Nominal and Verbal Semantic Structure:
Analogies and Interactions

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Abstract

This paper examines parallels in semantic structure between noun phrases and verbal predicates in constructions in which they are mutually constraining and contribute to the expression of LEXICAL ASPECT and GRAMMATICAL ASPECT. One of the main claims pursued here is that such interactions are semantically motivated: it is the nominal argument linked to the Incremental Theme role that interacts with the aspectual semantics of verbal predicates and sentences, at least in the most typical cases. I will show how such interactions, which appear to be procedural and directional, can be described declaratively within a constraint-based (or unification-based) framework. This area intersects with lexical semantics, morphology and it poses intriguing problems to the mapping between syntax and semantics. It also provides an excellent basis for cross-linguistic studies and for exploring how nouns and verbs relate to the ontology of individuals and eventualities. The data is mainly drawn from English and Slavic languages, which are compared to German and Finnish.

1 Introduction

Many constructions in natural languages clearly point to syntactic and semantic parallels between nominal and verbal predicates. Such parallels have been discussed in philosophy (e.g., Vendler, 1957/67; Taylor, 1977; Mourelatos, 1978/81), formal semantics (e.g., L. Carlson, 1981; Hinrichs, 1985; Bach, 1981, 1986; Krifka, 1986, 1989, 1992, 1997; Link, 1987) and cognitive linguistics (e.g., Jackendoff, 1983, 1990, 1991, 1996; Talmy, 1986; Langacker, 1987, 1990). In cognitive linguistics, the semantic structure of both nominal and verbal predicates are characterized in terms of the same spatial notions and principles of spatial organization: the topological notion of 'boundary', the degree of their extension as point-like or extended, and their internal consistency as continuous or discrete. In formal semantics and philosophy much attention has in recent years been paid to the description of parallels between nominal and verbal predicates in terms of the notions based in the theories of mereology, or part-whole relations[1]. A number of interesting properties of nominal and verbal predicates can be understood in terms of the ways in which entities denoted by them stand as a whole in relation to their parts. Our knowledge about such part-whole relations is grounded in our experience with concrete entities located in space.

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[1]The term 'mereology' comes from Greek *meros* meaning 'a part'. Mereology was developed by Stanislaw Lesniewski in several papers in 1916 and in 1927-31, for whom mereology provides an interpretation for the language of set theory. "The notion of 'singleton', or unit set, can serve as the distinctive primitive of set theory. The rest is mereology", is how Lewis (1991:vii), succinctly puts it.

This paper examines semantic parallels between noun phrases and verbal predicates in constructions in which they are mutually constraining and contribute to the expression of LEXICAL ASPECT and GRAMMATICAL ASPECT. Lexical aspect concerns the classification of verbal predicates and sentences according to whether they entail a well-defined delimitation, and if not, whether they entail any changes of state. These criteria yield the tripartite division into EVENTS (*Mary cut her bagel into two neat pieces*, *Mary won the match with a nasty serve*, *Mary spotted her suitcase right away*), PROCESSES (*Mary gossiped about Harry*) and STATES (*Mary loves calculus*). Events are denoted by *quantized* (also called *telic, bounded* or *delimited*) predicates and sentences, while processes and states are denoted by *cumulative* (also called *atelic, nonbounded* or *nondelimited*) predicates and sentences. Events, processes and states are collectively referred to as EVENTUALITY TYPES (introduced by Bach, 1981)[2] .

The category of 'grammatical aspect' concerns the classification of verb forms and periphrastic verbal constructions into perfective and imperfective, with the progressive as a subcategory of the imperfective. Grammatical aspect is encoded by individual verb roots or stems (e.g., Slavic languages), by inflectional morphemes on the verb (e.g., Romance languages), or by special function morphemes within a verbal complex (e.g., the English progressive construction, creoles based on Romance languages). What all of these devices share is that they are attached directly to the verb, or form a constituent with the lexical category V. They allow us to present eventualities as having run their whole 'natural' course (TOTALITY), which is typically marked by some perfective verb form, or as being parts of larger eventualities (PARTITIVITY), which is typically marked by some imperfective verb form. For example, the English progressive sentence *John was closing the window* denotes proper parts of events that are in the denotation of the non-progressive sentence *John closed the window*. The Russian perfective sentence Ivan zakryl (pf.) oknó 'Ivan closed the window' entails that the whole event of closing of the window took place, and as a result the window was closed.

Lexical aspect and grammatical aspect are inherently verbal categories. Their primary locus of expression is the verb and they are mainly designed for operating on the domain of eventualities, the domain from which verbs, verb phrases and sentences take their denotations. Nevertheless, the semantic notions used for their characterization (i.e., partitivity and totality here) can be also encoded by noun phrases or prepositional phrases, which take their denotations from the domain of individuals. Vice versa, verbs marked for grammatical aspect can have effects on the interpretation of noun phrases. One of the main claims pursued here is that such interactions are semantically motivated: it is the nominal argument, direct or oblique, linked to the Incremental Theme role that interacts with the aspectual semantics of verbs, verb phrases and sentences, at least in the most straightforward cases. As a point of departure for discussing such interactions I will take the well-known case in which the quantization properties of the Incremental Theme noun phrase influence

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[2]For semantic categories that belong to '(inherent) lexical aspect' (see Comrie, 1976; Van Valin, 1990), Dowty (1979) uses the term 'aspectual class', and occasionally, the term 'Aktionsart' (Hinrichs (1985), Van Valin (1990), Zaenen (1993) is also used. Originally, 'Aktionsart' (the term coined by Agrell, 1908), was used in the narrow morphological sense and concerned classification of verbal affixes and other derivational devices according to their lexical semantic contribution to the meaning of verbs. In this way it was used in traditional and structuralist Germanic and Slavic linguistics (cf. Maslov, 1959; Isačenko, 1960, 1962). The lexical view of aspect originated in the classification of verb meanings in the philosophy of action (cf. Ryle (1949), Kenny (1963), Vendler (1957/67), Mourelatos (1978/81)) and it was introduced into modern linguistics by Dowty (1972, 1979). The currently used tripartite distinction into events, processes and states goes back to Mourelatos (1978/81)) and his criticism of Vendler's four-fold distinction into accomplishments, achievements, activities and states.

the quantization properties of verbal predicates and sentences (e.g., *Mary ate the sandwich* (quantized) vs. *Mary ate soup/blueberries* (cumulative)). Then I will examine how the verbal aspect constrains the quantization as well as closely related quantificational and (in)definiteness properties of Incremental Theme noun phrases in Slavic languages and show that this phenomenon is not simply a converse of the English case. Finally, I will draw on some data from German and Finnish showing how prepositional phrases and case-marking on noun phrases that are linked to the Incremental Theme role encode the information relevant to the calculation of both the lexical aspect and the semantics of perfectivity and imperfectivity.

First, I will propose that we can provide a unified analysis for all these seemingly disparate types of interactions between noun phrases and verbal predicates (or sentences) and highlight the similarities among them, if we describe them within a constraint-based (or unification-based) framework. (For a detailed exposition of the constraint-based framework see Sag and Pollard, 1994, for example.) Although we have here what may appear to be inherently procedural and directional processes, the rules governing the integration of the semantics of an Incremental Theme argument and a verb into the semantics of a predicate or a sentence can be described in a strictly declarative way by assuming that an Incremental Theme argument and a verb are mutually constraining, and state the relevant constraints governing such mutual dependencies over both of them. Constraints imposed by the language require that information coming from these two sources be compatible.

Second, the constraints concern two types of semantic distinction: *quantization vs. cumulativity* and *partitivity vs. totality*. I will argue that we minimally need these two sets of semantic distinctions, whereby *quantization vs. cumulativity* is the main distinction in the domain of lexical aspect (or eventuality types), and *partitivity vs. totality* constitutes the core distinction in the domain of grammatical aspect. Whether a clear line between the semantics of these two categories needs to be drawn is one of the perennial problems in the domain of aspectual phenomena. (For recent discussions see Smith, 1991/97; Depraetere, 1995; de Swart, 1998, among others). For example, in asserting *John was closing the window*, the speaker explicitly excludes the final part of the denoted event, namely, that proper part involving the state in which the window is closed. Since this is exactly the proper part that coincides with the inherent delimitation of the described eventuality, the question here arises whether *John was closing the window* still involves an event (quantized) predicate in its semantic description or whether the effect of the progressive is here to yield process (cumulative) predicates. If we could motivate characterizing the semantic contribution of the progressive operator in terms of some function that maps sets of eventualities of a certain type (e.g., event-denoting *closed the window*) onto eventualities of some possibly other type in this way (e.g., process-denoting *be closing the window*), and do the same for the imperfective and perfective operators, we would only need one type of semantic distinction at the level of lexical aspect (or eventuality types) to characterize the semantics of both the categories of 'lexical aspect' and 'grammatical aspect'. I will discuss data that speak against such an elegantly simple picture and show that lexical aspect (or eventuality types) and grammatical aspect are semantically distinct. One piece of evidence will come from Slavic imperfective sentences in which an Incremental Theme noun phrase (in the sense of Dowty (1988, 1991) and Krifka (1986, 1992, 1998)) retains its inherently quantized property. Here, we need to clearly distinguish the contribution of the quantized Incremental Theme noun phrase, which is relevant to the calculation of the lexical aspect of the whole sentence from that of the imperfective aspect (partitivity).

Third, with respect to grammatical aspect, I propose that the semantic core of many, possibly all, aspectual systems, can be characterized in terms of the basic mereological relations PARTITIVITY and TOTALITY. These relations are two among several contributing properties that characterize the semantics of the imperfective and perfective categories. The realization of other contributing properties depends on the markedness relation between the members of a given aspectual opposition and the relative verb-prominence in the encoding of information relevant to grammatical aspect. (This may be dubbed the 'prototype view of aspect'). Languages differ with respect to how the partitive and totality relations are preferably encoded in different surface constituents in a sentence. We may identify two main syntactic and morphological types of encoding: namely, by means of verbs or verb-headed phrases and, less-typically, by means of nouns, noun-headed phrases or prepositional phrases. The differences in the mode of encoding are associated with substantive semantic differences. Marked categories (e.g., the English progressive and the Slavic perfective) are more restricted in their domain of application, in their semantics and the range of contextually determined uses than unmarked categories (e.g., the English non-progressive and the Slavic imperfective). Moreover, both marked and unmarked categories of verb-marked grammatical aspect (e.g., English and Slavic) are less constrained in all the above respects than expressions of grammatical aspect by means of an overt marking on nominal arguments, direct or oblique (e.g., Finnish and German). The difference in the encoding by verb-centered means as opposed to mainly noun-centered means is also associated with a different clustering of typical formal and semantic properties and a different conceptual organization. For example, many languages that encode grammatical aspect within the verb (verbal root/stem or verbal complex) typically have a rich verbal morphology, which also encodes distinctions in eventuality types (e.g., by various verbal derivational morphemes, as in Slavic, or preverbs, as in Australian aboriginal languages (see Evans, 1989, 1991, 1995, for example), or serial verb constructions, as in Japanese, Hindi). This may be coupled with a nominal determiner system that may lack the functional category 'article' (as in Slavic languages) and even certain determiner quantifiers so that distinctions that are expressed in English by means of articles and determiner quantifiers are here (optionally) conveyed by means of verbal morphology. A good example is the combination of a prefixed perfective verb with an Incremental Theme noun phrase which is undetermined and headed by a mass or plural common noun in Slavic languages. In such cases the perfective verb encodes not only all the information about grammatical aspect (perfectivity) and lexical aspect (quantization), but also the information relevant to the referential properties of the Incremental Theme noun phrase (totality, definiteness). What we see here is a system that is designed to express distinctions relevant to the denotational domain of verbs, and that is exploited to impose constraints on the semantic properties of an argument noun phrase, which itself is formally unmarked with respect to totality, quantization, and definiteness.

Fourth, the constraints that govern the interaction between Incremental Theme arguments (direct or oblique) and verbal predicates point to the same eventuality subtype, in which the individual denoted by the Incremental Theme noun phrase undergoes a change in successive stages, and through this change it is intrinsically tied to the (temporal) delimitation of the event. For example, *Mary ate the sandwich* denotes an event during which the sandwich disappears part by part in lockstep with the progression of the eating event. Once all the sandwich is gone, the eating event necessarily ends. This intrinsic object-event relation is crucial to the various types of interaction of verbal predicates and Incremental Theme noun phrases in typologically unrelated languages discussed here, and not only in English. There are different ways in which we can represent it. Here, it is represented by establishing homomorphic mapping relations between the

denotations of Incremental noun phrases and verbal predicates (see Krifka, 1986, 1992; Dowty, 1988, 1991). This presupposes that some of the denotational properties of noun phrases and verbal predicates be analyzed in terms of the mereological part structure, and modelled algebraically as join complete semi-lattices (see Link, 1983, 1987; Bach 1981). This apparatus provides us with a well-defined basis for exploring the parallels between nominal and verbal predicates in a systematic way and for understanding how nouns and verbs relate to the ontology of individuals and eventualities.

The outline of the paper is as follows. In section 2, I will give some background assumptions on the mereologically-based notions of 'quantization', 'cumulativity', 'Incremental Theme', as well as on the interactions between Incremental Theme noun phrases and verbal predicates in English and Czech. In section 3, I will present in detail some more data from Slavic languages (Czech, Russian and Polish) that strongly suggest that we need to separate the contribution of Incremental Theme noun phrases to the lexical aspect of a sentence (quantization-cumulativity) from the contribution of imperfective aspect (partitivity-totality). I will also propose that the quantized-cumulative distinction is generally orthogonal to the definite-indefinite distinction. Specifically, for Slavic languages that have no functional category 'article' it means that undetermined noun phrases with mass and plural noun heads are not ambiguous between the quantized-definite and cumulative-indefinite interpretations. In section 4, I will outline the constraint-based account to the interactions between Incremental Theme noun phrases and verbal predicates in English and Slavic languages. Here, I will also propose the 'prototype' theory of grammatical aspect, with the mereologically-based relations 'partitivity' and 'totality'. In section 5, I will discuss the expression of grammatical aspect by nominal arguments (direct and oblique) in Finnish and German.

2 Previous work on interactions between noun phrases and verbal predicates
2.1   Influence of noun phrases on verbal predicates

The influence of noun phrases on verbal predicates has been discussed[3] in connection with English data, such as (1):

(1) a. Mary ate the sandwich   in an hour / ?for an hour.
    b. Mary ate soup / blueberries   ??in an hour /   for an hour.

When a verb like *eat* is combined with a count noun phrase like *the sandwich* it yields a quantized verbal predicate (1a)[4]. The same type of a verb combined with a mass or a plural noun phrase like

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[3]See Verkuyl (1972:54-97, 1989, 1993), Dowty (1972, 1979, 1991), Platzack (1979), Krifka (1986, 1989, 1992), Tenny (1987, 1994), Filip (1993/99), Jackendoff (1996), among many others.

[4]'?' indicates that (1a) is possibly acceptable if *ate the sandwich*, which typically is event-denoting or telic, can be coerced into a process or atelic interpretation, that is, if it can be understood to mean that Mary spent five minutes eating the sandwich without necessarily finishing eating all of it. (See Hinrichs (1985:16), Zucchi (1998), for example). Verbs that do not denote eventualities involving consumption (*Mary ate the sandwich*), destruction (*John burned the incriminating letter*) or creation (*John built a cabin in the woods*) during which a given object token can be subjected to the denoted event only once, also allow for an iterative or generic interpretations. For example, *John played the sonata for half an hour* can mean that John played the sonata repeatedly within the period of half an hour, in addition to the simple process (or cumulative) interpretation that he spent half an hour playing the sonata without finishing playing the whole piece.

soup or *blueberries* yields a cumulative predicate (1b)[5]. Quantized predicates entail a (temporal) delimitation in the event they denote, while cumulative predicates have no such entailment. For example, in (1a) the eating event is delimited by the spatial extent of the sandwich, while in (1b) *soup* and *blueberries* denote quantities whose boundaries are not fixed, and hence the boundaries of the eating event are not fixed, either. The quantized and cumulative status of verbal predicates is reflected in the distributional properties of temporal adverbials:

(2) a. The domain of application of time-span adverbials, such as *in*-PPs, is restricted to quantized (or event) predicates.
  b. The domain of application of durative adverbials, such as *for*-PPs, is restricted to cumulative (or process and state) predicates.

By contrast, complex verbal predicates headed by verbs such as *liked* (state) and *carried* (process) are cumulative, regardless whether the noun phrases filling their argument positions are single count or plural:

(3) a. Mary liked the song for a week (and then she got bored with it) / ??in a week.
  b. Mary liked John innuendos for a week (and then she got bored with them) / ??in a week[6].

(4) a. John carried a box / the three boxes I gave him for an hour / ??in an hour.
  b. John carried boxes around the department for an hour / ??in an hour.

The eventualities of liking or carrying some object(s) are not (temporally) delimited by any quantificational or referential property of the noun phrase denoting the object(s).
    Starting with Verkuyl's (1972) and Dowty's (1972) work, there have been a number of proposals attempting to formulate rules governing the influence of noun phrases on the telicity of verbal predicates. All agree that we must take into account at least the following factors: (i) the lexical semantics of the main verb, which must be episodic (cp. (1) and (3)); (ii) its relation to the

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[5] '??' indicates that some speakers may find this sentence acceptable under an iterative or a generic reading (see also Hinrichs' (1985:17) comments on *John picked strawberries in an hour*). Similar examples are the following: (i) *Pat built houses (*)in six months*, (ii) *Lynn made cookies in forty minutes*. With verbs like *build* and *make* the undetermined plural direct object typically yields a cumulative (process) interpretation, and hence the whole complex predicate should occur in the scope of a durative *for*-phrase. However, (i) is acceptable if it has a generic (habitual) interpretation, that is, when it expresses a generalization over particular building events, whereby each is associated with a different house whose construction took six months (see Fillmore and Kay, 1993): [in six months [Pat build a house]]. In (ii) the undetermined plural noun phrase *cookies* seems to denote some conventional amount of cookies (a batch of cookies, for example) that are baked during one baking event. So in the scope of the time-span adverbial *in forty minutes* the interpretation of *cookies* appears to have a quantized interpretation and determines the telic (event) reading of the complex verbal predicate *made cookies*. How exactly the interpretation of undetermined plural noun phrases in sentences like (i-ii) is an open question.

[6] '??' indicates that sentences in (3) are acceptable if the state predicate with *liked* and the process predicate with *carried* can be coerced into an inchoative interpretation, that is, conveying the transition into the state of liking or carrying something. In other words, sentences in (3) are acceptable if the time-span adverbial *in a week* can coerce a state/process to event shift.

nominal argument that determines the telicity of a verbal predicate (cp. (1) and (4))[7]; and (iii) the quantificational status of this privileged argument. What is still a matter of lively debates is the nature of the lexical knowledge underlying (i) and (ii). Is it chiefly of syntactic or semantic nature?

Syntactic approaches share the assumption that the effects of noun phrases on the quantization of verbal predicates arise from certain structural configurations in the lexical representation of verbs and the way they are projected from the lexicon to syntax (see Tenny, 1987, 1994; Verkuyl, 1972, 1993, for example)[8].

However, semantic proposals are more convincing[9]. Among these, the most successful to date is that of Krifka (1986, 1992) and the closely related proposal by Dowty (1988, 1991). According to them, the argument that influences the telicity of a complex verbal predicate is assigned the thematic role of Incremental Theme. A part of the meaning of certain episodic predicates, such as *eat*, is (modelled by means of) a homomorphism which establishes a one-to-one mapping between (the denotation of) the Incremental Theme and event argument. As is customary in event semantics (following proposals in Davidson, 1967; Parsons, 1986; Kratzer, 1989, 1995), sentences denoting episodic eventualities are represented with an additional argument position for an event variable. (The definition of the mapping is given by Krifka, 1986, 1992, 1998, and elsewhere. See Appendix below.) For example, for the event denoted by (1a) the mapping guarantees that every part of the eating corresponds to exactly one part of the sandwich, and vice versa. The verb phrase *ate the sandwich* denotes eating events during which the sandwich undergoes successive changes, part by part, which can be correlated with the incremental development of the eating event. Once all the sandwich is gone, there is no eating of that sandwich possible and the eating event must necessarily end. This presupposes that the denotations of nominal and verbal predicates, individuals and eventualities, respectively, are analyzed in terms of part-whole relations based in theories of mereology, which are here represented by complete join semi-lattices (see Link, 1983, 1987; Bach, 1986). Having the domain of entities structured in this way allows us to explicitly capture the intuition that the referent of an Incremental Theme argument is intrinsically tied to the (temporal) extent of the event by defining the one-to-one mapping between their denotations. Given that thematic roles are defined as relations between eventualities and individuals, $\theta(x,e)$[10], Krifka proposes that the mapping is encoded in grammar as part of the definition of the Incremental Theme thematic role. ('Incremental Theme' is Dowty's (1988, 1991) term, Krifka uses the term 'successive' or 'gradual' Patient.)[11]

The general rule for the interaction between an Incremental Theme argument and a verbal predicate, the rule of aspectual composition, can be informally stated as in (5):

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[7]The predicate-argument relation in question is referred to as the "ADD-TO" relation in Verkuyl (1972, 1993), the "measuring out" relation in Tenny (1987, 1994), the "gradual"/"successive" Patient relation in Krifka (1986, 1992), the "Incremental Theme" relation in Dowty (1988, 1991) and the "structure-preserving binding" in Jackendoff (1996).

[8]For criticisms of Tenny's proposal see Filip (1990, 1996b, 1993/99), Dowty (1991), Jackendoff (1996). Verkuyl's (1972) account is discussed in Krifka (1986, 1989).

[9]For references and discussions of semantic accounts see Hinrichs (1985), Krifka (1986, 1989), Verkuyl (1993).

[10]See Parsons (1980, 1990), Carlson (1984), Dowty (1991), for example.

[11] Dowty (1988, 1991) proposes that the only thematic roles are two cluster concepts, Proto-Agent and Proto-Patient, each characterized by a set of verbal entailments with respect to their arguments. 'Incremental Theme' is one of the Proto-Patient entailments.

(5) <u>aspectual composition</u>: An episodic verb (in sentences denoting single eventualities) combined with a quantized Incremental Theme argument yields a quantized complex verbal predicate, while with a cumulative Incremental Theme argument it yields a cumulative complex verbal predicate.

The definitions of quantized and cumulative predicates are given in (6) (see Krifka, 1997, and elsewhere):

(6) a. A predicate P is **cumulative** iff $\forall x,y[[P(x) \wedge P(y) \rightarrow P(x \oplus y)] \wedge card(P) \geq 2]$
[whenever P applies to x and y, it also applies to the sum of x and y, provided that it applies to at least two distinct entities.]

b. A predicate P is **quantized** iff $\forall x,y[P(x) \wedge P(y) \rightarrow \neg\, y < x]$
[whenever P applies to x and y, y cannot be a proper part of x.]

(Definitions of the operation of sum formation '⊕' and the proper part relation '<' are given in the Appendix.)

Quantized predicates are expressed by singular count noun phrases, measure noun phrases (*three glasses of wine*) and quantified noun phrases (*all the apples*, *three apples*), as well as by quantized verbal predicates (*to recover, to eat the sandwich*). Cumulative predicates are expressed by mass nouns, plurals, and atelic verbal predicates, namely processes (*to run*) and states (*to own*). Cumulative predicates are additive and divisible. For example, any sum of parts which are individually denoted by *water* also falls in the denotation of *water*, and any two sums of entities in the denotation of *apples* add up to a sum also in the denotation of *apples*. Parts of the interpretation of *water* and *apples* are describable by the same nouns *water* and *apples*. In contrast, quantized predicates are neither additive nor divisible. The main difference between the denotational domains of nominal and verbal predicates is in the type of the semi-lattice that structures them[12]: The denotation of each quantized predicate has the structure of an atomic join semilattice. Cumulative predicates take their denotation from the domain that is non-atomic.

Now going back to our lead examples in (1), from the principle of aspectual composition in (5) it follows that (1a) *Mary ate the sandwich* is quantized, because *the sandwich*, the Incremental Theme argument, is quantized and stands in a homomorphic relation to *ate the sandwich*. The same homomorphic relation holds between *soup /blueberries* and *ate soup /blueberries* in (1b), but since the Incremental Theme argument is here cumulative, the whole verb phrase is cumulative. Given that direct objects of verbs *liked* and *carried* in (3) and (4) are not assigned to an Incremental Theme argument, their quantization and cumulativity properties have no effect on the quantization status of the whole verb phrase. The inherent eventuality type of *liked* and *carried*, state and process, respectively, is inherited by the whole verb phrase and sentence.

Both Krifka and Dowty point out that the quantization status of a verbal predicate or a sentence does not depend just on the lexical structure of the main verb, and on what is explicitly coded in the linguistic expressions, but also on pragmatic factors like the interpreter's knowledge about the larger scenes evoked by the linguistic material. Their apparatus can be extended to verbal predicates and sentences whose telicity is determined by the mapping between the part structure of

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[12]This was proposed by Link (1983, 1987) and Bach (1986).

the Path and the part structure of the event argument, as in *John walked to the post office*[13]. With the notion of 'Path' we can represent changes of state in various dimensions, and not just the change of position in the spatial domain. We can measure qualitative changes, such as a change in the consistency of an object: cp. *The butter melted/was melting*[14]. In *John was becoming an architect but was interrupted before he could finish his degree*, the part structure of the event correlates with the steps on an implicit Path one must go through to become an architect (see Dowty, 1991:569). Krifka (1992) mentions that the mapping properties are not necessarily always "'hard-wired' in the thematic relations, but follow from other knowledge sources. Consequently, we should assume that even the object role of verbs like *eat* does not exhibit graduality as some grammatical feature, but simply because the normal way of eating enforces the graduality properties" (p.45). The interactions between the lexical semantics of a verb with the semantics of its co-constituent in a given sentence and with pragmatic factors in the calculation of the quantization of a sentence are discussed in Filip (1993/99) and are also focused on in Jackendoff (1996).

2.2   Influence of verbal aspect on the semantic properties of noun phrases

The thematic role 'Incremental Theme' along with the principle of aspectual composition, given in (5), motivates the effects of noun phrases on verbal predicates in English, as we have seen in the previous section, but also the converse cases in which the verb has effects on the semantics of Incremental Theme noun phrases, as Krifka (1992:49) observes. This follows, because the homomorphic mapping ensures that the part-whole relations of the denotation of the Incremental Theme argument are correlated with the part-whole relations of the event, and vice versa. Examples of this type can be found in Slavic languages, and Krifka discusses Czech data in this connection:

(7) a.   Ivan   vy‑pil^P čaj.   **Czech**
          Ivan   COMPL-drink.PAST   tea.SG.ACC
          'Ivan drank (up) (all) the tea / the whole portion of tea.'

     b.   Ivan   pil^I čaj.
          Ivan   drink.PAST   tea.SG.ACC
          (i) 'Ivan drank (some/the) tea' (and then cleaned the kitchen)
          (ii) 'Ivan was drinking (some/the) tea' (when I arrived)

(8) a.   Ivan   s-nĕdl^P jablka.
          Ivan   COMPL-eat.PAST   apple.PL.ACC
          'Ivan ate (up) (all) the apples.'

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[13]See Krifka (1998) for the formal definition of the notion of 'Path' as a one-dimensional (non-branching, non-circular and directed) axis.

[14]Such a change of state can be thought as being decomposable into distinguishable separate stages, each of which can be represented as a point on a directed Path. Any changes that can be measured on a scale can be represented as a motion through certain points on a directed Path in this way, as has been proposed by Tenny (1987, 1994, 1995), Jackendoff (1990, 1996) and Krifka (1998). For a thorough description of the role of the Path participant in the event structure, see also Tenny (1994, 1995) and Jackendoff (1996), for example.

b. Ivan   jedl^I   jablka.
   Ivan   eat.PAST   apple.PL.ACC
   (i) 'Ivan ate (some/the) apples.'
   (ii) 'Ivan was eating (some/the) apples.'

(The aspect of a verb is here indicated with the superscript "I" standing for imperfective aspect and "P" for perfective aspect. "COMPL" stands for the 'completive' semantic contribution of the prefix.) Perfective sentences (7a) and (8a) denote completed events, during which a certain amount of tea and apples was consumed. In perfective sentences (7a) and (8a), the mass and bare plural noun phrases 'tea' and 'apples' are interpreted as definite noun phrases with the totality meaning corresponding to the universal quantifier *all* or some totality expression like *whole*. Hence, they are also quantized. That the totality interpretation is clearly an entailment associated with the Incremental Theme argument can be shown by the observation that it cannot be negated without a contradiction. Notice that we cannot continue (7a) with a clause cancelling the totality entailment, as in (9), without a contradiction:

(9)   *Ivan vypil^P   čaj$_i$,   ale nevypil^P   [ho/jej všechen]$_i$.   **Czech**
        *Ivan drink.PAST   tea.SG.ACC$_i$ but neg.eat.DRINK   [it all.SG.ACC]$_i$
        *'Ivan drank (up) [the whole portion of tea]$_i$, but he did not drink [it all]$_i$'.

In contrast, such a contradiction does not arise in the corresponding imperfective sentences (7b) and (8b). The propositions expressed by (7b) and (8b) involve possibly a part of the denoted eventuality, but not necessarily all of it. Here, 'tea' and 'apples' tend to have a cumulative and indefinite interpretation. (The imperfective sentences (7b) and (8b) have a range of interpretations which will be discussed further below in connection with (12)).

     The data in (7) and (8) is significant for two reasons. First, although aspectual operators are commonly assumed to be sentence or predicate operators, they here constrain the interpretation of Incremental Theme noun phrases. Their effects are comparable to (in)definite articles and also to various partitive and universal determiner quantifiers. Second, undetermined noun phrases with common noun heads are frequent in Czech, because just like other Slavic languages (with the exception of Bulgarian and Macedonian), it has no functional category 'article', that is, there is no formal expression of the (in)definiteness, unlike in English which distinguishes *the apples* and *apples,* for example.

     If we compare the English examples in (1) with the Czech ones in (7) and (8), we see that in the English case, it is the Incremental Theme noun phrase that encodes all the quantization information of the verb phrase, while the verb is unspecified in this respect. In the Czech case, it is the verb that carries all the informational load about the grammatical aspect, totality and partitivity, and quantization properties of the sentence, while the Incremental Theme noun phrase is unspecified in these respects. The information about quantization appears to be 'transferred', as Krifka puts it, from the noun phrase to the verb phrase in English and, in the opposite direction, from the verb to the noun phrase in Czech. Despite the differences in which the quantization information is encoded in the surface syntactic and morphological structure, in both English and Czech the interactions between the Incremental Theme noun phrase and the verbal predicate are predicted by one common principle, namely the principle of aspectual composition in (5). In order to give a compositional analysis for the Slavic data, Krifka makes the following assumptions in addition to the aparatus introduced in section 2.1. First, undetermined noun phrases are ambiguous between a definite and an indefinite interpretation. This is captured by a syntactic rule 'NP → N'

that is associated with two semantic interpretations, a definite and an indefinite one (see Krifka, 1992:49):

(10) čaj: (i) indefinite+cumulative   'tea' $\lambda x[\textbf{tea}(x)]$
             (ii) definite+quantized   'the tea' $\lambda x[x = FU(\textbf{tea}) \wedge \textbf{tea}(x)]$

      jablko: (i) indefinite+quantized   'an apple $\lambda x[\textbf{apple}(x, 1)]$
               (ii) definite+quantized   'the apple' $\lambda x[x = FU(\textbf{apple}) \wedge \textbf{apple}(x, 1)]$

      jablka: (i) indefinite+cumulative   'apples' $\lambda x[\textbf{apples}(x)]$
               (ii) definite+quantized   'the apples' $\lambda x[x = FU(\textbf{apples}) \wedge \textbf{apples}(x)]$

For example, in Czech the undetermined mass noun phrase *čaj* and plural *jablka* are ambiguous between the indefinite reading 'tea', 'apples' and the definite reading 'the tea', 'the apples', as (10) shows. In the definite reading mass and plural noun phrases are quantized, in the indefinite reading, they are cumulative. The definite noun phrase *the tea* applies to the fusion (FU) or sum of all tea quantities, which is a tea quantity as well, because *tea* is cumulative. Singular count nouns like *jablko* can mean either 'an apple' or 'the apple' and it is quantized in both the definite and indefinite reading. Second, perfective aspect forces a quantized interpretation of a complex verbal predicate, which in turn forces a quantized interpretation of the Incremental Theme argument, as predicted by the aspectual composition given in (5). From this it follows that undetermined noun phrases with mass and plural nouns will also have a definite interpretation in perfective sentences. Although imperfective aspect may require a cumulative interpretation of a complex verbal predicate, Krifka (1992:50) observes that the cumulativity requirement on imperfective predicates is not as strict as the the quantization requirement on perfective predicates.

The correlation of perfective aspect with direct objects that have a definite and totality interpretation is well-known in Slavic linguistics[15]. The advantage of Krifka's account over other accounts is that it makes explicit and clearly testable predictions about the cases in which verbal aspect influences the interpretation of argument noun phrases, and about the cases in which it *does not*. For example, in Czech perfective sentences given in (11), we see that the quantized and definite interpretation of the direct objects is not enforced, which, on Krifka's account, can be straightforwardly motivated by the assumption that the direct objects are here not linked to the Incremental Theme role.

(11) a. Václav   donesl^P balíky   na poštu.   **Czech**
           Vaclav   carry.PAST   package.PL.ACC to post-office
           'Vaclav carried (some/the) packages to the post office.'

      b. Uslyšel^P studenty   na chodbě.
           hear.PAST   student.PL.ACC   on corridor
           'He heard (some/the) students in the corridor.'

The role of lexical semantics of verbs in motivating the correlation of perfective aspect with direct objects that have a definite and totality interpretation was already observed by Wierzbicka (1967)

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[15]For Russian see Forsyth, 1970; Chvany, 1983, for example. For Polish, see Wierzbicka (1967), for Czech Krifka (1986, 1992) and Filip (1992, 1996a, 1993/99).

and Forsyth (1970), for example, in traditional Slavic linguistics. But they do not provide any systematic motivation for it.

However, the problem with Krifka's analysis of Slavic data is that it makes correct predictions only for a part of the relevant data. There are two main reasons for this. First, the interaction between Incremental Theme noun phrases and verbs relies on only one type of distinction, quantization vs. cumulativity, which results in some cases apparently failing to comply with the aspectual composition given in (5). Second, we also find cases that contradict the assumption that undetermined mass and plural nouns are ambiguous between 'cumulative-indefinite' and 'quantized-definite' interpretations, as stated in (10). In the next section I will discuss some problematic cases and show how we can repair Krifka's approach and preserve the principle of aspectual composition.

3 More empirical evidence

In this section, I will first show that we cannot account for the interaction between imperfective verbs and Incremental Theme noun phrases in terms of the simple correlation 'cumulative verb - cumulative Incremental Theme noun phrase', as is predicted by the assumption that imperfective verb forms are cumulative and the principle of aspectual composition. The reason is that singular count Incremental Theme noun phrases retain their quantized interpretation in the scope of imperfective aspect. Second, undetermined noun phrases with plural and mass noun heads in Slavic languages are not ambiguous between 'indefinite-cumulative' and 'definite-quantized' interpretations. In general, we need to decouple the category of quantization from definiteness, and cumulativity from indefiniteness. To illustrate these points I will use examples from Russian, and some from Polish, which work just like the Czech data analyzed in Krifka in the respects relevant for the present discussion.

3.1   Imperfectivity and quantization

If imperfective aspect enforces a cumulative interpretation of a complex verbal predicate, then the principle of aspectual composition given in (5) requires that the Incremental Theme noun phrase in the Russian sentence (12) has a cumulative interpretation.

(12)   Ivan   jel^I jábloko.   **Russian**
       Ivan   eat.PAST   apple.SG.ACC
       (i) 'Ivan was eating an / some / the apple.' (progressive reading)
       (ii) 'Ivan ate an / some / the apple.'

Consequently, although the Russian noun phrase jábloko '(an/the/some) apple' is quantized when analyzed as a predicate, when combined with the imperfective verb jel 'he ate, he was eating', it would have to behave like a cumulative noun phrase in compliance with the aspectual composition. This result seems to be confirmed by the distributional properties of the diagnostic temporal adverbials. In Slavic languages, the domain of application of durative adverbials is restricted to imperfective verbs. The domain of application of time-span adverbials is mostly restricted to perfective verbs, and when applied to imperfective verbs, they enforce certain reinterpretations (e.g., inchoative, for example). This is shown in (13) and (14):

(13) a. Ivan jel^I jábloko   pjat' minút   / ??za pjat' minút.   **Russian**
      Ivan eat.PAST apple.SG.ACC   five minutes   / ??in five minutes
      (i) 'Ivan ate an / the apple ??for five minutes / in five minutes.'
      (ii) 'Ivan was eating an / the apple for five minutes / ??in five minutes.'

    b. Ivan jel^I muss z jáblok   pjat' minút   / *za pjat' minút.
      Ivan eat.PAST sauce from apple.PL.GEN   five minutes   / *in five minutes
      'Ivan ate / was eating apple-sauce for five minutes / *in five minutes.'

(14) a. Ivan sjel^P jábloko   *pjat' minút / za pjat' minút.
      Ivan eat.PAST apple.SG.ACC   *five minutes / in five minute.
      'Ivan ate up the apple *for five minutes / in five minutes.'

    b. Ivan sjel^P muss z jáblok   *pjat' minút / za pjat' minút.
      Ivan eat.PAST sauce from apple.PL.GEN *five minutes / in five minutes
      'Ivan ate up the apple-sauce *for five minutes / in five minutes.'

In analogy to the English examples like those in (1), and to the distributional properties of temporal adverbials in (2), it is concluded that Slavic perfective predicates are quantized, because they are restricted to occur with time-span adverbials, while imperfective ones are cumulative, because they freely occur only with durative adverbials (see Kipka, 1990; Piñón, 1995:46, 56-7; Schoorlemmer, 1995:79). Since the Russian complex predicate jel jábloko in (12) is compatible with the durative adverbial, it must be cumulative, according to (5). The principle of aspectual composition then requires that the Incremental Theme noun phrase jábloko '(an/the) apple' must be cumulative, as well. While the Russian verb phrase jel jábloko, as in (12), is considered to be cumulative, the English verb phrase *ate an/the apple* is quantized. Therefore, in the translation of (12) into English, we see a difference in the compatibility with temporal adverbials.

    However, an inherently quantized noun like jábloko cannot shift to a mass interpretation, at least not in Russian sentences like (13) or (15). The reason is that (13) does not mean 'There was some apple-stuff that was (in the process of being) eaten by Ivan', or simply 'Ivan ate / was eating apple-stuff / apple-sauce'. Moreover as (15) shows, the referential identity is required between the pronoun and its antecedent noun phrase jábloko 'an/the/some apple', hence jábloko has a count interpretation here (cf. Carlson, 1977).

(15) Ivan jel^I jábloko$_i$,   a Boris egó$_i$ jel^I tóže. **Russian**
    Ivan eat.PAST apple.SG.ACC$_i$ and Boris it$_i$ eat.PAST too
    (i) 'Ivan ate an/the/some apple$_i$ and Boris ate it$_i$ too.'
    (ii) 'Ivan was eating an/the/some apple$_i$ and Boris was eating it$_i$ too.'

Consequently, (15) ought to be true in a situation in which Ivan and Boris took bites from the same apple, a situation which some may consider odd. If the Incremental Theme noun phrase jábloko '(an/the) apple' in (15) shifted to a mass interpretation, then the referential identity between this noun phrase and the pronoun would not be required, because (15) would mean something like 'Ivan had apple-sauce and Boris had it, too'. But (15) has no such meaning. Such data indicate that Incremental Theme noun phrases with singular count noun heads retain their count, and hence quantized, reading in the scope of imperfective aspect.

    We are faced with the problem that the test based on anaphora and the test based on temporal adverbials produce inconsistent results with regard to the interpretation of inherently quantized Incremental Theme noun phrases in the scope of imperfective aspect. These results shed doubts on the assumption that imperfective verbs are cumulative, on the principle of aspectual composition

and the application of the diagnostic temporal adverbials to perfective and imperfective predicates in Slavic languages.

The cumulative interpretation of an inherently quantized noun phrase is also analyzed in terms of some partitive operator, as Piñón (1995:57) proposes for the Polish data analogous to the Russian sentence in (12):

(16)   Irenka jadła[I] jabłko   (przez pięć minut, #w pięć minut).   **Polish**
        Irenka ate   apple.SG.ACC   (through five-ACC minutes-GEN, #in five-ACC minutes-GEN)
        'Irenka ate at an apple (for five minutes, # in five minutes).'   (Piñón, 1995:57)

According to Piñón (1995), a combination of an imperfective verb like jadła 'she ate, she was eating' and a singular count noun phrase jabłko '(an/the/some) apple', as in (16), corresponds to the partitive predicate 'ate at an apple'. Piñón's account relies on the lexical stipulation that imperfective verbs in Polish are restricted to denote processes (p. 46, 56, 57). Therefore, a verb phrase constructed from the imperfective jadła 'she ate, she was eating' and a singular count noun phrase jabłko '(an/the) apple', must be process-denoting. To this it may be objected that it is questionable whether the partitivity operator expressed by the preposition *at* in English has the effect of eliminating the inherent boundaries of objects in the denotation of *an apple* in *ate at an apple.* More importantly, a partitive sentence like *She ate at an apple* corresponds to only one reading of the Polish sentence Jadła jabłko. The Polish imperfective sentence (16) and the corresponding Russian sentence (12) have a number of contextually-determined readings. Let me illustrate this point with the Russian sentence (12), which has at least five contextually determined readings listed under (i)-(v) in (12'):

(12')   Ivan   jel[I]   jábloko.   **Russian**
        Ivan   eat.PAST apple.SG.ACC
        (i) 'Ivan was eating an / some / the apple.' (progressive reading)
            'Ivan ate at an / some / the apple.' (partitive)
        (ii) 'Ivan ate all the apple / the whole apple.' (completive reading)
        (iii) 'Ivan ate an / some / the apple.' [and did (not) finish eating it] (general factual reading)
        (iv) 'Ivan repeatedly ate an / some apple.' (iterative reading)
        (v) 'Ivan used to eat an / some apple.' (generic reading)

Leaving aside the iterative and generic uses not covered by the principle of aspectual composition in (5), Russian imperfective sentences like (12/12') can have a progressive and partitive interpretation[16], where the assertion is made about a part of the eating event, and hence also about a part of the apple being eaten. Although there is an endpoint inherent in the event denoted by (12/12'), namely the state in which all of the apple is consumed, this endpoint is not asserted to be reached. (12/12') can also have a completive reading in appropriate contexts, namely, 'Ivan ate an

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[16]The progressivity and partitivity can be viewed as being here equivalent, at least from the truth-conditional point of view. The semantic contribution of the progressive operator is characterized in terms of the notion of 'partitivity' in Bach (1986) and Krifka (1992), for example, and this characterization can be traced back as far as Bennett and Partee's (1972/78) proposal.

/ the apple [and finished eating it]' or 'Ivan ate (all) the (whole) apple up'[17]. In the completive reading, (12/12') is clearly quantized and its Incremental Theme argument is quantized, as well. Finally, (12/12') can be used to assert that an event of eating of the apple took place, pure and simple, disregarding any generic, progressive or completive implications. In traditional Slavic linguistics, this use is labeled 'general factual' or 'simple denotative' use of imperfectives (see Comrie, 1976:113, for example)[18].

Given the wide range of contextually determined readings of imperfective sentences, we cannot assume that imperfective verbs in Slavic languages, such as Russian and Polish, are cumulative, pure and simple, despite the fact that they occur in the scope of durative adverbials. From this it would also follow that the empirical evidence for the uniform cumulative interpretation of the Incremental Theme noun phrase in the scope of the imperfective operator is rather weak. In order to account for the variety of readings of imperfective sentences, we cannot appeal to the ambiguity of the imperfective operator. Neither can it be assumed that there is just one single core meaning included in every instance of its use. For example, we cannot assume that the imperfective operator has some fixed weak meaning, such as the cumulative or process reading, that may be pragmatically strengthened to yield the stronger general factual and completive readings. This presupposes that the reference to a whole event (under the completive interpretation) is stronger from the informational point of view than the reference to possibly only a part of an event. Such pragmatic strengthening may be achieved via conversational implicature, which is distinguished by its cancellability. However, the added strength over a core cumulative or process interpretation does not seem to be cancellable in (17):

(17) Kto   zdes'   otkryval[I]   oknó?   **Russian**
      who   here   open.PAST   window.SG.ACC
      'Who opened the window, had the window open?'

(17), an example taken from Schoorlemmer (1995:113), can be uttered in a situation in which it is obvious to the speaker and hearer that the window was open, because the curtains are wet, for example. The question is as to *who* opened it. Continuing (17) with (18) would result in a contradiction:

(18) No   ešče   ne   otkryl[P]   egó.   **Russian**
      but   yet   not   open.PAST   it.
      'But he has not opened it yet.'

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[17]When imperfective verb forms are associated with a contextually determined completive meaning, they functionally overlap with perfective verb forms. In such cases, it may be preferable to use the corresponding perfective verb forms in both Russian and Polish.

[18]In the 'general factual' or 'simple denotative' use of the imperfective aspect, there is no specific reference to the completion of the event and "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, 1976:113). Descriptive grammars (e.g., Maltzoff, 1965:166, for example) associate this use with verbs denoting eating or drinking, where the idea of completion is not stressed, as with Russian verbs like *závtrakat'* *(po-)* 'to have breakfast'; *obédat' (po-)* 'to have lunch'; *užinát'(po-)* 'to have supper; *pit' (vy-)* 'to drink', etc.

Therefore, the completive reading of the imperfective sentence cannot come here from pragmatic strengthening of the cumulative (or process) meaning of the imperfective operator.

On accounts that treat Slavic imperfective predicates as semantically cumulative or process-denoting, proposed in Krifka (1986, 1989), Piñón (1995) and Schoorlemmer, (1995), for example, we would not be able to capture the different readings of imperfective sentences like (12) and the quantized interpretation of the Incremental Theme noun phrase in (15), because both would be simply cumulative due to the cumulativity of the main imperfective verb. Such accounts appear to be well-motivated on independent grounds. Assuming that imperfective verbs are cumulative is quite common and it is in the tradition of approaches that define the semantic contributions of perfective, imperfective and progressive operators in terms of functions that map sets of eventualities of a certain type onto eventualities of some (possibly other) type. For example, Mourelatos (1978/81:197) and Bennett (1981:15) argue that progressives are semantically activities (in Vendler's, 1957/67 sense), cumulative or process-denoting predicates in the terminology used here. Vlach (1981) treats the whole class of progressive predicates as stative predicates. Kamp and Rohrer (1983) propose that imparfait sentences in French introduce state variables, just like lexical state predicates. Moreover, proposing that the imperfective operator enforces the cumulative interpretation of Incremental Theme noun phrases seems to be well-motivated given that the grammatical aspect of a lexical head verb, perfective and imperfective, determines on its own the aspect type of all the verb's projections up to the level of a simple sentence. Consequently, it may be expected that the cumulative semantics of the head imperfective verb will be inherited by all its projections. Characterizing the semantic contribution of grammatical aspect in terms of eventuality types (or lexical aspect) amounts to blurring the line between these two categories, which might be viewed as a desirable simplification. However, one of the problems that this account faces is the existence of quantized readings of Incremental Theme noun phrases that are combined with imperfective verbs, as in (15). Such examples appear to fail the principle of aspectual composition, and they are also problematic for the statement of the rules that govern the distribution of the diagnostic temporal adverbials.

3.2 (In)definiteness vs. quantization

Another complicating factor is related to the assumption that undetermined mass and plural noun phrases in Slavic languages are ambiguous between the cumulative-indefinite and the quantized-definite interpretation, as given in (10) by Krifka (1992)[19]. If we look at a wider range of data than examples like (7) and (8), we see that the empirical evidence does not support this assumption. Consider the following Czech examples with Incremental Theme subject noun phrases:

(19)   a. Vlaky   projížděly[I]   hranicí.   **Czech**
          train.PL.NOM   PREF.pass.IPF.PAST   border.SG.INSTR
          (i) 'The trains were crossing the border', 'There were (some) trains crossing the border.'
          (ii) 'The trains crossed (repeatedly) the border.'

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[19]Piñón (1995:57-8) translates the Polish imperfective sentence (16) <u>Irenka jadła[I] jabłko</u> as 'Irenka ate at an apple' with the indefinite noun phrase 'an apple', while the corresponding perfective sentence <u>Irenka zjadła[I] jabłko</u> 'Irenka ate the apple' is translated with the definite noun phrase 'the apple'. The assumption that may be operative behind these translations is that imperfective verbs are correlated with indefinite Incremental Theme noun phrases and perfective verbs with definite ones. However, there are no restrictions on the (in)definiteness of singular count noun phrases in the scope of perfective and imperfective aspect, as Krifka (1986, 1992) observes for Czech, and Bittner and Hale (1995) for Polish.

b. Vlaky   projely^P hranicí.
train.PL.NOM   PREF.pass.PAST border.SG.INSTR
'(All) the trains crossed the border.'

One interpretation of (19a), which contains the imperfective verb projížděly 'they passed through', 'they crossed'; 'they were passing through', 'they were crossing', is progressive (or partitive) in which it is implied that there was an unbounded stream of trains crossing the border. That is, in this reading, the undetermined plural noun phrase 'trains' has a cumulative interpretation and, at the same time, a partitive interpretation: at some reference point in the past, some trains of some contextually specified set of trains, namely those passing through the border, were across the border and some were not. (19b) with the perfective verb projely entails that all the trains (that there were in the domain of discourse) passed through the border. Hence, 'trains' has a totality, and quantized, interpretation. Most importantly, regardless of the difference in the partitivity (19a) and totality (19b) reading, 'trains' is most likely to have the definite interpretation in both the imperfective (19a) and perfective sentence (19b). This has to do with the topic-focus informational structure of Czech sentences. Subjects often function as topics and topicalized constituents that occur in a sentence-initial position are often highly individuated and definite.

  What these Czech examples show is that the definite-indefinite distinction is orthogonal to the quantized-cumulative distinction. In the imperfective sentence (19a) vlaky (trains) is assigned the *definite* interpretation, while retaining its *cumulative* interpretation. However, the definite-cumulative reading of such undetermined plurals cannot be obtained on the assumption that undetermined noun phrases with plural noun heads in Slavic languages are ambiguous between 'indefinite-cumulative' and 'definite-quantized' interpretations (see (10) above). The same problem arises for undetermined noun phrases with mass noun heads.

  That the definite-indefinite distinction is orthogonal to the quantized-cumulative distinction can be clearly shown in languages in which (in)definiteness is explicitly marked by articles. For English, for example, it can be shown that the definite article does not (necessarily) make a mass or a plural noun phrase quantized. According to Jackendoff (1990), the sense of unboundedness, or cumulativity in the terminology used here, is in (20a,b) heightened by the use of progressive aspect, "which in a sense takes a snapshot of an event in progress" (p.101). The definite article "performs only a deictic function; in these cases it designates a previously known medium instead of a previously known object" (p.101).

(20) a. The water was rushing out of the faucet.
    b. The people were streaming into the room.

If the progressive is replaced by simple past, the event is viewed as temporally bounded, or quantized, and consequently, "the amount of water and the number of people is also bounded" (p.101).

(21) a. The water rushed out of the faucet.
    b. The people streamed into the room.

While in (20) and (21), the cumulative and quantized interpretations of the definite Incremental Theme noun phrases depends on the progressive and non-progressive aspect, in (22) these interpretations are enforced by the durative and time-span adverbials:

(22)   a. Bill ate the custard for hours / until he was full.
       b. Bill ate the custard in an hour / by 8:00.

As Jackendoff (1996:307, fn.5) points out, (22a) does not imply that all the custard was entirely consumed, but the definiteness of *the custard* has to do with the previous mention of custard. In (22b) *the custard* has a quantized *and* a definite reading. In sum, definite mass and plural noun phrases, unlike undetermined mass and plural noun phrases, are consistent with the quantized or cumulative interpretation[20].

As has been observed above, Czech along with the majority of Slavic languages, lacks the functional category 'article'. The differences in interpretation that are carried by articles in English, for example, are here inferred through, or expressed by, a variety of morphological, syntactic, prosodic and lexical devices: word order, stress, determiner quantifiers and various lexemes that modify nouns. In general, undetermined common noun phrases in languages without the functional category 'article' seem to shift more easily between definite and indefinite interpretations than undetermined noun phrases in languages with articles, such as English, that do not typically leave definiteness formally unmarked (cf. Partee, 1996; Chierchia, 1997). For this reason, it may also be proposed that undetermined noun phrases in languages without articles are not ambiguous between the definite and indefinite interpretation. In fact, in such languages the category of '(in)definiteness' does not belong to the system of grammatical categories. (For Slavic languages this has been argued by Chvany, 1983, for example.)

4   Proposal

Given the complexity of the interactions between verbal predicates and Incremental Theme noun phrases that we see in Slavic languages, and also in English, it seems implausible that such interactions can be adequately treated in terms of simple uni-directional, asymmetric dependencies, whereby one constituent imposes its quantization constraints on some other constituent: namely, the verb on the Incremental Theme noun phrase in Slavic languages and the Incremental Theme

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[20]It is worth mentioning that undetermined mass noun phrases that function as arguments of certain episodic non-progressive verbs in English appear to have quantized readings. Consider the following sentence: (i) *Sandy threw snow on Kim* (taken from Hinrichs, 1985). (i) is understood as suggesting that Sandy threw some quantity of snow on Kim. Such sentences pose problems for Quine's (1960) interpretation of mass terms, as Burge (1972) points out. Given that *snow* is here not used predicatively (as a predicate ranging over quantities of matter), the only other possibility is to treat *snow* as a singular term, on a par with other singular terms like proper names. Quine's analysis then predicts that *snow* in (i) should have the singular use of mass terms, and therefore, should refer to the scattered individual making up the totality of snow. But *snow* in (i) does not have here a kind reading nor can it have in its denotation the union of all things which are snow. (For a discussion of the problems related to such uses of mass terms see Burge (1972), Hinrichs (1985), and Chierchia (1997, 1998), for example). Although the most natural interpretation of *snow* in (i) appears to be quantized, *snow* in (i) does not behave like a typical quantized noun phrase with respect to the anaphora test. We see that referential identity is not required between *snow* and its anaphoric pronoun in (ii): (ii) *Sandy threw snow $_i$ on Kim and Kelly threw it $_{i,j}$ on Jim, too.*

Related to this is Hoepelman's (1981) observation that we cannot interpret *water* as meaning 'a quantity of water' in a sentence like *John drank water* (under a single eventuality interpretation), even though the sentence means that John drank a certain portion of the water that there was. The reason is that *water* behaves like a mass noun phrase and *a quantity of water* behaves like a count noun phrase with respect to the diagnostic temporal adverbials: cp (ii)*John drank water *in five minutes / for five minutes* and (iii)*John drank a quantity of water in five minutes / ?? for five minutes.*

noun phrase on the verbal predicate or sentence in English. Rather, a more promising way of analyzing such dependencies is to view verbs and Incremental Theme noun phrases as being mutually constraining, and state the relevant constraints over both of them. One way in which this strategy can be implemented is in constraint-based (or unification-based) terms (see Sag and Pollard, 1994, for a detailed exposition): A verb and an Incremental Theme noun phrase each provides partial information about a single linguistic object, a complex verbal predicate or a sentence. Moreover, a verb and an Incremental Theme noun phrase each provides a different type of information and constraints imposed by the language require that information coming from these two sources be compatible (see also Filip, 1992; 1993/99).

4.1 Grammatical aspect versus eventuality types

The Incremental Theme argument encodes information relevant to the calculation of the lexical aspect, or eventuality types (in the sense of Bach, 1981; see also section 2). It is specified here in terms of the mereologically-based notions 'quantization' and 'cumulativity'. In English and Slavic languages, the verb encodes the relations 'partitivity' and 'totality', which are also mereologically based, and which characterize the semantic contribution of the categories of grammatical aspect (perfective, imperfective and progessive). Since lexical aspect and grammatical aspect are characterized in terms of distinct semantic properties, this amounts to proposing that there is a clear line between these two categories. Nevertheless, lexical aspect and grammatical aspect are related in so far as the semantic properties in terms of which they are characterized are grounded in the same mereologically based apparatus, which facilitates the description of their systematic interactions.

The cost of introducing a new distinction, partitivity-totality, specifically for the semantic contribution of grammatical aspect, in addition to the quantized-cumulative distinction, which is reserved for the characterization of eventuality types on the level of lexical aspect, is justified, because it allows us to preserve the original principle of aspectual composition, given in (5), and all the insights related to its workings, not only in Slavic languages, but also in English and other languages. Specifically for Slavic languages this means that by separating the semantic contribution of the Incremental Theme noun phrase from that of grammatical aspect, we can capture the quantized readings of Incremental Theme noun phrases in the scope of imperfective operator without abandoning the principle of aspectual composition. We can also capture the fact that the grammatical aspect of a sentence is fixed once and for all by the aspect of its main lexical verb, perfective and imperfective, and therefore also the aspectual semantics of the main perfective and imperfective verb is passed onto their respective projections up to the level of a simple sentence. If imperfectivity is characterized in terms of the partitive relation, rather than in terms of cumulativity, then there is nothing contradictory about combining the semantics of imperfectivity with the quantized reading of an Incremental Theme noun phrase.

A lexical predicate with all its argument positions filled by variables or constants, that is, proper names or common nouns in the singular, denotes a set of basic eventuality descriptions of a given type: events, processes or states. Such basic eventuality descriptions serve as inputs into various eventuality type modifiers that derive non-basic eventuality descriptions[21]. Among such modifiers are optional adjuncts, temporal (durative like *for an hour* and time-span like *in an hour*) and directional (*to the post office* in *John walked to the post office*), for example, verbal prefixes,

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[21]See L. Carlson (1981) and de Swart (1998) for a similar distinction into basic and non-basic eventuality descriptions, in their terminology 'atomic' and 'non-atomic'.

as in Slavic languages (see Filip, 2000) and in other Indo-European languages, for example. Eventuality description modifiers map sets of eventualities of a certain type onto sets of eventualities of some (possibly other) type. This view also allows for eventuality description modifiers to be applied recursively to one another, as in *John walked to campus in twenty minutes every day last year* (see also de Swart, 1998).

Eventuality descriptions also serve as inputs into the operators of grammatical aspect. The semantic contribution of the perfective operator can be represented as a function that maps sets of eventualities of any kind onto sets of events represented in their entirety, as 'total events': PERF: $\mathcal{E} \rightarrow$ TOTAL.EVENT, whereby $\mathcal{E} = \{process, state, event\}$. This is expressed by the totality condition *TOT* in the semantic representation of perfective verbs:

(23) $\lambda P \lambda e[P(e) \ \& \ TOT(P)]$

If a given state of affairs is represented by a verbal predicate in its totality, there must be some limits imposed on its (temporal or spatial) extent, and consequently, it must be quantized. Hence, all perfective verbs are quantized by virtue of denoting 'total events'[22]. Depending on the idiosyncratic lexical semantic properties of a given perfective verb and the derivational devices used for its formation, the meaning of 'totality' can be understood as (i) the attainment of the inherent final delimitation of the denoted event ('completion', 'result'); (ii) completed transition into a state, event or process ('inchoation'); or (iii) a total event of a certain duration (short, long, punctual). The relevant Russian examples are (i) <u>dopisát'</u>[P] 'to finish writing'; (ii) <u>zakurít'</u>[P] 'to light up (cigarette, pipe, etc.); to begin to smoke; to take up smoking'; (iii) <u>prostoját'</u>[P] 'to stand for a relatively long time'. (For more examples from Czech, and a discussion see Filip, 1993/99.)

Just as the perfective operator so does the imperfective operator apply to states, processes and events alike. However, only the imperfective operator is 'transparent' with respect to the eventuality type of its input predicate: An imperfective sentence inherits its eventuality type from the eventuality description the imperfective operator applies to. The imperfective operator combines with predicates of states, processes and events and yields the corresponding predicates of *partial* states, processes and events. It contributes the partitivity condition *PART* to the semantic representation of imperfective verbs (24a), whereby *PART* is defined in terms of the mereological part relation '≤' (weak ordering relation), as in (24b) (see Krifka, 1992:47):

(24)   a. $\lambda P \lambda e \ [P(e) \ \& \ PART(P)]$
       b. $PART = \lambda P \lambda e' \exists e[P(e) \land e' \leq e]$

The reason for using the part relation '≤' ('part-of-or-equal') for the semantic contribution of the imperfective operator is that it allows us to cover a variety of contextually determined uses that imperfectives can have, without having to resort to ambiguity or to pragmatic strenghtening (or weakening) of some core fixed single meaning. As has been observed above, imperfective verb forms can be used to denote incomplete (partial) eventualities and also completed events. The completive reading of imperfectives is compatible with the part '≤' relation, which may relate eventualities denoted by basic predicates to their proper parts, but this is not necessarily so. The part relation allows any eventuality to be a part of itself.

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[22]Apparent counterexamples to the claim that perfective verbs are semantically quantized are discussed in Filip (2000).

Having two sets of semantic oppositions, cumulativity-quantization and partitivity-totality, provides us with sufficiently rich tools to capture the interaction of imperfective verbs with quantized and cumulative Incremental Theme noun phrases. Let us look again at the pair of Russian imperfective sentences in (13a,b), repeated here in (25a,b):

(25) a. Ivan   jel^I jábloko.   **Russian**
          Ivan   eat.PAST   apple.SG.ACC
          'Ivan ate / was eating an / the / some apple.'

      b. Ivan   jel^I muss z jáblok.
          Ivan   eat.PAST   sauce from apple.PL.GEN
          'Ivan ate / was eating apple-sauce.'

The quantization status of (25a) and (25b) is calculated following the principle of aspectual composition (5). The quantized Incremental Theme noun phrase jábloko 'an/the/some apple' yields the quantized (or event-denoting) verbal predicate in (25a), and the cumulative Incremental Theme noun phrase muss z jáblok 'apple-sauce' produces the cumulative (or process-denoting) verbal predicate in (25b). In addition, in each sentence, the imperfective operator contributes the partitivity condition. (25a) asserts that a part of the event denoted by the quantized base predicate EAT THE APPLE took place, and if we assume the one-to-one mapping between events and objects, it follows that a part of the apple was eaten. (25a) can be used not only to convey that some proper part of the whole apple was eaten (partitive reading), but also that the whole apple was eaten (completive reading). In any case the singular count noun phrase jábloko 'an/the/some apple' retains its quantized interpretation, as is desirable given the result from the anaphora test, illustrated by (15). Similarly, (25b) asserts that a part of the process denoted by the cumulative base predicate EAT APPLE-SAUCE took place. In (25b) muss z jáblok 'apple-sauce' denotes some undelimited quantity of stuff, and (25b) can be used to convey that some unspecified part of that stuff was eaten (partitive reading), or the whole portion of it that there was in the domain of discourse (completive reading).

The two types of distinctions in the domain of aspectual phenomena are intuitively very straightforward and they have analogues in the domain of nominal predicates and their denotational domain of objects. When talking about objects we pay attention to their individuation, that is, we distinguish between matter denoted by cumulative nominal predicates, on the one hand, and well demarcated countable objects denoted by quantized nominal predicates, on the other hand: cp. *gold* versus *a symphony.* Second, we talk about parts of objects or objects in their entirety. We may refer to parts of stuff and parts of countable objects with some partitive expression or construction, such as *This is part of a symphony* and *There is (some) gold in this coin* (see Bach, 1986:12), and we can present objects in their entirety, as in *This is the/a whole symphony.* There is one systematic gap: *cumulative+totality. This follows from general knowledge inference mechanisms: namely, asserting that a given entity is viewed in its entirety presupposes that the entity has limits to it, that is, the predicate denoting it must be interpreted as quantized.

If Slavic imperfective predicates can be semantically quantized, and their quantized Incremental Theme noun phrases, as well, yet at the same time they are compatible with durative adverbials, we cannot state the restrictions on the application of the diagnostic temporal adverbials (durative and time-span) to verbal predicates in a uniform way for both Slavic languages and English, as stated in (2). What exactly do durative adverbials, such as pjat' minút (Russian) '(for) five minutes' and time-span adverbials, such as za pjat' minút (Russian) 'in five minutes', test for and how do they work? Assuming that the grammatical aspect of a lexical head verb, perfective and

imperfective, determines on its own the aspect type of all the verb's projections up to the level of a simple sentence, the most straightforward way of delimiting the domains of application of temporal adverbials in Slavic languages appears to be in purely formal terms, with respect to the classes of perfective and imperfective verb forms[23], rather than in semantic terms, with respect to cumulative and quantized predicates, as is done for English:

(26)   The domain of application of durative adverbials is restricted to verbal predicates with imperfective head verbs, while the application of time-span adverbials to verbal predicates with perfective head verbs.

The differences in the statement of the distribution restrictions on verbal predicates in English, on the one hand, and in Slavic languages, on the other hand, can be taken as yet another piece of evidence for distinguishing grammatical aspect in Slavic languages from the category of lexical aspect. This in turn is closely related to the fact that grammatical aspect covers purely formal categories and it is fixed once and for all by a single perfective or an imperfective verb form in Slavic languages. Lexical aspect, on the other hand, covers semantic classes and in English the membership of a given verbal predicate or a sentence in a quantized or cumulative class of lexical aspect is often unstable. Although the criterial semantic notions (e.g., state vs. episodic situation, (in)definite change of state) on which the classes of lexical aspect are based are manifested in the entailments of individual verbs, most verbal predicates easily shift from their basic (or preferred) quantization type to another depending on the context in which they are used. Almost any cumulative verb, verb phrase and sentence can have a quantized interpretation[24], and vice versa, a quantized verb, verb phrase and a sentence can be coerced into a cumulative interpretation. Some of the most frequently discussed sentence-internal shifters of lexical aspect are optional adjuncts (temporal, locative, directional, resultatives), phasal verbs, imperative mood, progressive aspect, and tense. The shifts also depend on the inferences that can be drawn from discourse-level linguistic context and the context of an utterance. Moreover, the quantization of a verbal predicate or a sentence crucially depends on the quantization properties of its Incremental Theme argument, as stated in the principle of aspectual composition in (5). Hence, the encoding of the semantic notions that are criterial for the determination of lexical aspect is often distributed over more than one syntactic constituent in a simple sentence.

Distinguishing between the semantic contribution of grammatical aspect, on the one hand, and the lexical aspect of verbal predicates to which operators of grammatical aspect are applied, on the other hand, can be also motivated by the behavior of English progressives with quantized Incremental Theme noun phrases:

(27)   a. Ivan was eating the apple   for five minutes / ?in five minutes.
        b. Ivan was eating apple sauce for five minutes / *in five minutes.

As is well known (see Dowty, 1977, 1979; Bach, 1981; Parsons, 1990, and many others), (27a) and (27b) have different inferences: From (27b) we can infer what is conveyed by the corresponding

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[23]There are other types of adverbials that are directly sensitive to the aspect of the main lexical verb in a sentence.

[24]Dowty (1979), for example, observes, "I have not been able to find a single activity verb [our cumulative verb, HF] which cannot have an accomplishment sense in at least some special context" (p.61).

non-progressive sentence *Ivan ate / had eaten apple sauce*, but from (27a) we cannot conclude *Ivan ate / had eaten the apple*[25]. This difference is clearly connected to the difference in the quantization properties of the base predicates, the quantized predicate EAT THE APPLE in (27a) and the cumulative EAT APPLE-SAUCE in (27b), which in turn stem from the difference in the quantization properties of the Incremental Theme noun phrases, *the apple* and *apple-sauce*, by the principle of aspectual composition (5).

Given the difference in inferences between (27a) and (27b), the question arises to what extent the claim is justified that the progressive operator has the effect of yielding a cumulative (process) reading, that is, stripping an event predicate of its inherent end-point in sentences like *Ivan was eating the apple* in (27a). This claim is often supported by the observation that progressives freely occur with durative adverbials, such as *for five minutes* in (27a), but not with time-span adverbials, such as *in five minutes*. If we concluded from this that the Incremental Theme noun phrase *the apple* in (27a) is interpreted cumulatively (possibly as a result of some quantized-to-cumulative shift), then (27a) and (27b) would have the same cumulative meaning, which would raise the question as to how the inference differences between them ought to be motivated. On the other hand, that the progressive does not automatically strip an inherently quantized base predicate of its inherent delimitation can be viewed as being supported by the observation that *Ivan was eating the apple in five minutes* can have a quantized reading involving an event in progress that is culminating within the specified period. In this reading, the progressive operator takes wide scope over *eat the apple in five minutes*, that is, both the time-span *in*-adverbial and the quantized base predicate (see de Swart, 1998:358): PROG[in five minutes[eat the apple]][26].

For Slavic languages there is even more evidence to assume that inherently quantized base predicates retain their quantized property in the scope of the imperfective operator, given that Slavic imperfectives can be used to denote completed events, a use that progressives in English cannot have. In general, progressivity is considered to be a subcategory of imperfectivity (see Comrie, 1976, for example). The reason is that the domain of application of the imperfective operator as well as its semantics and the range of contextually determined uses of imperfectives are broader than those of English progressives. First, the progressive operator is sensitive to the episodic-stative distinction, while the imperfective is not. The progressive operator requires that predicates in its scope be episodic, denote some 'temporary' or 'contingent' property (see Comrie, 1976; Carlson, 1977; Bach, 1981; Timberlake, 1982; Smith, 1985, 1991/97; for example). It can be applied to state predicates, provided they can be construed as having an episodic sense (Bach's,

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[25]Additional problems are posed by progressives that are based on predicates of creation, such as *build, write*, which involve incomplete objects. A sentence like *John is building a house* can be truthfully and felicitously uttered even if the object of creation will never come to existence. The problems related to the analysis of such progressives have been discussed under the labels 'imperfective paradox' (Dowty, 1977, 1979) or 'partitive puzzle' (Bach, 1986), for instance. The existence of progressives with verbs of creation serve as one of the main motivating factors for the treatment of the progressive as an intensional operator (see Dowty, 1972, 1979; Landman, 1992).

[26]Depraetere (1995) also proposes that in sentences like *John was drawing a circle* we need to evoke 'two different types of distinctions': "a classification based on potential endpoints, which is labelled *(a)telicity*, and one based on actual temporal boundaries, captured by the label *(un)boundedness*" (p.2-3). In Depraetere's terminology, *(un)boundedness* is used to characterize the semantic contribution of the categories of grammatical aspect: perfective, imperfective and progressive.

1981, "temporary" or "dynamic states")[27]: cp. *John is knowing all the answers to test questions more and more often* (Binnick, 1991:173), *I am understanding more about quantum mechanics as each day goes by* (Comrie, 1976:36)[28], *John is being a hero (by standing still and refusing to budge)* (Dowty, 1979:185)[29]. The imperfective operator can be freely applied to episodic and state predicates, including individual-level state ones. In fact, individual-level state predicates are imperfective, never perfective. Modal verbs and other verbs for which the perfective-imperfective opposition is neutralized (so-called 'imperfectiva tantum') are also imperfective[30].

Second, although Slavic imperfective verbs are used in contexts in which English progressives are required, that is, to denote eventualities in progress, for example, with temporal adverbials like 'right now', this similarity is often overemphasized at the expense of other contextually determined meanings that imperfectives, but not progressives, can have. Imperfectives can be used in contexts and with functions typically conveyed by perfective verb forms, namely to denote completed events. In such contexts imperfectives and their perfective counterparts are interchangeable without changing the truth-conditions of a sentence. In addition, progressives are only marginally used for habitual and generic statements (see Smith, 1991/97, for example), while imperfectivity and genericity manifest a number of formal and semantic affinities (see Filip and Carlson, 1997). Slavic languages either always or almost always allow for the expression of genericity by imperfective forms alone. Specifically generic morphemes attach to imperfective bases. Generics are aspectually stative (cf. Carlson and Pelletier, 1995) and the aspectual character of imperfectives seems to be semantically compatible with stativity. There is also a historical connection between imperfectivity and genericity. The imperfectivizing suffix -va-, used in the formation of some imperfective verbs (see (28)), developed from the marker of iterativity, frequency, or genericity, and it is synchronically homonymous with the marker for genericity -va-.

(28) simple imperfective → perfective → (secondary) imperfective

       pisát'[I]   **VY**-pisát'[P]   **VY**-písy-**VA**-t'[I]
       write.INF   **PREF**-write.INF   **PREF**-write-**IPF**-INF
       'to write', 'to be writing'   'to write out'   'to write out', 'to be writing out'

                                  dat'[P]   da-**VA**-t'[I]
                                  'to give'   'to give'/'to be giving'

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[27]Most, if not all, state predicates can be construed episodically. The only exceptions seem to be certain syntagmas with the verb *be*: **Mary is being drunk*, **Mary is being asleep*, and *be* when it combines with a locative prepositional phrase, as in **Mary is being in New York* (see Bach, 1981:77).

[28]Here, "the reference is not to an unchanging state of comprehension, the degree of comprehension being the same from one time-point to another, but rather of a change in the degree of understanding: on any given day, I understood more about quantum mechanics than on any previous day. Thus the verb *understand* here refers not to a state, but to a developing process, whose individual phases are essentially different from one another" (Comrie, 1976:36-7).

[29]*John is being a hero (by standing still and refusing to budge)* can be interpreted as expressing a temporary eventuality 'be acting / behaving in an heroic way' (see Dowty, 1979:185) that counts as a temporary manifestation of the disposition expressed by the basic non-progressive predicate BE A HERO.

[30]These are verbs that have just one form for the use as perfectives and imperfectives, an example from Russian is kaznít' 'to execute'. There are also imperfective verbs without perfective counterparts: múdstrovat' 'to philosophize'; privétstvovat' 'to greet' (simple imperfective borrowings from Church Slavonic); obožát' 'to adore'; protivoréčit' 'to contradict' (Church Slavonic imperfectives with prefixes).

All of these differences indicate that the semantic contribution of the Slavic imperfective and the English progressive operator to a sentence's semantics cannot be treated in the same way, contrary to frequent proposals. For example, Zucchi (1997) proposes that they both instantiate the function originally posited by Landman (1992) for the interpretation of the English progressive aspect: namely, the imperfective suffix -va- takes as input a predicate of complete events, expressed by a perfective verb as in (28), and yields predicates of complete/incomplete events.

I proposed above (see (24)) that the partitivity involved in the imperfective operator is best understood in terms of the part relation '≤' (a weak ordering relation) to accommodate the variety of contextually determined uses of imperfectives, including their completive use. The part relation involved in the semantics of the English progressive operator is to be understood in terms of the proper part relation '<' (a strict ordering relation): The progressive operator is used to map (sets of) eventualities into their *proper parts*. That is, in asserting *Max was crossing the street*, for example, the speaker excludes the final part of the denoted event, namely, that subpart that has Max on the other side of the street. *Max was crossing the street* can never be used to assert that the whole event of crossing the street took place. In order to express that the event of crossing of the street was completed, we need to use its non-progressive counterpart *Max crossed the street*.

Another closely related point concerns the necessity for an intensional analysis. In Landman (1992), the progressive operator is treated as an intensional operator[31]. However, given that Slavic imperfectives can be used to denote completed events, there is even less motivation than in the case of the English progressive operator to treat the imperfective as an intensional operator. Both the Slavic imperfective and English progressive operator may be best treated as extensional operators, following some independently made proposal for the English progressive in Parsons (1990), but an explicit argument for this position is beyond the scope of this paper.

4.2 Grammatical aspect, prototypes and markedness

I propose that the semantic core of possibly all aspectual systems can be characterized in terms of the basic mereological notions 'partitivity' and 'totality', here represented by means of the *PART* and *TOT* predicate modifiers (see (23) and (24) above). This, however, does not mean that the semantics of various aspectual systems in all languages is reducible just to these notions and that they are equally applicable to the aspectual systems of all languages. Rather, 'partitivity' and 'totality' are two among several contributing properties that characterize the semantics of the imperfective and perfective categories. The realization of other contributing properties depends on the markedness relation between the members of a given aspectual opposition and the relative verb-prominence in the encoding of information relevant to grammatical aspect. (A brief comparison of Slavic languages, English, German and Finnish will be given in section 5).

Progressives are more restricted with respect to their domain of application, their semantics and the range of uses than non-progressives are, and therefore, in this sense, the progressive aspect is considered to be the marked member in the progressive vs. non-progressive aspectual opposition. The English progressive can be only applied to episodic predicates, while non-progressives are both episodic and stative. The progressive operator maps eventualities into their proper parts, which requires that a predicate to which the progressive operator is applied denotes eventualities with a certain duration. Only an eventuality with a certain temporal extent can be thought of as

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[31]The idea that the progressive operator is to be treated within an intensional framework, namely as a "mixed modal-temporal" operator, was introduced into contemporary linguistics by Dowty (1972, 1977, 1979). Dowty provides an extensive argument for this position. An intensional analysis of the progressive is also advocated in Portner (1998).

having proper parts. Non-progressives denote eventualities with a certain extent and also single events that are understood as occuring at a single moment of time, such as *flash* or *blink*. Non-progressives can be used for the expression of completed events, but progressives never can. At the same time non-progressives can be used with the function that is typically associated with progressives, namely for eventualities in progress. We find this use in lively reports of sports events, for example: *He shoots - he scores!*

In the Slavic perfective vs. imperfective opposition, the perfective member is marked, as perfective verb forms are more restricted in their semantics, distribution and contextually determined functions than imperfective forms. The perfective operator can only have episodic predicates in its scope. As has been observed above, the imperfective operator does not have this requirement, individual-level state verbs, modal verbs and other verbs for which the perfective-imperfective opposition is neutralized are imperfective[32]. In Slavic languages, imperfective verb forms can be used to denote incomplete (partial) eventualities, and also completed events just as the marked perfective verb forms. According to Comrie (1976), it is the 'general factual' or 'simple denotative' use of the imperfective (see also comments on example (12')) that is "perhaps the strongest single piece of evidence in Russian (and similarly in the other Slavonic languages) for considering the Perfective to be the marked form" (p.113).

In light of the above observations, the marked members of the aspectual oppositions in English and Slavic, the progressive and the perfective aspect, respectively, can be semantically characterized in terms of the clusters of the following properties:

(29)   The PROG operator is a function that maps eventualities into their *proper parts.*
        Necessary constraint on the input predicate P: P denotes sets of episodic and protracted
                                                eventualities.
        Additional elaborations: manifestation of a disposition, potential for an imminent
                                change, incremental change, etc.

(30)   The PERF operator is a function that maps (sets of) eventualities into (sets of) *total* events.
        Necessary constraint on the input predicate P: P denotes sets of episodic eventualities.
        Additional elaborations: result, completion, limited duration, punctuality, etc.

The clusters of concepts that characterize the Slavic perfective and the English progressive aspect can be viewed as characterizing two prototypical members of the perfective and imperfective category, respectively. The prototype view presupposes that perfective and progressive predicates and sentences each express clusters of non-discrete concepts or aspectual properties. The systematic expression of aspect in any given language can be understood as realizing at least the part (*PART*) or totality (*TOT*) relation and possibly some of the other properties and constraints that contribute to the progressive and perfective prototypes. The more of these properties and

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[32]A similar situation is common in other languages as well. For example, Comrie (1976:116) mentions that some stative verbs in Georgian lack the distinct aorist and imperfect forms in the past tense, instead they have just one form whose meaning is primarily like that of the imperfective of other verbs. In general, it is the unmarked member, formally and/or semantically, in a given opposition that is used in neutralizing contexts, while the marked member is excluded or much less frequent. Comrie (1976) also observes that "in the case of verbs which for semantic reasons have only one form, (...) the form that is appropriate semantically will be used. But we would not expect to find verbs with the morphology of the marked aspect being used irrespective of aspect, or only with the meaning of the unmarked aspect, at least not as a regular phenomenon" (p.116).

constraints are grammaticalized in a given language-specific aspectual category, the closer it will be to these two prototypes.

The prototype view of aspect has the advantage that it does not presuppose that there is any one set of universal concepts that are equally applicable to all languages (see also Dahl, 1985). Neither does it imply that the aspect category in a given language is necessarily reducible to a single semantic 'invariant' property (or a pair of such properties), contrary to the structuralist approaches to aspect, for example[33].

Moreover, if we assume that the mereologically-based notions of 'partitivity' and 'totality' constitute the semantic core of perfective and imperfective aspect in natural languages, we can represent at least part of the semantics of the grammatical aspect and lexical aspect by means of the same mereologically-based apparatus. (Recall that in section 2 it has been shown that at least some of the properties of the classes of lexical aspect can be described in terms of mereologically-based notions 'quantization' and 'cumulativity'.) Such a characterization of grammatical aspect and lexical aspect has the advantage that it allows us to describe in a straightforward way their interaction and integration into a sentence's semantics. Finally, if we assume that the mereological notions of 'partitivity' and 'totality' constitute the semantic core of aspectual systems in natural languages, we can also describe in a straightforward way the parallels between various aspectual systems regardless whether the relevant aspectual notions are encoded by means of verbs or some periphrastic verbal constructions, or by means of nouns, noun phrases and various constructions with a locative or partitive origin, as in Finnish and German, for example. I will address these two points in the next two sections, 4.3 and 5.

4.3   Mutual constraints between noun phrases and verbal predicates: Another try

A direct comparison of English and Slavic examples, as in (1) and (7/8), may suggest that the information about quantization and cumulativity 'flows' from the Incremental Theme noun phrase to the verb phrase in English and, in the opposite direction, from the verb to the Incremental Theme noun phrase in Czech, Russian and Polish. In Czech, it is the verb that specifies more information than the Incremental Theme noun phrase about lexical aspect (quantization and cumulativity) and also about the partitivity and totality relations, which characterize the semantics of grammatical aspect. In English, on the other hand, it is the Incremental Theme noun phrase that carries the most of the informational load. The apparent 'flow' of the relevant information in one direction is due to the imbalance in which the relevant aspectual information is encoded in the surface syntax and morphology. In each case, it is due to the fact that certain linguistic forms specify more information than others or specify information that takes precedence over the information specified by other linguistic forms. Therefore, such interactions between noun phrases and verbal predicates appear to be inherently procedural and directional. In Krifka's (1986, 1989) work this is reflected in such informal formulations as 'the transfer of reference mode' from the Incremental Theme argument onto the complex verbal predicate, and vice versa.

The variability of the meanings of noun phrases and verbal predicates that we encounter in English, Czech, Russian and Polish can be accounted for via ambiguity, which is often captured

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[33]Identifying the invariant semantic contribution of perfective and imperfective aspect to the sentential semantics is crucial in structuralist theories. Those that subscribe to the view of aspect as a privative opposition assume that perfective is the marked member with a specific positive semantic invariant feature, while the unmarked imperfective member is defined as not opposing any positive or negative meaning to that of the marked member. However, the unmarked member may, in specific contexts, take on the opposite semantic value of the perfective (see Jakobson, 1932:74).

by general lexical rules or type-shifting operations. However, the main disadvantage of such approaches is massive and unmotivated multiplication of interpretive rules, or multiplication of lexical entries or interpretations of items in question. Take the Slavic undetermined noun phrases with common noun heads, for example. We cannot account in any systematic and adequate way for all the meanings they can assume in dependence on verbal aspect and other linguistic and extralinguistic context by simply enumerating them as multiple senses of such noun phrases: quantized-definite, cumulative-definite, cumulative-indefinite, etc. This would lead to a rampant multiplication of interpretive rules for noun phrases, that is, to one syntactic rule 'NP → N' (where N is a common noun) would correspond not just two semantic interpretations, but many more. Neither can we account for this variety of noun phrase meanings by positing just one lexeme for each common noun in Russian and imposing constraints on the interpretation of particular argument positions of an imperfective verb, that is, applying a strategy similar to one in Carlson (1977), for example, for existentially quantified mass and plural nouns in English. This would lead to an unmotivated proliferation of lexical entries for verbs or proliferation of senses for verbs.

We can avoid such problems and provide a unified analysis for both the English and Slavic data if we assume a constraint-based (or unification-based) view of these interactions. By providing a declarative description for processes that appear to be inherently procedural and directional, we can better highlight the similarities between English and Slavic examples. In constraint-based terms, a verb and an Incremental Theme noun phrase each specify partial information about a single linguistic object, a complex verbal predicate or a sentence. In the previous section I proposed that the constraints concern two types of distinction: quantization vs. cumulativity and partitivity vs. totality. Constraints imposed by the language require that information coming from these two sources be compatible.

In English, a verb and an Incremental Theme noun phrase each introduce instances of the feature attribute 'QUANT'. This is encoded in lexical entries for verbs, which is illustrated in (31) with the HPSG-style lexical entry for the English verb *eat*:

(31)   The lexical sign for *eat*

$$
\begin{bmatrix}
\text{PHON } eat & \\
\text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} verb \\ \text{QUANT [3]} \end{bmatrix} \\ \text{SUBCAT} & \langle \text{[1]NP, [2][NP[QUANT [3]}\alpha \text{]]} \rangle \end{bmatrix} \\
\text{SEM} & \begin{bmatrix} \theta\text{-ROLE} & \langle e, \text{[1]AGT}_i, \text{[2][INC-TH [QUANT 3]]}_j \rangle \\ \text{CONTENT} & \begin{bmatrix} psoa \text{ [e-type incremental]} \\ \text{PRED} & \begin{bmatrix} \text{REL} & eat \\ \text{EATER} & i \\ \text{EATEE} & j \end{bmatrix} \end{bmatrix} \end{bmatrix} \\
\text{CONTX [...]} &
\end{bmatrix}
$$

The information about the eventuality type is here encoded as the value of the feature attribute 'e-type' in the 'psoa' feature structure (where 'psoa' stands for a 'parametrized state of affairs'). For a verb like *eat*, 'psoa' takes as its value '[e-type incremental]', which is to be understood as a place-

holder with an abbreviating function. It points to the place in the lexicon where all the relevant properties of the incremental eventuality type are characterized, including, most importantly, the information about the object-event homomorphism, defined by Krifka (1986, 1992, and elsewhere; see also Appendix). The noun phrase which is co-indexed with the Incremental Theme argument in the thematic structure is assigned the feature [QUANT α], where 'α' is a feature value variable standing for '+' and '-'. In the lexical entry for *eat*, it is required that the verb and the noun phrase that is co-indexed with the Incremental Theme argument and the Incremental Theme argument itself have the same value for the QUANT attribute. This is encoded with the numeral '[3]' called the 'tag'. In general, structure-sharing is indicated by two (or more) different occurrences of a tag, which amounts to expressing that two different feature attributes have the same value. The sharing of the feature structure QUANT between the verb and the Incremental Theme noun phrase is here intended to capture two observations: First, the Incremental Theme and its governing verb form a syntactic and semantic unit from the point of view of the classification of verbal predicates into quantized and cumulative eventuality types. Second, the quantization value of this unit is determined by the quantization status of the noun phrase that satisfies the Incremental Theme requirement of the verb. The syntactic structure-sharing has as its semantic correlate the principle of aspectual composition, given in (5) above. The aspectual composition can be thought of as one of the integration functions that combine the meaning of sentence's constituents into an interpretation of a sentence by integrating partial information provided by each constituent. A general HPSG-style rule for the unification of the 'QUANT' values of the verb and the Incremental Theme noun phrase is given in (32):

(32)

$$
\begin{bmatrix} phrase \\ \text{HEAD}\,[1] \end{bmatrix} \rightarrow \begin{bmatrix} phrase \\ \text{HEAD}\,[1] \begin{bmatrix} verb \\ \text{QUANT}\,[2] \end{bmatrix} \end{bmatrix} \begin{bmatrix} phrase \\ \text{HEAD} \begin{bmatrix} noun \\ \text{QUANT}\,[2] \end{bmatrix} \end{bmatrix}
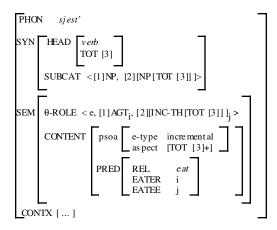$$

This rule allows us to calculate the quantization properties of complex verbal predicates also in those cases in which the noun phrase that determines the quantization of a verbal predicate is not a subcategorized Incremental Theme argument of its head verb: e.g., *She combed her hair* in its quantized reading, for example. (See remarks at the end of section 2.1.)

In Slavic languages, there are three separate distinctions whose members interact in systematic ways in the interpretation of Incremental Theme noun phrases that depends on verbal aspect:

(33)   partitivity - totality distinction
        quantized - cumulative distinction
        definite - indefinite distinction

Grammatical aspect is marked directly in the lexical entries of verbs with the cross-categorial feature specifications '[TOT +]' and '[PART +]'. This is motivated by the assumption that the semantic relations associated with the aspectual operators, *PART* and *TOT* (see (23) and (24) above) are encoded by verbal roots and stems. In a given Slavic sentence, the feature specifications '[TOT +]' and '[PART +]' percolate upwards from the lexical head verb to the phrasal level and ultimately determine the aspect of a simple sentence. Also constraints on the compatibility between aspect semantics and the Incremental Theme argument come from the lexicon. (34) is a partial lexical entry for the Russian perfective verb *sjest'* 'to eat up'.

(34) Lexical sign for *sjest'* 'to eat up'

```
┌                                                                        ┐
│ PHON    sjest'                                                         │
│                                                                        │
│ SYN ┌ HEAD ┌ verb   ┐                                        ┐         │
│     │      │ TOT [3] │                                        │         │
│     │      └        ┘                                         │         │
│     │                                                        │         │
│     └ SUBCAT  <[1]NP, [2][NP[TOT [3]] ]>                     ┘         │
│                                                                        │
│ SEM ┌ θ-ROLE  < e, [1]AGT_i, [2][INC-TH[TOT [3]] ]_j >                 │
│     │                                                                  │
│     │ CONTENT ┌ psoa ┌ e-type   incremental ┐                ┐         │
│     │         │      └ aspect   [TOT [3]+]   ┘                │         │
│     │         │                                              │         │
│     │         │ PRED ┌ REL     eat ┐                         │         │
│     │         │      │ EATER   i   │                         │         │
│     │         └      └ EATEE   j   ┘                         ┘         │
│                                                                        │
│ CONTX [ ... ]                                                          │
└                                                                        ┘
```
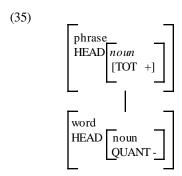
(34) differs from the lexical entry for the English verb *eat* in that it has a specification for its inherent grammatical aspect type as one of the values of the 'psoa' feature. The feature specification '[TOT +]' here encodes the perfective aspect of the verb. For the perfective verb *sjest'* 'to eat up' it is required that the verb and its Incremental Theme argument both have the same value '+' for the TOT feature, indicated by the tag '[3]'. This reflects the semantic proposal I made elsewhere (see the [34]'Incremental Theme Hypothesis' in Filip, 1992, 1993/99) that aspectual operators are linked to both the Incremental Theme and event argument, which means that they bind variables filling the corresponding argument positions and the lexical fillers of the argument positions provide the descriptive content. This has the effect of aspectual operators simultaneously quantifying over (parts of) an object (denoted by the Incremental Theme noun phrase) and (parts of) an event[35]. In the scope of the perfective operator *TOT*, the Incremental Theme noun phrase is interpreted as meaning approximately *all the* x, *the whole of* x, provided there are no other quantificational elements present in a sentence.

Individual nouns are specified only with respect to quantization, but not with respect to the attribute 'TOT', hence they do not match the '[TOT +]' requirement imposed on the Incremental Theme argument by a perfective verb. They acquire this feature specification from a perfective verb when they are integrated into a perfective construction that combines a perfective verb with a noun phrase that satisfies its Incremental Theme argument requirement. The result of this integration is a 'two-story construction' (35) (following some independent proposals in Fillmore and Kay, 1991).

---

[34]In Filip (1999:226) it is fomulated as follows: "Incremental Theme Hypothesis: aspectual operators and morphological V-operators function as quantifiers over episodic predicates and their arguments. They bind the variable introduced by the Incremental Theme argument. If there is no Incremental Theme argument, quantification is directed at the event variable alone; if there is neither, quantification is undefined."

[35]The idea that certain quantifiers can simultaneously quantify over individuals and events can be found in Lasersohn (1990, 1995, 1998). He proposes that the distributivity operator does not just involve quantification over individuals, but rather it quantifies simultaneously over the members of a group and parts of an event.

(35)

$$\begin{bmatrix} phrase \\ HEAD \begin{bmatrix} noun \\ [TOT \ +] \end{bmatrix} \end{bmatrix}$$

$$|$$

$$\begin{bmatrix} word \\ HEAD \begin{bmatrix} noun \\ QUANT \ \text{-} \end{bmatrix} \end{bmatrix}$$

(35) 'derives' a quantized noun phrase from a mass or plural noun. That is, it takes a mass or a plural noun as its argument and yields a noun phrase marked in its external structure with the feature specification [TOT +]. Any constituent with the feature structure [TOT +] must be also quantized, that is, specified as [QUANT +]. This is captured by a general feature co-occurrence restriction: [TOT +] → [QUANT +]. (Recall that a predicate denoting an entity in its entirety, as a totality of some stuff or plural individual, must be quantized, as entities represented in their entirety must be also conceived as having boundaries.) Mass and plural nouns are inherently cumulative and marked with the feature specification '[QUANT -]' in their lexical entries. The feature specification [QUANT -] of the input mass and plural nouns is retained in the internal structure of the 'two-story' noun phrase construction. In other words, we distinguish between 'inherent (lexical) feature specifications' and 'structural feature specifications'. 'Inherent (lexical) feature specifications' are feature specifications that lexical items are assigned in their lexical entries. 'Structural feature specifications' are feature specifications that constituents inherit from constructions whose argument slots they fill.

The feature structures given in (34) and (35) contain no information about the (in)definiteness of noun phrases. The definite-indefinite distinction is independent of the quantized-cumulative distinction, unlike in Krifka's system. There is just one lexeme for each (non-ambiguous) mass and plural noun, completely unspecified for (in)definiteness. All information relevant to the (in)definite interpretation of noun phrases comes from verbal forms, sentential and discourse context.

The 'two-story' construction in (35), in which we distinguish between internal (input) constraints and external constraints, can be thought of as the constraint-based correlate of a semantic type-shifting operation that shifts mass and plural interpretations of nouns to the interpretation of 'the totality of the individual (portion or plurality), or the maximal individual, that falls under the denotation of a noun'. This operation forms semantically singular predicates out of semantically mass and plural predicates and it is lexically required for undetermined plural and mass noun phrases that are linked to the Incremental Theme role and function as arguments of perfective verbs. That the perfective operator is linked to the variable introduced by the Incremental Theme argument, and not by some other nominal argument, can be shown by Czech examples in (36):

(36) a. Napsal^P dopisy (inkoustem). **Czech**
  COMPL.write.PAST letter.PL.ACC (ink.SG.INSTR)
  'He wrote the letters (in ink).'

b. Napsal^P   VSECHNY   dopisy   (inkoustem).
COMPL.write.PAST   ALL   letter.PL.ACC (ink.SG.INSTR)
'He wrote all the letters (in ink).'

c. Napsal ^P   dopisy   (??VSÍM   inkoustem).
COMPL.write.PAST   letter.PL.ACC (??ALL   ink.SG.INSTR)
'He wrote the/some letters (??with all the ink).'

d. Vypsal^P   (na dopisech)   VSECHEN   inkoust.
COMPL.write.PAST   (on letter.PL.LOC) ALL   ink.SG.ACC
'He used up all the ink (to write the letters).'

(36a) entails (36b). However, (36a) does not entail that the Agent used all the ink to write the letters. In fact, the optional instrumental complement cannot be modified with the determiner quantifier 'all', as (36c) shows. In order to express that all the ink was used to write the letters, we would have to use a different prefixed verb, namely *vypsat* with the meaning 'to use x completely up by writing with it' that takes as its direct object (Incremental Theme) the optional instrumental complement of the simplex verb *psát* 'to write', 'to be writing', as (36d) shows.

Although the effect of the perfective operator on the meaning of Incremental Theme noun phrases has been compared here to the effect of the universal quantifier like *all*, undetermined mass and plural noun phrases in the scope of the perfective operator do not have all the quantities of stuff and all the individuals that there are in their denotation. For example, (36a) means that *some contextually specified totality* of letters was subjected to the denoted event. Similarly, for undetermined mass noun phrases in the scope of perfective aspect, such as čaj 'tea' in (7a), the reference is to some maximal portion of tea in the domain of discourse. One way to analyze this is to propose that the totality of letters or tea referred to here is the maximal or largest individual that falls under the denotation of 'letters' or 'tea'. Such affinities between the perfective semantics and notions like totalities of plural individuals and totalities of portions of stuff make Link's (1983, 1987) lattice-theoretic logic of plurals and mass terms particularly suitable for the description of the Slavic data. Such notions are closely related to clearly quantificational meanings, such as those expressed by determiner quantifiers that are insensitive to the count-mass distinction. We can capture the semantic effects of the perfective operator on the semantics of undetermined mass and plural Incremental Theme noun phrases with the sigma operator σ, introduced by Link (1983):

(37) $[\![$ čaj $]\!]$ $= \sigma x[\mathbf{tea'}(x)]$ '(all) the tea'
        $[\![$ dopisy $]\!]$ $= \sigma x[\mathbf{letters'}(x)]$ '(all) the letters'

Sigma terms are the suprema of the extensions of the predicates in question, the supremum operation applies uniformly to atomic and non-atomic structures, that is, the denotation domains of plural and mass nouns, respectively. In a complete lattice structure, there is a supremum for any set of entities. The supremum (called sup_U) of a non-empty subset of U (the universe of discourse) is its least upper bound: e.g., $[\![$ čaj $]\!]$ = $sup_U(\{x | x \in [\![$ tea $]\!]\})$, $[\![$ dopisy $]\!]$ = $sup_U(\{x | x \in [\![$ letters $]\!]\})$, for example. This guarantees that for every x and y in U, there is an element $x \oplus y$ in U, the least upper bound of $\{x,y\}$. The least upper bound is unique. Hence, the σ operator can be used to interpret definite individual terms.
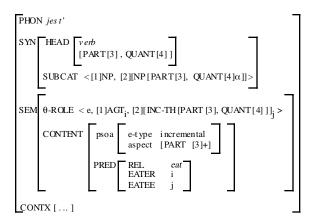
We can treat Link's σ operator as a type-shifting operator whose effect is comparable to the iota operator in Partee (1987). (See also Bittner and Hale, 1995, for a similar proposal.) It

combines with a common noun whose basic meaning is of the predicative type $<e,t>$ and yields an individual term of type e. The sigma operator cannot be applied to proper names, pronouns, demonstratives and various indexicals, which are of the individual type e. Such a type-shifting operation is independently motivated, if we assume that undetermined noun phrases with common noun heads in Slavic languages are of type $<e,t>$. Since this type is excluded in referential positions, we need a type-shifting operation to raise it to type e or to type $<<e,t>,t>$ (cf. Partee, Bach, Kratzer, 1987:18-19). There are four operations available for Slavic languages like Czech, Russian and Polish in Partee's (1987) inventory: *A, THE, nom* and *iota*. All four operations are available, provided a particular type-shifting operation is not lexically required or excluded for independent reasons.

What needs to be yet resolved is the problem of preventing the sigma operator from applying to singular count noun phrases. If the Incremental Theme noun phrase is inherently quantized, the whole noun phrase and its head have the feature specification '[QUANT +]'. The Incremental Theme noun phrase inherits the feature specification '[TOT +]' when it is integrated into a sentence as an argument of a perfective verb. However, it is not necessarily interpreted as a definite noun phrase[36]:

(38) Ivan   sjel^P jábloko.   **Russian**
      Ivan   eat.PAST   apple.SG.ACC
      'Ivan ate (up) (all) the apple / a whole apple.'

The feature specification that encodes the aspectual contribution of imperfective verbs to the meaning of sentences, is given as '[PART +]' in the lexical entries of imperfective verbs, as in (39) for *jest'* 'to eat', 'to be eating'.

(39) Lexical sign for *jest'* 'to eat', 'to be eating'

```
PHON jest'
SYN  HEAD  verb
           [PART [3], QUANT [4] ]

     SUBCAT  <[1]NP, [2][NP[PART[3], QUANT[4]α]]>

SEM  θ-ROLE  < e, [1]AGT_i, [2][INC-TH[PART[3], QUANT[4]]]_j >

     CONTENT  psoa  e-type  incremental
                    aspect  [PART [3]+]

              PRED  REL     eat
                    EATER   i
                    EATEE   j

CONTX [ ... ]
```

The semantic correspondent of the [PART +] feature structure is the part relation *PART*, understood as '≤'. A verbal predicate marked as [PART +] can be [QUANT +] or [QUANT -]. The assignment of the determinate value to the feature attribute 'QUANT' of a complex verbal predicate depends on the value of the feature attribute QUANT assigned to the noun phrase that functions as the Incremental Theme argument ([QUANT [4]α]). The value sharing for the QUANT feature attribute has as its semantic correlate the principle of aspectual composition given in (5). In addition, in the lexical entry for the Russian imperfective verb *jest'* 'to eat', 'to be eating', given in (39), it is required that the verb and the noun phrase that is co-indexed with the Incremental Theme argument and the Incremental Theme argument itself have the same value for the PART feature. Similarly as in the case of the perfective operator, this reflects the assumption that aspectual operators are linked to both the Incremental Theme and event argument (see the 'Incremental Theme Hypothesis', Filip, 1992, 1993/99). Hence, in the scope of the imperfective operator the Incremental Theme noun phrase will have the partitive interpretation in the sense of the part relation '≤', in addition to being either quantized or cumulative.

Given that imperfective verb forms can be used with a variety of contextually-determined readings, the interpretation of Incremental Theme noun phrases varies in dependence on the particular reading of a given imperfective verb form. For example, if a given imperfective sentence has a progressive use, the imperfective operator will be interpreted in terms of a proper part relation, and consequently the Incremental Theme noun phrase as well, meaning approximately *part of* x, *some (but not all of)* x.

5   Extension to other languages

One way of organizing the large variety of means for the expression of grammatical aspect (perfective, imperfective) is to divide them into two main groups: verb-centered and noun-centered:

(40)   <u>primary expression of aspect   example language</u>

verb-centered and syntactic	English
verb-centered and morphological	Russian
noun-centered and syntactic	German
noun-centered and morphological	Finnish

Given that the category of 'grammatical aspect' concerns semantic distinctions in the domain of eventualities it is most naturally encoded by individual verb roots or stems (e.g., Slavic languages), by inflectional morphemes on the verb (e.g., Romance languages), or by special function morphemes within a periphrastic verbal construction (e.g., English). In Finnish and German an encoding system that is primarily designed for the expression of the partitivity and totality relations in the domain of individuals is exploited to convey information about whether a sentence denotes completed events or incomplete/partial eventualities, which are distinctions proposed here for the semantic interpretation of grammatical aspect. In Finnish, the partitive and accusative inflectional suffixes on nouns can have the semantic effects of the functions posited for perfective and imperfective aspectual operators in Slavic languages (see also Tommola, 1990; Kiparsky, 1998, and others). In German, a partitive prepositional phrase contributes the proper part relation to the meaning of a sentence, and in this respect it is comparable to the contribution of the progressive operator in English. In German and Finnish, the aspectually relevant nouns and

the partitive prepositional phrase are also specified with respect to the quantized-cumulative distinction, which concerns lexical aspect, quantized and cumulative.
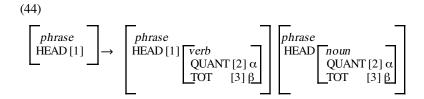
The Finnish case is illustrated by examples in (41). (The exposition of the Finnish data is mainly based on Karlsson (1983:94), Dahl and Karlsson (1976:11), and Tommola (1990:361).)

(41) a. Join   kahvin.   Luin   kirjat.   **Finnish**
          drank.1SG   coffee.SG.ACC   read.1SG book.PL.ACC
          'I drank up (all) the coffee.'   'I read (all) the books.'

      b. Join   kahvia.   Luin   kirjoja.
          drank.1SG   coffee.SG.PART   read.1SG book.PL.PART
          (i) 'I drank coffee.'   'I read books.'
          (ii) 'I was drinking coffee.'   'I was reading books.'

The accusative suffix on a noun indicates that the reference is to the maximal individual that falls under the denotation of the noun in question, and also that the noun phrase headed by such a noun may have a definite reference. From this it also follows that an accusative-marked noun phrases are quantized. In (41a), the accusative-marked mass and plural noun phrases denote the maximal quantity of stuff ('(all) the coffee') and the maximal plurality of individuals ('(all) the books'), respectively. Since the accusative case-marked noun phrases are here linked to the Incremental Theme role, they add the totality condition to the meaning of a base verbal predicate so that the output predicate denotes completed events, that is, it has denotations that are similar to those of perfective predicates in Slavic languages, for example. The expression of perfectivity in Finnish and in Slavic languages functionally overlaps in one important respect: Finnish and Slavic sentences with a 'perfective' (i.e., totality) meaning and a present tense main verb have a future time reference (under a single event interpretation). Finnish has no grammatical future tense, and "the non-past form needs a marker elsewhere, usually in the object case marking" (Toivainen, 1991:5).

A noun case-marked with the partitive expresses an indefinite, non-delimited quantity of some stuff (with mass nouns) and of a plural individual (with plurals), or a part of a delimited object (with quantized nouns). In (41b), the partitive-marked noun phrases are linked to the Incremental Theme role, and they yield complex verbal predicates that bear close semantic affinities to imperfective predicates in Slavic languages: namely, they can be used to denote incomplete/partial events, to assert that an eventuality of a certain type took place, and they can be even used in contexts in which it is clear that the denoted event was completed (see also Kiparsky, 1998, ex. (10)). A simplified unification schema for Finnish is given in (44):

(44)

$$
\begin{bmatrix} phrase \\ \text{HEAD}\,[1] \end{bmatrix} \rightarrow \begin{bmatrix} phrase \\ \text{HEAD}\,[1] \begin{bmatrix} verb \\ \text{QUANT}\,[2]\,\alpha \\ \text{TOT}\quad[3]\,\beta \end{bmatrix} \end{bmatrix} \begin{bmatrix} phrase \\ \text{HEAD} \begin{bmatrix} noun \\ \text{QUANT}\,[2]\,\alpha \\ \text{TOT}\quad[3]\,\beta \end{bmatrix} \end{bmatrix}
$$

The value variable β of the feature attribute TOT is the positive value '+' if the Incremental Theme noun phrase is accusative-case marked and it is '[ ]' if it is partitive-case marked. This is motivated by the observation that the accusative is the marked member in the accusative-partitive alternation, because sentences with an accusative case-marked Incremental Theme noun phrase are restricted to denote completed events. In contrast, sentences with a partitive-marked Incremental

Theme noun phrase have a range of contextually determined interpretations, and therefore, the partitive is unmarked in the accusative-partitive alternation. The feature specification [TOT [ ]] can be combined with either [QUANT +] or [QUANT -], depending on the inherent quantization properties of its head noun, while [TOT +] only co-occurs with the feature specification [QUANT +]. The feature specification [TOT +] associated with the accusative Incremental noun phrase must match with the positive values of the attributes [QUANT +] of the Incremental Theme noun phrase, the verb phrase and the whole sentence. This is due to the feature co-occurrence restriction [TOT +] → [QUANT +]. (See also section 4.3.)

Since the Finnish case marking that has the effect of aspectual operators is restricted to sentences that denote incremental eventualities, it has a much narrower range than the Slavic aspectual distinction 'perfective-imperfective' does. A further limitation on the expression of the category of 'grammatical aspect' in Finnish comes from the fact that there are contexts in which the opposition 'partitive-accusative' case is neutralized. For example, this is the case in negative sentences, as the object of a negative sentence is required to be in the partitive case. From the point of view of the interactions between noun phrases and verbal predicates, the Finnish examples in (41) are a converse case of the Slavic case, as illustrated by Russian examples in (7,8). In Slavic languages the aspectual operators, perfective and imperfective, encode the partitive and totality relations in the domain of eventualities and at the same time they are exploited to constrain the interpretation of Incremental Theme noun phrases. The information regarding partitive and totality relations also has consequences on the quantization and (in)definiteness properties of Incremental Theme noun phrases. As far as the expression of definiteness is concerned, we see that the functions that are ascribed to definite articles in English, for example, can be, to a certain extent, here taken over by the same devices that are used to convey information about whether a sentence denotes completed or total events. Perfective verbs in Slavic languages denote completed events and at the same time require the definite interpretation of mass and plurals linked to the Incremental Theme argument, while imperfective verbs impose no such restriction. In Finnish, the accusative case marking on a mass or plural noun in an undetermined noun phrase induces the definite interpretation of a whole noun phrase, and at the same time the accusative case-marked Incremental Theme noun phrase is used to in sentences denoting completed events. In sum, once an inherently cumulative noun phrase is assigned a totality interpretation, because it is in the accusative case (Finnish) or because it is an Incremental Theme argument of a perfective verb (Russian, Czech Polish), it is also interpreted as definite. It is important to emphasize that the necessary correlation of the totality interpretation with the definite interpretation does not apply either in Finnish and Slavic languages, if the relevant Incremental Theme noun phrase is quantized: if it is headed by a singular count noun, if it contains a determiner quantifier or a measure expression. It also does not necessarily apply if there are other quantificational elements in a sentence.

Le us now look at the German partitive *an*-construction, where *an* roughly corresponds to the English preposition 'on' or 'at'. German (42b) with the partitive *an* denotes an event that is a proper part of the event denoted by (42a) with the accusative direct object. (42a) conversationally implicates that the denoted event was completed, but it may also be used to express incomplete or partial events.

(42)   a. Alex   baute   ein   Haus.   **German**
                 Alex   built   a.SG.ACC   house
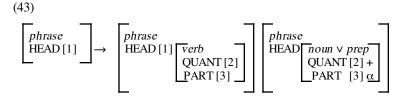   'Alex built a house.'

    b. Alex   baute   an   einem   Haus.
       Alex   built   on.PREP   a.SG.DAT house
      'Alex was building a house.'

In (42b) the partitive *an*-phrase linked to the Incremental Theme role refers to a proper part of the whole house denoted by the noun phrase 'a house' governed by the preposition *an*. Here, a proper part of the house is correlated with that proper part of the event during which it came into existence. Hence, the German *an*-construction serves to convey incomplete or partial events, but never completed events, and in this respect it is comparable to the English progressive construction.

The German construction with the partitive preposition *an* (lit.: 'on', 'at') is an illustration of a frequent cross-linguistic strategy to exploit various adverbial phrases with an originally locative origin for the expression of functions that are typically expressed by imperfective verb forms or function morphemes to map eventualities into their parts. As Comrie (1976:98ff., 103) observes, transpositions from space to time underlying various extensions of locative expressions to the expression of imperfectivity (and progressivity) are common across languages: cp. *on the table* and *on Friday*, *to be in the room* and *to be in the process of doing something.*

For German a simplified unification schema is given in (43):

(43)

$$
\begin{bmatrix} phrase \\ \text{HEAD}\,[1] \end{bmatrix} \rightarrow \begin{bmatrix} phrase \\ \text{HEAD}\,[1] \begin{bmatrix} verb \\ \text{QUANT}\,[2] \\ \text{PART}\,[3] \end{bmatrix} \end{bmatrix} \begin{bmatrix} phrase \\ \text{HEAD} \begin{bmatrix} noun \lor prep \\ \text{QUANT}\,[2]\,+ \\ \text{PART}\quad[3]\,\alpha \end{bmatrix} \end{bmatrix}
$$

The feature attribute PART has as its value the variable α that stands for the positive value '+', or the indeterminate value '[ ]'[37]. The positive value '+' is introduced by the Incremental Theme noun phrase realized as the partitive *an*-phrase, while the indeterminate value '[ ]' by the Incremental Theme noun phrase which is accusative-case marked. The reason is that the German construction with the partitive *an*-phrase linked to the Incremental Theme role is the marked member in the accusative-partitive opposition, as it serves to convey partial (or incomplete) events, and never completed events. The construction with the Incremental Theme noun phrase in the accusative case is aspectually unmarked, because it is instantiated by sentences that denote completed or incomplete/partial events, as we have seen in (42a). Just as the English progressive construction so does the German partitive *an*-construction only license episodic predicates that denote events with a certain temporal extent. In so far as the English progressive and the German partitive *an*-construction cannot be used to convey completed events, they are clearly distinguished from the Slavic imperfective aspect, the unmarked member in the aspectual opposition 'perfective-imperfective'. The German partitive *an*-construction is more restricted than the progressive construction in English and imperfective sentences in Slavic languages. In addition to the core

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[37]The indeterminate value '[ ]' is an empty feature structure, or a variable that subsumes "all other feature structures, atomic or complex, because, as the trivial case, they contain no information at all" (Shieber, 1986:15). According to Shieber (1986), the indeterminate value '[ ]' "can be viewed as being a non-monotonic device. That is, a system with ANY values can have an ill-formed functional structure become well-formed through further unifications. In this sense, ANY violates the spirit of declarativeness, although it does in such a weak way that we are willing to put up with it" (Shieber, 1986:44).

constraint, which involves the notion of 'partitivity', along with the concomitant constraint on the temporal extent of the event denoted by the base predicate (see also (29) above), the partitive *an*-construction involves four further constraints: (i) the base predicate is quantized; (ii) the base predicate satisfies the 'uniqueness of events' constraint (see Krifka, 1986, 1992), which ensures that there is only one event related to the object by the Incremental Theme relation; (iii) the Incremental Theme argument denotes a participant whose spatial *extent* or volume changes during the course of the event and whose *extent* is directly related to the temporal extent of the event; (iv) the subject is linked to the Agent thematic role. (For a detailed description of the constraints governing the German partitive *an*-construction see also Filip (1989, 1993/99.) The most important constraint here is the first one, because it motivates the feature specification '[QUANT +]' in the German unification schema (43). The partitive *an*-construction only licenses quantized based predicates, that is, predicates with quantized Incremental Theme noun phrases: cp. (a) *Paula strickte (die) Jacken* [Paula knitted (the) jacket.PL.ACC] 'Paula knitted (the) jackets', 'Paula was knitting (the) jackets' vs. (b) **Paula strickte an Jacken* [*Paula knitted on jacket.PL.DAT] *'Paula knitted on jackets' vs. (c) *Paula strickte an den Jacken* [Paula knitted on the jacket.PL.DAT] 'Paula was knitting (the) jackets'. The use of the definite article with the plural noun contributes to the definite and quantized reading of the whole noun phrase, hence the partitive sentence (c), but not (b), is well-formed. There is no constraint on the definiteness and quantization of the accusative direct object in (a).

In this section I focused on the expression of semantic functions posited here for the interpretation of perfective, imperfective, and progressive aspect by means of verbal arguments (direct and oblique) in Finnish and German. The unifying conditioning factor at play here is the requirement that the relevant verbal argument be linked to the Incremental Theme role. This requirement ties the Finnish and German cases to the interaction between Incremental Theme noun phrases and verbal predicates in English and Slavic languages. The advantage of the constraint-based description is that it allows us to provide a unified analysis for all the different types of interactions between noun (or prepositional) phrases and verbal predicates discussed here and highlight the similarities and differences among them. Categories of argument-marked grammatical aspect exhibit various degrees of similarity to categories of verb-marked grammatical aspect by virtue of satisfying (at least some of) the contributing properties that characterize the progressive and perfective prototypes given in (29) and (30) above. The differences in the mode of encoding between argument-marked and verb-marked grammatical aspect are correlated with substantive semantic differences. We have seen that categories of argument-marked grammatical aspect are clearly more constrained in their domain of application, semantics and the range of contextually determined uses than categories of verb-marked grammatical aspect. This could be perhaps seen in connection with the fact that the expression of semantic functions that characterize grammatical aspect by means of an overt marking on nominal arguments, direct or oblique (e.g., Finnish and German), is less typical than the expression of such functions by means of verbs (e.g., English and Slavic). What is significant is that the German partitive *an*-construction appears to be the most restricted in its semantics and domain of application among the devices discussed here. In terms of the typicality of expressions of semantic distinctions that characterize the categories of 'grammatical aspect', it could be tentatively proposed that morphological verb-marked aspect as in Slavic or in English ranks the highest and constructional syntactic means with some marking by means of oblique prepositional phrases rank the lowest.

6 Concluding remarks

The typologically distinct Indo-European languages discussed here (i.e., Slavic, English, German) and Finnish manifest different types of interaction between noun phrases and verbal predicates in the domain of lexical and grammatical aspect. The interactions differ across languages depending on the way in which each language preferably encodes the semantic distinctions relevant to lexical and grammatical aspect: namely, quantization vs. cumulativity and partitivity vs. totality, respectively. Despite these differences, and a different clustering of typical properties and conceptual organization associated with each mode of encoding, we observe that the same general constraints govern such interactions. In the most straightforward cases, such interactions are semantically motivated: it is the verbal argument linked to the Incremental Theme role that interacts with the aspectual semantics of verbs, verb phrases and sentences. Through the Incremental Theme argument the rules that govern such interactions point to the same fragment of conceptual structure, which may be labeled 'incremental eventuality type'. It involves a participant, realized as the Incremental Theme argument, which undergoes a change in successive stages, and through this change it is intrinsically tied to the temporal extent of the event. The incremental eventuality type represents one cross-linguistic schematization, one common conventional way in which languages conceptualize the structure of various states of affairs in the world.

This strongly suggests that it cannot be a matter of co-incidence that languages converge on the same constraints, but rather a matter of common parallels and interactions between the denotational domains of verbal and nominal predicates that are pervasive in natural languages. Here, the relevant denotational properties of nominal and verbal predicates are analyzed in terms of the mereological 'part' structure, and modelled algebraically as join complete semi-lattices. The interactions between them are represented by establishing homomorphic mapping relations between their part structures. Further investigations of the regularities that govern such parallels and interactions between nominal and verbal predicates will reveal more insights into the semantic differences underlying the verb-noun distinction and its relation to the ontology of individuals and eventualities.

One direction for future research is to relate the interactions between noun phrases and verbal predicates to the general theory of quantification and semantic typology. In this domain we observe significant parallels between quantificational notions that are expressed by determiner quantifiers within noun phrases (*all, some*), or D-quantifiers, and by various elements outside of the NP (such as verbal affixes, auxiliaries, and adverbials), or A-quantifiers (see Partee, Bach and Kratzer, 1987; Bach et al., 1995). In languages with a rich verbal morphology we can find verbal affixes that not only have morphological, syntactic, and semantic effects on the argument structure of the verb to which they are applied, but they also provide certain noun phrases with quantificational force. Slavic languages have verbal prefixes of this type, and other examples are verbal affixes in aboriginal languages of Australia, Warlpiri (Hale, 1989) and Mayali (Evans, 1995), and affixes on agreement verbs and classifiers within the verbs of motion and location in American Sign Language (Petronio, 1995).

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Appendix

(1) Definition of a part structure P (Krifka, 1998:199):

$P = \langle U_P, \oplus_P, \leq_P, <_P, \otimes_P \rangle$ is a part structure, iff

a. 'U_P' is a set of entities, individuals, eventualities and times: $I_P \cup E_P \cup T_P \subset U_P$
b. '$\oplus_P$' is a binary **sum operation**, it is a function from $U_P \times U_P$ to U_P.
   (It is idempotent, commutative, associative.)
c. '$\leq_P$' is the **part relation**: $\forall x,y \in U_P \; [x \leq_P y \leftrightarrow x \oplus_P y = y]$
d. '$<_P$' is the **proper part relation**: $\forall x,y \in U_P \; [x <_P y \leftrightarrow x \leq_P y \wedge x \neq y]$
e. '$\otimes_P$' is the **overlap relation**: $\forall x,y,z \in U_P \; [x \otimes_P y \leftrightarrow \exists z \in U_P [z \leq_P x \wedge z \leq_P y]]$
f. **remainder principle**: $\forall x,y,z \in U_P \; [x <_P y \rightarrow \exists! z [\neg\, [z \otimes_P x] \wedge z \oplus_P x = y \,]]$

(2) Definition of the 'Gradual Patient' thematic role (Krifka, 1986, 1989, 1992):
$\forall P \; [\text{GRAD}(P) \leftrightarrow \text{UNI-O}(P) \wedge \text{MAP-O}(P) \wedge \text{MAP-E}(P)]$

a. Mapping to objects
   $\forall R [\text{MAP-O}(R) \leftrightarrow \forall e, e', x \; [R(e, x) \wedge e' \leq e \rightarrow \exists x'[x' \leq x \wedge R(e', x')]]]$
   [Example: *drink a glass of winee;* every part of a drinking of a glass of wine
   corresponds to a proper portion of the glass of wine]

b. Mapping to events
   $\forall R [\text{MAP-E}(R) \leftrightarrow \forall e, x, x' \; [R(e, x) \wedge x' \leq x \rightarrow \exists e'[e' \leq e \wedge R(e', x')]]]$
   [Example: *drink a glass of wine*; every proper portion of the glass of wine that is
   drunk corresponds to a part of the drinking]

c. Uniqueness of objects
   $\forall R [\text{UNI-O}(R) \leftrightarrow \forall e, x, x' \; [R(e, x) \wedge R(e, x') \rightarrow x = x']]$
   [Example: *drink a glass of wine;* it is not possible for one event to have two different
   object tokens, x = x', subjected to it]

Krifka (1998) argues that we need stricter relations than mapping to events and mapping to objects, namely mapping to subevents and mapping to subobjects. The latter are defined as follows (Krifka, 1998:211-212):

a'. Mapping to subobjects
   $\forall x \in U_P \; \forall e, e' \in U_E \; [\theta(x,e) \wedge e' <_E e \rightarrow \exists y[y <_P x \wedge \theta(y,e')]]$

b'. Mapping to subevents
   $\forall x,y \in U_P \; \forall e \in U_E \; [\theta(x,e) \wedge y <_P x \rightarrow \exists e'[e' <_E e \wedge \theta(y,e')]]$