t(e_1) \subseteq t(e_2)$).
- ii. Cross-temporal identity: e_1 and e_2 have the same temporal starting point (and share the same essence: they count intuitively as the same event or process at different times).
- iii. e_2 is a development of e_1 , e_1 is an earlier version of e_2 , e_1 grows into e_2 , e_1 and e_2 are qualitatively distinguishable.

MAX_E was originally proposed in Filip & Rothstein (2005) and Filip (2008) for the analysis of the shared semantic core of telicity in Germanic languages and PFV in Slavic languages. Subsequently, it was adapted by Altshuler (2013, 2014) for the analysis of the Hindi perfective, Russian imperfective, and English progressive, and it was also applied in the modal analysis of the Russian perfective in Tatevosov (2013).

The main novel proposal is that there is a typology of MAX_E operators, also building on some unpublished work by Altshuler & Filip (2014):

- (16) Typology of MAX_E operators.
MAX_E operators
(i) share the requirement to select the maximal STAGE (Landman 1992, 2008) of a certain eventuality type P leading to the most informative proposition in a given context, but
(ii) differ with respect to whether the maximal stage requirement is satisfied when stages of P-eventuality
(a) culminate with respect to the culmination condition inherent in P, or
(b) cease to develop at some contextually determined stage.

MAX_E is a function that yields a set of singular maximal events, MAX_E(P), relative to P and context. MAX_E is applied to an eventuality description of any aspectual class, EVENT, PROCESS or STATE. In a given context, MAX_E singles out the largest unique event stage in a poset of eventuality stages in the denotation of P which leads to the most informative proposition among the relevant alternatives. The effect of MAX_E, in simple terms, is to individuate what is intuitively ‘a single event, seen as an unanalysed whole’ (Comrie 1976, Dahl 1985) relative to a predicate P and a particular context. The uninflected predicate P in the scope of MAX_E need not uniquely determine an individuating function for its application, and therefore what is one maximal/individuated event falling under P may vary from context to context.

MAX_E could be viewed as an analogue of the supremum of a set in the nominal domain, used to represent the semantics of the definite article (see Montague (1973, Sharvy 1980, Krifka 1986). In discourse structure and temporal anaphora, such maximal events function as non-overlapping atomic events (see Kamp and Rohrer (1983) on the discourse function of perfective aspect).

This proposal presupposes two key ideas in Davidsonian event semantics. First, similar to entities and the nominal domain, eventualities are identified under particular descriptions. One and the same state of affairs in the world can always be described by more than one correct description.¹⁰ Different descriptions ascribe different properties to a given state of affairs (Krifka 1989, 1998, Filip 1993/99, Partee 1999, Rothstein 2004, i.a.).

Second, similar to objects (i.e. countable entities as in the denotation of count nouns), events are only individuatable under particular descriptions (modulo context). There are different implementations of this idea, see e.g., Verkuyl (1971/72, 1993, and elsewhere), Tenny (1987, 1994), Jackendoff (1996), Ramchand (1997). In mereological event semantics assumed here, this idea is formalized by Krifka (1989, 1990), and subsequently in various modifications and refinements adapted in Filip (1993/99, 1997), Rothstein (2004), Nakanishi (2007), among others. Observing that events have no measurable dimension as part of their ontological make up, Krifka (1989, 1990) argues that they can, therefore, never be directly measured, and hence ‘apportioned’ to individuated event units. Instead, they can be indirectly measured, and hence individuated, by measuring their participants or run times. The formal implementation of this idea presupposes, as is standard in event semantics, that verbal predicates take arguments identified in terms of thematic roles that denote relations between eventualities e and their participants x (or, alternately, denoting (partial) functions from sets of eventualities e to sets of their participants x , see also above). The object-induced indirect measurement of events is specifically sanctioned by INCREMENTAL RELATIONS between eventualities e and one of their participants x , which, in turn, are characterized in terms of a one-to-one mapping between parts of e and parts of x (Krifka 1989, 1990). For instance, this mapping straightforwardly predicts that the uninflected predicate *eat two cookies* denotes a quantized set, a set of individuated events (accomplishments in Vendler’s terms), because *two cookies* denotes a quantized set (of cookies to the amount of two). The mode of composition of a predicate with an argument x standing in an incremental relation to eventualities e , is known as ASPECTUAL COMPOSITION (Krifka 1989 and elsewhere). Events can also be indirectly measured, and individuated, by means of their run times. For instance, in *walk for an hour*, the temporal measure phrase *for an hour* indirectly measures walking events by directly measuring their run time, assuming that there is a one-to-one mapping between events E and their run times T . Given that *an hour* is quantized, so is the uninflected predicate *walk for an hour*. Eventuality descriptions that are individuated via quantized nominal predicates in compliance with aspectual composition, for instance, fall under the aspectual class of EVENTS, while those that lack a criterion of individuation for their application denote either PROCESSES or STATES.

Generally, in the mereological approach to aspectual classes advocated here, aspectual class is a matter of individuation of events,

or lack thereof. Aspectual classes are viewed as constraints on the way in which grammars of natural languages allow us to identify and individuate eventualities.¹¹

The individuation criteria for application of predicates, as described above, for instance, are to be distinguished from the maximization operation that applies to predicates of EVENTS, PROCESSES, and STATES. While aspectual class is a matter of individuation criteria of application of predicates (and lack thereof), PFV aspect is a matter of their maximization in a particular context. Specifying the individuation criteria for a predicate's application does not imply the maximization requirement to select the maximal STAGE in a set of event stages in that predicate's denotation at a given context (see (16) above).¹² Take, for instance, the uninflected predicate *eat two cookies*. It specifies an individuation criterion for its application which determines what counts as 'one' whole event in its denotation, namely an event of consuming two cookies. It does so via aspectual composition, a special case of an object-induced indirect measurement of events in its denotation. A MAX_E operator, which is expressed by means of the relevant PFV morphology in languages with a grammatical category of aspect, adds the requirement that the largest event stage of eating of two cookies be singled out in a given context. Languages exhibit variation in how they semantically delimit their MAX_E operators introduced by various overt morphological means. The maximization requirement may be satisfied when (i) either both cookies are completely eaten in a particular context, which is the requirement introduced by the Russian PFV or the Hindi COMPLEX PFV, or (ii) stages of individuated events in the denotation of *eat two cookies* terminate at some contextually determined stage, prior to both cookies being completely eaten, which is the requirement added by the Hindi SIMPLE PFV, for instance.

3.3 Typology of MAX_E operators: Some Examples

3.3.1 The encoding of MAX_E operators.

The variation among languages in how they semantically delimit their MAX_E operators depends on the nature of PFV forms by which they are introduced, i.e. on the morphological and syntactic means by which PFVs are formed, and how such means interact with the system of other grammatical means that are available in a given language for the individuation of events (e.g., resultative XP's, temporal adverbials, cardinal count adverbials or iterative adverbials like *three times*).

MAX_E REALIZED BY DEDICATED OVERT MARKERS. MAX_E may be grammaticalized by means of a dedicated PFV morphological marker, a complex predicate construction (Hindi), a serial verb construction (Thai). For instance, as we have seen above, Hindi has two PFV forms, which are traditionally referred to as the SIMPLE PFV (Singh 1998), formed with the suffix *-yaa* directly attached to the main lexical verb, and the COMPLEX PFV (ibid.), which takes the form *Verb1 Verb2*, where *Verb1* is a bare root form denoting an eventuality description and *Verb2* is a light verb ‘take’ that is inflected and bleached of its original lexical meaning.¹³

MAX_E AS A PHONOLOGICALLY NULL OPERATOR. In languages with a grammatical category of PFV, MAX_E may be introduced by a dedicated PFV morphological marker, a complex predicate or a syntactic construction, but it may also be covert in PFV verb forms, as in Slavic languages. Slavic languages have a grammatical category of PFV aspect, as commonly agreed upon, but, as I propose, MAX_E is a semantic modifier of episodic predicates which corresponds to a phonologically null operator (see also Filip 2008). This may come as a surprise to those who take Slavic grammatical aspect to exemplify a prototypical system of grammatical aspect in natural languages, and verbal prefixes functioning as grammatical markers of PFV aspect on verbs. However, contrary to this common view, Slavic verbal prefixes are not PFV markers, as Filip (1993/99, 2000, 2005, 2008, and elsewhere) argues. The reason is that neither any single prefix nor prefixes as a whole class consistently in *all* of its/their occurrences signal PFV on verbs. Neither is there other overt marker that would have such a systematic grammatical function. Moreover, verbal prefixes commonly form (secondary) imperfective verbs where they co-occur with an imperfective suffix, which clearly means that within such complex imperfective forms it makes no sense to speak of prefixes marking PFV aspect. Neither can the imperfective suffix be viewed as a fully developed grammatical marker of imperfectivity, given that its occurrence on verbs is not fully predictable, and it may also occur in bi-aspectual verbs. In Slavic languages, the grammatical perfective/imperfective distinction is best viewed as a lexicalized distinction between perfective and imperfective verbs that operates at the lexical V level. Virtually all lexical verb forms (finite and non-finite) are either perfective or imperfective, and what makes verbal aspect a grammatical category in Slavic languages lies in its systematic interactions with syntax and other grammatical categories like tense.

It is also commonly assumed that MAX_E is a phonologically null operator in languages that have no grammatical category of PFV, as

in Germanic languages like English and German. Here, MAX_E is a null operator that applies to eventuality descriptions expressed at the VP (and IP) level (for motivation see Filip & Rothstein 2005), and it is introduced into the logical representation based on pragmatic reasoning modulo semantic inferences and general world knowledge.

3.3.2 Slavic languages.

Slavic ‘atelic perfectives’, as illustrated by the Russian example in (5), and repeated below for convenience, induce the quantization puzzle, as has been observed above (see Filip 1992, 2000):

- (17) *My po.jezdili^{PFV} po našemu gorodu.* [= (5)] Russian
 we DEL.drive.PST on our town
 ‘We went for a ride around our town.’

The source of the quantization puzzle posed by Slavic ‘atelic perfectives’ lies in verbal prefixes with which they are formed, because they have common vague measurement uses (Filip 2000, 2005) or contribute meanings akin to those of weak lexical quantifiers (Filip 1992, 1996). For instance, the Russian delimitative prefix *po-*, as in (17), where it occurs in the combination of ‘*po-* + manner_of_motion V stem’, intuitively partitions the denotation of the V stem into ‘event chunks’, but does not uniquely determine their individuation criterion. Therefore, the whole prefixed verb fails to be quantized, according to Krifka’s original definition of quantization, given in (3).

In order to understand the quantization puzzle posed by Slavic ‘atelic perfectives’ like the Russian *my pojezdili* ‘we went for a ride’, it helps looking at a parallel quantization puzzle in the nominal domain. As Filip (2000) observes, there is a sizeable number of nouns like *twig*, *sequence*, *line*, *plane*, *fence*, *wall* that are grammatically count, and yet semantically fail to be quantized (Krifka 1992, Gillon 1992, Zucchi & White 1996, 2001, Rothstein 2010, and earlier related observations by Mittwoch 1988). For instance, *twig* denotes sets of entities that have proper parts falling under the predicate *twig*; if we break a twig into two pieces, each piece may be still be describable as *a twig*.

What nominal predicates like the grammatically count *twig* and the Russian perfective verb *my pojezdili* ‘we went for a ride’ (5/17) share is that entities in their denotation, objects and events, respectively, are treated as individuated entities in the grammar, even if they do not lexically uniquely determine what counts as ‘one’ individuated entity in their denotation; rather, what is ‘one’ in their denotation is partially context dependent and hence may vary from context to context.

While Slavic ‘atelic perfectives’, such as the Russian *my pojezdili* ‘we went for a ride’, fails to be quantized, according to Krifka’s original definition of quantization in (3), Filip (1992, 2000) argues that they can be assimilated to perfective verbs that are uncontroversially quantized (possibly also entailing culmination), if they are analyzed as partially specified by context: specifically they denote a unit-counting extensive measure function (‘extensive measure function’ in the sense of Krifka 1989) that is partially specified by context that fixes what counts as ‘one’ event relative to a prefixed perfective verb, and what counts as ‘one’ event varies with context. Consequently, such prefixed perfective verbs denote a context-sensitive quantized set.

Subsequently, Filip (2000, 2008) proposes that Slavic verbal prefixes with measurement or vague quantity meanings/uses induce an ordering (partial order) on event stages in the denotation of PFV prefixed stems they form. MAX_E , introduced into the logical representation by PFV verb stems, triggers a context-sensitive inference that yields the maximal event relative to an ordering induced by a prefix and context. This scalar-based analysis of Slavic prefixed verbs presupposes that scalar implicatures can generally be computed within grammar (see Levinson 2000, Landman 2004, Chierchia 2004, 2006, i.a.). Moreover, it presupposes independent arguments made elsewhere (Filip 1993/99, 2000, 2005, 2008) that Slavic verbal prefixes are not perfectivizers, i.e. not markers of perfectivity, but rather introduce an ordering on event stages, a precondition on the application of MAX_E , which is introduced by PFV verb stems. Inspired by Filip (2008), a detailed scalar-based analysis of Russian verbal prefixes is implemented in Kagan (2016, and see also references therein).

Adding the MAX_E operator to the inventory of aspectual operators is also motivated by the quantization puzzle in English, illustrated by the following examples:

- (18) a. Mary wrote a sequence of numbers in 10 minutes. (Zucchi & White 1996)
b. Mary ate more than three apples in an hour.

The puzzle arises when complex accomplishment (telic) predicates derived by aspectual composition contain an Incremental Theme argument that fails to be quantized when analyzed in isolation, according to (3). Examples are indefinite DPs like *a sequence of numbers*, *more than three apples* in our examples above, and also numerical NPs like *at most/at least three apples*, measure (pseudo-partitive) NPs like *a quantity (of milk)*, and arguments containing count, but non-quantized nouns like *twig*, *sequence*, *line*, *plane*, *fence*, *wall*. The aspectual compo-

sition predicts that such an Incremental Theme argument, which is not quantized, should yield a complex verbal predicate that is not quantized either, but this is not borne out, because it is straightforwardly compatible with time-span *in*-adverbials, as (18a-b) above show. Given that the domain of application of time-span *in*-adverbials is restricted to quantized (telic, accomplishment) predicates, *a sequence of numbers* and *more than three apples* in (18a-b) behave with respect to aspectual composition just like uncontroversially quantized DPs/NPs like *an apple* or *three apples*. Moreover, verbal predicates in (18a-b) do not sanction reference to partial events:

- (19) Mary ate at least three apples (in ten minutes/#for ten minutes)
* ... but finished eating only one / *... but did not finish eating them.

What makes VPs like *more than three apples* quantized is the presence of a phonologically null MAX_E operator in its logical representation, as Filip & Rothstein (2005) and Filip (2008) propose. An Incremental Theme argument like *more than three apples* is lexically associated with a scale of objects, by virtue of containing a numerical phrase, and therefore gives rise to scalar implicature. Given that *more than three apples* saturates the Incremental Theme argument slot of *eat*, which entails one-to-one object-event mappings for it, the result of their aspectual composition, the uninflected predicate *eat more than three apples*, denotes a ‘scale of events’ (Landman 1998) induced by a scale of objects associated with *more than three apples*, i.e. a set of alternative event stages that are ordered on a scale by asymmetrical entailment. The ordering of event stages provides the right ordering input for the application of MAX_E , which is a phonologically null operator associated with the simple past tense in (18b). It yields a set of maximal events i.e. the most developed versions of the ordered event stages in the denotation of *eat more than three apples* relative to a given context. This ensures quantized reference and thus telicity.

3.3.3 Hindi and Thai.

Among the many accounts proposed for the analysis of PFV non-culminating accomplishments, here of main interest are the accounts proposed for Hindi and Thai that presuppose the same theory as we do here, namely event semantics enriched with mereology. For Hindi, Singh (1991, 1998) argues that the phenomenon of PFV non-culminating accomplishments is induced by the SIMPLE PFV just in case it applies to accomplishments that entail one-to-one object-event mappings for their Incremental Theme argument (in the sense of Krifka

1992, 1989 and elsewhere), and hence are derived by aspectual composition (ibid.). The SIMPLE PFV is the ‘neutral perfective’, according to Singh (1991, 1998), a member of the PFV category *sui generis*, which allows for a non-culminating (partitive) or a culminating (completive) interpretation depending on context. The COMPLEX PFV imposes culmination requirement on the same type of an accomplishment. This is formally captured by the totality operator TOT(q) (standing for ‘total affectedness’), which is introduced by the COMPLEX PFV form and applied to the Incremental Theme relation, which enforces a culminating (completive) interpretation of the complex accomplishment predicate, due to the one-to-one object-event mappings the main lexical verb entails for its Incremental Theme argument.

The main problem with Singh’s account is that the distinction between non-culminating and culminating interpretations induced by the SIMPLE PFV and COMPLEX PFV, respectively, does not just arise with accomplishments involving incremental predicate-argument relations. This distinction also arises with predicates headed by verbs like *fluff*, *squeeze* (which is also observed by Singh 1998, p.198, Table 2, p.185), or *hang*, as Kothari (2008) and Arunachalam & Kothari (2012) observe.

- (20) *maya-ne kamiiz Taang-ii par vah Tangii nahiin* (Kothari 2008)
 Maya-ERG shirt hang-PFV but it-ACC hung not
 ‘Maya hung the shirt, but it didn’t get hung.’

The advantage of the semantic analysis of PFV proposed here is that the culminating/non-culminating interpretations of PFV forms is not restricted to accomplishment predicates involving incremental predicate-argument relations. PFV forms are analyzed in terms of the MAX_E operator that may be applied to an eventuality description of any aspectual class, EVENT, PROCESS or STATE, provided its input eventuality description is interpretable as denoting an ordering (partial order) of event stages. MAX_E imposes the maximal stage requirement on it, which is satisfied when the relevant stages (i) culminate with respect to the culmination condition inherent in its input eventuality description (the Hindi COMPLEX PFV form), or (ii) cease to develop at some contextually determined stage (the Hindi SIMPLE PFV form).

Koenig & Muansuwan’s (2000) analysis of Thai PFV non-culminating accomplishments is predicated on the assumption that Thai accomplishment stems are fundamentally imperfective and atelic, because they never refer to complete eventualities, but to “(non-necessarily proper) subparts of inherently bounded eventualities” (p.162). Thai accomplishment stems, according to them, have the same range

of meanings as imperfectively (“imparfait”) marked accomplishments in French (ibid., p. 163), including the habitual and progressive ones. (See also (8) above). This leads them to propose that accomplishment stems (verbs, verb stems) have a covert IMPFV (intensional) operator as part of their lexical meaning¹⁴ (p.162). When the ‘semi-perfective’ operator $\text{Max}(e,\varphi)$ is added to a sentence containing a bare accomplishment stem, it constrains its denotation to maximal events, relative to that accomplishment description. $\text{Max}(e,\varphi)$ is a new event description operator, which yields the largest event that satisfies φ (p.167); intuitively, it “adds the information that the eventuality stopped” (p.168).

While Koenig & Muansuwan’s (2000) MAX operator is close in spirit to the maximization operator proposed by Filip & Rothstein (2005) and Filip (2008), it is unsatisfactory in several respects. First, $\text{Max}(e,\varphi)$ is claimed to yield “the largest event that satisfies φ ”, which is the maximal event relative to an event description (p.147), but it is left unclear what exactly it means to be “the largest event that satisfies φ ”, given that φ does not by itself provide any upper bound.. Second, the property of being an accomplishment is not a ‘lexical’ property of Thai verbs (or verb stems), but rather, as all their examples clearly indicate, it is a property of VPs, similar to English. Therefore, it makes no sense to talk of the ‘lexical’ meaning of Thai accomplishments. Third, Koenig & Muansuwan (2000) claim that bare accomplishments do not entail culmination (p. 163) and therefore are atelic (p.168). This clearly indicates that they confound culmination entailment (requirement) and lack thereof, associated with PFV/IMPFV operators, with culmination condition associated with bare accomplishment predicates like *EAT THREE APPLES*. Finally, Koenig & Muansuwan (2000) suggest that their analysis developed for Thai ‘semi-perfective’ in combination with accomplishment predicates should carry over to other languages in which PFV non-culminating accomplishments have been attested, including Chinese (see e.g. Talmy 1991; Smith 1997), Hindi (see e.g. Singh 1991), Korean (see e.g. Park 1993), and Tamil (see e.g. Paramasivam 1977). This, however, raises the question about what is a PFV marker, given the wide variety of formal means that are taken to be markers of ‘perfective’ meanings, and to what extent such means can be claimed as serving the same ‘perfectivizing’ function, and therefore are amenable to the same analysis. What also deserves discussion is the grammatical PFV status of the Thai set of verbs that are taken to have ‘perfective’ meanings: ‘ascend’ (*khûn*), ‘descend’, ‘exit’, ‘enter’, ‘go’ and ‘come’ (Thepkanjana 1986).

Koenig & Muansuwan's (2000) most important insight is that the analysis of non-culminating accomplishments in the scope of PFV in Thai must involve some kind of maximization operator. They propose $\text{Max}(e, \varphi)$, which models the meaning of the 'semi-perfective' category, and requires termination or cessation of events, which is a weaker notion than culmination, which they equate with the traditional notion of telicity. They conclude that "(a)telicity is not the sole property of event descriptions relevant to the semantics of grammatical aspect" (p.147). One way of understanding this proposal is that the category of PFV must be split into subcategories, with the Thai 'semi-perfective' category representing a PFV category *sui generis*. As a consequence, the semantics of PFV cannot be reduced to one sole property or feature, but rather we need at least two notions: namely, *CULMINATION* and *TERMINATION* (or *CESSATION*). This is an important conclusion, but it does not force us to split PFV into different subcategories, each analyzed in terms of separate notions. Rather, as proposed here, the variety of ways in which natural languages delimit their PFV forms can be all analyzed in terms of a typology of MAX_E operators, all of which share the same requirement to select the maximal *STAGE* (Landman 1992, 2008) of a certain eventuality type *P*, but vary with respect to whether the maximal stage requirement is satisfied when stages of *P*-eventuality (i) culminate with respect to the culmination condition inherent in *P*, or (ii) cease to develop at some contextually determined stage.

4. Conclusion

The merit of this programmatic proposal lies in providing a possibility of formulating a unified semantic analysis of the category PFV, while at the same time taking into account the cross-linguistic differences among its particular instantiations in typologically unrelated languages. Intuitively, the maximal stage requirement leads to 'bounded' or individuated events, but leaves the exact nature of their boundaries lexically and grammatically underspecified, i.e. whether events are 'bounded' or individuated by virtue of ceasing to developing or culminating.

If the hypothesis is correct, i.e. if PFVs denote sets of maximal singular events (represented by $\text{MAX}_E(P)$), the ontological presuppositions motivating the semantics of *PERFECTIVITY* are tied to one of our most basic cognitive abilities, namely how we individuate entities as singular discrete units by some criterion of measurement, and how we count them.

Two important consequences of the proposed analysis are: first, there is a typology of distinct perfective operators that all encode the MAXIMAL STAGE requirement, and second, the ‘stage-of’ relation underlies the semantics of different members of grammatical aspect, not just the progressive operator, as suggested by Landman (1992).

Notes

¹ In the course of this paper, the abbreviations PFV and IMPFV should be interpreted, depending on the context, as either ‘(im)perfectivity’ or ‘(im)perfective’.

² In glossing the examples, the following abbreviations are used:

PFV	perfective	SG	singular
IMPFV	imperfective	PL	plural
NOM	nominative	1	first person
GEN	genitive	2	second person
ACC	accusative	3	third person
M	masculine	REFL	reflexive
F	feminine	ERG	ergative
N	neuter	PST	past

³ The light verb ‘take’ is bleached of its original lexical meaning (e.g. Hook 1974, 1976; Butt 2003), but in addition to the PFV meaning it contributes other aspects of meaning, possibly including affective connotations of surprise (see Hook 1976, also cited in Arunachalam & Kothari 2012, p.28, fn. 3.).

⁴ According to Singh (1991, 1998), “the perfective of simple verbs is used for arbitrary endpoints, and the so-called compound verbs (CV) for natural endpoints” (Singh 1998, p.173).

⁵ However, there is no general agreement that the simple past in English is aspectually perfective. For instance, de Swart (1998) proposes that “[t]he Simple Past tense in English is aspectually neutral and ‘transparent’: it applies to states, processes and events alike, and the sentence inherits its aspectual character from the eventuality description the tense operator applies to” (de Swart 1998, p.365).

⁶ ‘Eventuality’ (a term coined by Bach 1981) covers the denotations of predicates of ‘actions’ or ‘events’ in the sense of Davidson (1967, 1969 and elsewhere), and also the denotations of predicates of states (Bach 1981, 1986; Parsons 1990, among others). This reflects the idea that every verbal predicate introduces an event argument into the verb’s lexical structure, and hence an explicit reference to eventualities. See also Higginbotham (1985, 2000) for the proposal that every predicate head of *V*, *N*, *A*, and *P* category in the *X*-bar system has an event argument position, also adopted by Pustejovsky (1988), Grimshaw (1990), Chierchia (1995).

⁷ This is unlike in standard first order predicate logic (FOL) and also in Davidsonian semantics. In FOL, verbal predicates denote relations between individuals: $[[drink] = \lambda y \lambda x [DRINK(y,x)]$; or verbs denote sets of individuals: $[[smile] = \lambda x [SMILE(x)]$. In Davidson (1967, and elsewhere) and Davidsonian semantics, verbs denote relations between event(ualitie)s and individuals: e.g., $e[hug(John, Mary, e)]$ involves a three-place predicate *hug*, which expresses a relation between a hugging event, John and Mary. ‘There exists some event *e* which is a hugging of John by Mary’. In general, “[i]f *a* is the translation of an *n*-place verbal predicate, then *a* is an (n+1)-place relation, with the last argument restricted to the domain of the event structure, UE” (Krifka (1998, p.209).

⁸ Alternately, thematic roles denote (partial) functions from sets of events to

sets of their participants, e.g., Agent(e)=p) (Landman 2000, p.38; Rothstein 2004, p.4); the choice between the two is not essential here. There is a general agreement on the thematic uniqueness, or the Unique Role Requirement (URR): namely, that each event has at most one Agent, at most one Theme, and so on (Carlson 1984, 1998, Parsons 1990, Landman 1996, 2000).

⁹ The Kleene star attached to ‘Aspectual-Operator’ indicates zero, one or more operations. For the purposes of this paper, I wish to set aside the question whether grammatical aspect is a covert semantic category in languages that lack the overt formal category of grammatical aspect, and the semantic notions taken to be carried by perfective/imperfective verbs or verb forms are to be regarded as covert on the sentential (or propositional) level). The Kleene star is also intended to handle constructions in which there are multiple aspectual markers that apply recursively. De Swart (1998) groups the modifiers introduced by the categories of grammatical aspect, progressive, imperfective, passé simple in French, for instance, *for-* and *in-*adverbials into one class of aspectual operators. She defines a set of nine functions that map eventualities of one type into eventualities of possibly another type, namely, PROG, PROC, ITER, HAB, ADD-CUL, ADD-PREP, INCHO, BOUND, DYNAMIC, which may apply recursively.

¹⁰ The idea of eventualities ‘under a description’ stems from Davidson (1969, and elsewhere), with the phrase ‘under a description’ coined by Anscombe (1959).

¹¹ A similar view is also expressed by Rothstein (2004 p. ix, 4): “aspectual classes constrain the way in which events can be individuated.”

¹² This idea is in the spirit of Kratzer (2004), who following Parsons (1990), distinguishes between culmination conditions and culmination requirements.

¹³ I will set aside the question whether the complex PFV in Hindi is best analyzed as a matter of derivational morphology or syntax.

¹⁴ Semantics for the imperfective operator (Koenig and Muansuwan 2000).

a. $\alpha = \text{ImPFV}(ev, \varphi)$

b. An eventuality ev and an event description φ satisfy condition α iff there is an e' which (non-necessarily properly) includes ev and satisfies φ in all inertia worlds--i. e. in all worlds compatible with what it would mean to complete ev without being interrupted.

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