Lexical Aspect (Aktionsart)

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1 Introduction: lexical aspect and aspectual classes

Lexical aspect concerns the classification of *verbs*, taken as lexical items, into *aspectual classes*. The lexical aspectual class of a verb is commonly taken to be "the Aristotelian class to which the basic verb belongs" (Dowty 1979, 52). "Aristotelian class" here refers to the type of semantic category with origins in the tradition of the philosophy of action and mind in the mid-twentieth century which takes its roots from Aristotle, and was introduced into linguistics by Dowty (1979). Apart from Ryle (1949) and Kenny (1963), the most profound impact on linguistics has come from Vendler's (1957) four-way classification into *states*, *activities*, *accomplishments*, and *achievements*, largely thanks to its adaptation in Dowty (1972; 1977; 1979 and elsewhere):

(1) *Vendler's (1957) aspectual classes*
States: *know*, *believe*, *desire*, *want*, *love*, *hate*, *(dis)like*, *rule*, *dominate*.
Activities: *run*, *walk*, *swim*, *pull*, *push (a cart)*.
Achievements: *recognize*, *realize*, *spot*, *identify*, *lose*, *find*, *reach (the summit)*, *find*, *win (the race)*, *cross the border*, *start/stop/resume*, *be born/die*.
Accomplishments: *run a mile*, *paint a picture*, *make a chair*, *build a house*, *write/read a novel*, *deliver a sermon*, *give/attend a class*, *play a game of chess*, *grow up*, *recover from illness*.

Subsequent broadening of the empirical scope to non-agentive verbs and data from other languages than English, as well as the rise of event semantics in the early 1980s, led to an alternative tripartite agentivity-neutral classification into *states*, *processes*, and *events* (Taylor 1977; Mourelatos 1978; Bach 1981; 1986; Krifka 1986; 1989; Parsons 1990), and also its refinements in terms of further subdivisions proposed by Bach (1986):

(2) *Bach's (1986) aspectual classes*
States: (i) static: *be drunk*, *be in New York*, *own x*, *love x*, *resemble x*
(ii) dynamic: *sit*, *stand*, *lie*+LOC
Processes: *walk*, *push a cart*, *be mean* (agentive)
Events: (i) protracted: *build x*, *walk to Boston*
(ii) momentaneous: (a) culminations: *die*, *reach the top*
(b) happenings: *recognize*, *notice*, *flash once*

Events subsume accomplishments and achievements, and the latter class is divided into culminations and happenings, which include *semelfactives* like *flash (once)*. However, Smith (1991), among others, treats semelfactives as an aspectual class *sui generis*, rather than as a subcategory of some other aspectual class (see further below).

The mereological enrichments of event semantics raised attention to similarities between aspectual classes and the semantics of the count/mass distinction (see Taylor 1977 for early observations in the philosophical (Aristotelian) tradition), which Bach (1986) captures in terms of the following analogy: events :

processes = things : stuff. This analogy highlights a fundamental line between verbal predicates that entail some limit(s), and are, therefore, straightforwardly acceptable in counting constructions (Mourelatos 1978), on the one hand, and (dynamic) verbal predicates that lack this entailment, on the other hand. This basic distinction among verbal predicates is taken to coincide with the *telic/atelic* distinction coined by Garey (1957).

The classification into aspectual classes concerns verbs taken as lexical items, but also VPs (the level of "inner aspect," Travis 1991), as the paradigm examples given in the taxonomies above show, and even sentences,[1] according to some at least. However, the notion of *lexical aspect*, strictly speaking, only concerns the aspectual class of verbs taken as *lexical items*. Although we often find statements like "*compose a symphony* is a lexical accomplishment," it makes no sense to speak of the "lexical aspect" of a VP, let alone of the "lexical aspect" of a sentence.

Aspectual classes are covert semantic categories which are manifested in different ways across the grammars of different languages. They are systematically correlated with certain empirical (grammatical) properties that are tendentially universal. The properties have to do with the way in which the aspectual classes interact (i) with grammatical aspect (perfective, imperfective, progressive, etc.), and possibly also other categories of the Tense–Mood–Aspect system; (ii) with their differential co-occurrence patterns with temporal adverbials, adverbs of quantification; as well as (iii) with various expressions of quantity, counting and measurement. Aspectual classes also interact with the grammar of distributivity, plurality (pluractionality, iterativity), and genericity.

For tapping into these empirical (grammatical) properties, we have sets of diagnostic tests, which differ across languages, however. Dowty (1979, 55–62) gives a detailed summary of the relevant tests for English. As many have observed (Dowty 1979; Parsons 1990; among others), the tests do not converge on coherent Aristotelian aspectual classes, but identify overlapping clusters which merely distinguish subsets of such classes or supersets. The reason for this is that the tests pick up certain aspectually relevant properties which may recur in the characterization of more than just one aspectual class, such as terminal point (or limit, goal, result), punctuality, duration, dynamicity (or stages).

The lexical aspect of a verb plays a key role in its lexical semantic representation, and contributes to the representation of systematic relations among the lexical semantic classes of verbs. The lexical aspect is, therefore, tied to theories of the interface between lexical semantics and syntax, and specifically also to the theory of thematic roles and argument realization. Among the main tasks of a theory of *lexical aspectual classes* is then to answer the following basic questions:

i. What are the aspectually relevant semantic properties lexicalized in (root) verbs? What are the relations among them (e.g., partial orders, (privative) feature systems), how do they induce taxonomies of aspectual classes, and what do they indicate about the relationships among aspectual classes? How are the aspectually relevant semantic properties lexicalized in (root)

verbs related to other semantic properties of verbs which are also grammatically relevant (e.g., agentivity, causation, manner of motion, incipient state)?

ii. What is the relation between the lexical aspectual class of a V and the aspectual class of a larger linguistic unit into which it is integrated?

Bach (2005) suggests that the aspectual classification into events, processes, and states is "probably universal." This idea is discussed in von Fintel and Matthewson (2008) in connection with potential semantic universals. They propose that there might be a set of universal building blocks from which language-specific aspectual classes are built. This raises the following set of questions:

iii. Is there one universal set of aspectual classes? Or, is there one set of universal aspectually relevant semantic properties from which language-specific aspectual classes are derived? If so, what are the constraints on admissible clusters of aspectually relevant semantic properties that characterize the range of lexical aspectual classes in natural languages?

This chapter will survey some of the most salient approaches to lexical aspect, and along the way also suggest some answers to the above questions, following the suggestions in the surveyed studies.

2 The four aspectual classes in Vendler (1957)

Vendler (1957, 44) argues that the source of aspectual classes lies in "the most common time schemata implied by the use of English verbs," and it is his main goal to identify and empirically motivate them. Immediately, we need to clarify that Vendler's aspectual classes are not properties of just surface verbs, contrary to his explicit claim, but also of VPs, which he does not explicitly acknowledge, even if all his examples of accomplishments are VPs (e.g., *run a mile*, *draw a circle*, *paint a picture*, *make a chair*, *build a house*, *write a novel*, *read a novel*).

Vendler (1957, 149) identifies four time schemata, which, in a nutshell, are as follows: accomplishments and activities, which are temporally extended and predicated of *periods of time*, but only accomplishments require that such time periods be unique and definite. States and achievements hold at *time instants*, but only achievements require that they be unique and definite. However, as Vendler also observes, the time schemata alone do not motivate his four aspectual classes, but rather they are to be viewed as abstractions over clusters of fine-grained distributional and semantic properties that distinguish among his classes.

As a point of departure, Vendler (1957) introduces two distributional properties, which, according to him, are sufficient to distinguish his four aspectual classes: namely, compatibility with progressive and with durative adverbials like *for*-adverbials.

(3)	Vendler's aspectual classes	PROG	durative ADV (e.g., *for*-adverbials)
	ACTIVITY	+	+
	ACCOMPLISHMENT	+	−
	ACHIEVEMENT	−	−
	STATE	−	+

Compatibility with the progressive is correlated with the aspectual property [+successive phases], which is a combination of [+durativity] and [+change-of-state] (any change of state whatsoever, i.e., dynamicity), while compatibility with *for*-adverbials is correlated with [+durativity] ("lasting for a period of time" in Vendler's terms) and also [−terminus], that is, the lack of the terminus entailment. In what follows, let us examine these correlations in more detail.

According to Vendler (1957), compatibility with the progressive is a characteristic grammatical property of activity and accomplishment predicates, because they describe situations "going on in time, i.e., roughly … consist[ing] of successive phases following one another in time" (Vendler 1957, 144), that is, they describe *dynamic* situations holding over extended intervals. It is Vendler's first test that treats activities and accomplishments as one natural class and fundamentally separates them from achievements and states. At first blush, this would seem to make sense given that intuitively the main function of PROG(P) is to refer to a (non-final) part or phase of an eventuality in P at some reference time *t* (time point or interval). And so implicit in Vendler's reasoning is the idea that achievements and states denote eventualities that have no successive phases, therefore, PROG should not apply to them. This idea appears confirmed by the following examples, where "#" means that the sentence is unacceptable (following Rothstein 2004, 42), "peculiar if not ungrammatical or 'unsemantic'" (Bach 1981, 77, who marks such sentences with "?"):

(4) a. Kim was running. — activity
b. Kim was assembling an Ikea desk. — accomplishment
c. # Bill is noticing that Mary has dyed her hair. — achievement
(Rothstein 2004, 42)
d. # John is believing that the earth is flat. — state
(Bach 1981, 77)

Vendler (1957) is right in recognizing that acceptability in the progressive does not divide verbal predicates into two clearly disjoint groups: namely, non-state (dynamic) predicates that occur in the progressive and state predicates that do not. However, his claim that achievements and states are uniformly unacceptable in the progressive has been criticized, as virtually all have at least some felicitous uses in the progressive (Mourelatos 1978; Vlach 1981; Bach 1981; Zucchi 1998; among others) (see further below). The important insight gained from such data is that achievements are more heterogeneous than Vendler (1957) assumed and many still take for granted. States constitute the most puzzling and challenging class, which is also evident in Vendler's (1957) insightful discussion of states in section III of his paper. Dowty (1979, section 3.8.2) discusses one of their subclasses, namely

sit-stand-lie verbs, bringing forth some of the nearly intractable properties of states. (Nevertheless, states commonly serve as the basic building blocks in decompositional analyses of aspectual classes, following Dowty (1979) who takes them to be "aspectually simple and unproblematic" (Dowty 1979, 71).) The varied interactions of the progressive with states and achievements raise the question about their delimitation from processes (activities) and accomplishments, respectively.

The second test, straightforward compatibility with durative adverbials, such as *for*-adverbials, is correlated with both [+durativity] and [−terminus], and is used to separate activities from accomplishments:

(5) a. Sam {ran | pushed the cart} for half an hour. activity
b. Sam {drew a circle | ran a mile} #for half an hour. accomplishment

"#" above means that accomplishments are unacceptable with durative adverbials, barring meaning shifts in appropriate contexts: for example, *Sam drew a circle very slowly and with great care, bit by bit for 10 minutes, but still did not manage to draw a nice symmetric round shape*.

Activity predicates do not lexically specify a terminus, an end point of some sort, which Vendler seems to correlate with their temporal property of holding over intervals that are "not unique or definite" (Vendler 1957, 149), and with "homogeneity": namely, they "go on for a time," "in a homogeneous way; any part of the process is of the same nature as the whole" (Vendler 1957, 146). In temporal logic, this inspired the proposal that activity predicates are true at any subinterval and at any moment of an interval at which they hold, which is now disputed (see further below).

In contrast, accomplishments, unlike activities, describe situations which consist of successive phases none of which "is of the same nature as the whole." For instance, if it took Sam 10 minutes to draw a circle, he did not draw it within the first 5 minutes. The reason for this is that accomplishments describe eventualities that "proceed toward a terminus which is logically necessary to their being what they are" (Vendler 1957, 146). *Draw a circle* describes a situation that takes a certain time, delimited by a change in the size of the circle as it gradually comes into existence until it is completely drawn. Its successive phases, therefore, cannot be alike and no proper part of a whole event of drawing a circle is of the same nature as that whole event. The terminus entailment of accomplishments is what seems to make their associated intervals "unique and definite" (Vendler 1957, 149), and motivates their direct modification by means of time-span adverbials, such as temporal *in*-adverbials (Vendler 1957, 145), as we see below.

(6) a. Sam {drew a circle | ran a mile} in 10 minutes. accomplishment
b. Sam {ran | pushed the cart} #in 10 minutes. activity

The interpretation of temporal *in*-adverbials that is relevant for the accomplishment test concerns the measure of entire events in their denotation, that is, the time within which the terminus was reached from some (implicit) onset.

The interpretation of temporal *in*-adverbials that is irrelevant for this test is the inchoative one meaning "starting *after* x-time from now or some given reference point" (see also Vendler 1957, 147). Under this interpretation, also activity predicates are acceptable with *in* adverbials, provided they first undergo a shift into the inchoative interpretation of roughly "start ϕ-ing/to ϕ," with the *in*-adverbial measuring the time until the onset of the described eventuality from some reference point. Of course, *in*-adverbials may also modify state and achievement predicates and indicate the onset of eventualities (from some understood reference point): for example, *Sally knew the answer in 5 seconds*, *Alice won the race in 5 minutes*.

Turning to states and achievements, these, according to Vendler, are uniformly unacceptable in the progressive, but differ in so far as "achievements occur at a single moment, while states last for a period of time" (Vendler 1957, 147). This semantic difference motivates the observation that only states can be straightforwardly modified with durative adverbials, such as a *for*-adverbial or *until I was 7* (Vendler 1957, 147):

(7) a. Zeno believed in the stork until he was 7.
b. I only knew her for 5 years, but those were some great 5 years.

(8) John spotted Mary *for a few minutes.

(Rothstein 2004, 8)

In fact, a unique "occurrence at a single moment" is the single most distinguishing property of achievements, which is evident in their being straightforwardly modifiable with adverbials that refer to specific moments of time, such as *at α time* (e.g., *at noon sharp*, *at 10:53 a.m.*, Vendler 1957, 147), while members of other aspectual classes are not:

(9) a.	The detective found the victim's body at 4 p.m.	achievement
b.	#John ran at 4 p.m.	activity
c.	#John drew a circle/built a house at 4 p.m.	accomplishment
d.	#John knew Mary/knew the answer/was intelligent at 4 p.m.	state

"#" above indicates unacceptability, unless the appropriate "point"-like interpretation can be construed, modulo context. Activity predicates are acceptable with *at α time* temporal adverbials just in case they first undergo a shift into the inchoative interpretation of roughly "start ϕ-ing/to ϕ." An accomplishment sentence like *John built a house* is odd with *at 4 p.m.*, at least under our usual everyday criteria about how situations take place in the actual world, and excluding magic or fictional construals. States are odd with time-point adverbials for pragmatic reasons, due to a kind of Gricean principle of economy (see also related observations in Taylor 1977; Dowty 1979). If *John was intelligent* is true of John at some interval, which most likely corresponds to his whole lifespan, then it is true of John also at *any* instant of that interval, as also captured by the time schema for states in Vendler (1957, 149). Therefore, it would be odd or uninformative to single out

one particular moment and assert the truth of John's being intelligent at that moment.

The above summary of the main tests used by Vendler (1957) illustrates a key heuristic strategy developed by philosophers in the mid-twentieth century in the study of aspectual classes, which relies on empirical (grammatical) tests for their key differentiating semantic features. Methodologically speaking, when applying diagnostic tests we need to separate the inherent lexical meaning of verbs from their shifted ones (the result of aspectual shift and coercion). How to draw the line between the two may not be always entirely clear, and it also raises the question of when we need to appeal to lexical ambiguity or polysemy (see also Dowty 1979, 62). This problem was noticed by Vendler (1957), who observes that the tests employed for classifying verbal predicates into aspectual classes often indicate that the predicates behave as though they belonged to more than just one aspectual class. For instance, epistemic state verbs like *know* or *understand* can have an achievement-like "insight" sense in the context of time-point adverbials like *suddenly*: *And then suddenly I knew!* (Vendler 1957, 153). When a given verb, a verb phrase, or a sentence alternates between aspectual classes in dependence on context, such alternations follow systematic patterns. An adequate theory of aspectual classes must formulate testable predictions about how such predictable interpretive patterns are best to be analyzed, based on the inherent lexical aspectual class of verbal predicates interacting with context.

Starting with Dowty (1972; 1977; 1979), the suite of tests and our understanding of the semantic properties they detect have been expanded, which also led to drawing the lines between aspectual classes in different ways than Vendler (1957) originally did. These points will be here discussed in some detail, starting with the tests whose implementation is most problematic in Vendler (1957): first, acceptability with the progressive; and second, modification with durative adverbials.

3 States

A key characteristic property of all state predicates is that they hold of individuals at *any* moment during the period of time at which they are true. (See below on the homogeneity property of state predicates.) This insight is captured in Vendler's (1957, 149) temporal schema for states: "'*A* loved somebody from *t*1 to *t*2' means that at *any* instant between *t*1 and *t*2 *A* loved that person" (Vendler 1957, 149). This applies equally to state predicates expressed by verbs like *love*, *know*, *believe* (individual-level predicates) and to adjectives like *drunk*, *happy* (stage-level predicates): if it is true that John was drunk from *t*1 to *t*2, then it is also true at *any* instant between *t*1 and *t*2. Subsequently, this idea was formalized by means of temporal meaning postulates in interval semantic approaches to states, starting with Bennett and Partee (1972) and Taylor (1977).

The main function of PROG(P) is to refer to a (nonfinal) stage of an eventuality in P at some reference time *t* (time point or interval), at which the nonprogressive base P itself is *not* asserted to be true, which would be putting it in the simplest terms, following suggestions in Carlson (1977), Taylor (1977), Dowty (1979, 175),

and also Landman (1992; 2008), [2,3] and setting aside the problems raised by the imperfective paradox (Dowty 1977; 1979) or the partitive puzzle (Bach 1986; see below). From a semantics of PROG(P) along these lines it follows, as Taylor (1977) argues, that no state predicates should occur in the progressive. His reasoning is that it would be highly odd, misleading, or uninformative at the least, for state predicates to be used in the progressive form which indicates that a stage of a state predicate holds at some reference time *t* that falls within a larger interval at which its corresponding nonprogressive form is true and yet the nonprogressive form itself is *not* true at *t*. Dowty (1979) finds Taylor's (1977) argument compelling, albeit with the caveat that there are two subclasses of state predicates that can occur in the progressive: namely, verbs of the *sit-stand-lie* class and the "agentive *be* + nominal/adjective XP" (Dowty 1979, 185) (aka the "active *be*" in Partee 1977 or the "*be* of action" in Parsons 1990, 35).

However, what Dowty (1979) and also many others failed to notice is that virtually all state predicates have at least some uses that are acceptable in the progressive (Bach 1981; Zucchi 1998; Fernald 2000; among others, and references therein). Different state predicates exhibit different degrees of ease with which they can be used in the progressive depending on context. Let us start with a few salient examples in order to illustrate these points. For instance, *I'm living in California* is perfectly natural and straightforwardly understood as referring to a temporary, contingent episode, whereas its nonprogressive counterpart *I live in California* describes a non-temporary state. Similarly, epistemic STATE verbs like *understand*, *believe*, or *love* are used in the progressive when the emphasis is on purely transient, contingent epistemic states.

(10) a. I'm living in California.
(Bach 1981)

b. I'm understanding you but I'm not believing you.
(Bach 1981)

c. I'm loving it.

Epistemic state verbs like *understand* and *believe* are also acceptable in the progressive in the context of degree adverbials which enforce a reference to a change in the degree of understanding or the strength of belief:

(11) a. #I am understanding quantum mechanics.
a′. I am understanding more about quantum mechanics as each day goes by.
(Comrie 1976)

b. #John is believing that the earth is flat.
(Bach 1981)[4]

b′. John is believing more and more in his abilities.

However, in contrast to *understand* and *believe*, *know* in the progressive tends to be unacceptable, even if it occurs in the same context of degree adverbials. (12c) is acceptable, but here the reference is to an increase in the number of iterated episodes:

(12) a. #John is knowing the answer.
b. I find that I know/#am knowing more about quantum mechanics with each day that passes.
(Comrie 1976, 39)[5]
c. #John is knowing the answer more and more.
(Zucchi 1998, 369, fn. 21)[6]
d. John is knowing all the answers to test questions more and more often.
(Binnick 1991, 173)

While the above examples may suggest that acceptability of state predicates in the progressive requires agentive control, this is not necessary. Resembling somebody more and more need not be under one's control:

(13) a. #John is resembling his father.
(Zucchi 1998, 50)[7]
b. John is resembling his father more and more as each day goes by.
(Zucchi 1998, 50)

Agentivity is, however, required for the felicitous use of progressives of copular state predicates, both individual-level (*intelligent*) and stage-level (*noisy*), as we see in the contrasts below, where the copular verb *be* is understood as meaning 'be behaving' or 'be acting':

(14) a. John is being noisy./#The river is being noisy.
(Partee 1977)
b. Bill is being difficult/#tall/#asleep/#ill/#a bachelor.
c. #Cathy was being intelligent.
c′. Cathy thought she was being intelligent by pressing Liz with hostile questions.[8]
d. John is being a hero (by standing still and refusing to budge).
(Dowty 1979, 185)

The most resistant to progressive use is the copular predicate "locative *be* + PP" (Bach 1981; Bach and Chao 2012).

(15) *Mary is being in New York.
(Bach 1981)

In sum, what all felicitous progressives of states seem to share is that their truth conditions depend on some temporary location or epistemic stance, some ongoing change or manifest behavior at a reference time. What is to be explained is how the different interpretive patterns, such as those observed above, arise from the interaction of the progressive with different subclasses of state predicates.

The progressive is sensitive to different semantic components of state predicates it applies to, as the above examples show. There seem to be two main types of factors, one semantic and the other syntactic: (i) whether a given state predicate is individual-level or stage-level (Carlson 1977; Dowty 1979; Bach 1981; among

others); and (ii) whether the form in which a state predicate is realized is that of a non-copular lexical verb or a copular construction (Zucchi 1998).

Building on Carlson (1977), Dowty (1979) and Bach (1981) emphasize the relevance of the individual-level versus stage-level distinction for the conditions under which state predicates will be acceptable in the progressive. All individual-level predicates are state predicates: for example, *know*, *believe*, *love*, *resemble*, *intelligent*, *soluble*, *fragile*. They denote properties of individuals that tend to hold of them at intervals that are relatively long and vague (Dowty 1979), and often during their whole lifespan. Apart from ordinary individuals, Carlson's ontology also has stages of individuals, that is, manifestations or realizations at some location and reference time *t* (time point or interval). Stage-level predicates comprise (i) all dynamic predicates, that is, all predicates that entail any change whatsoever, namely processes (with Vendler's activities as their agentive subclass) and events (accomplishments and achievements); and (ii) stage-level state predicates. Stage-level states describe temporary states, and while they entail no change, they may be a result of change and may be associated with the potential for change (Dowty 1979). Stage-level state predicates are expressed by adjectives, such as *drunk*, *happy*, *sick*, *bored*, *sweaty; clean*, *well-dressed*, *silent*, *noisy*, nouns like *pedestrian* (which may be thought of as entailing changes in location), and by verbs of the *sit-stand-lie* class (Dowty 1979). All stage-level predicates tend to be true of stages of individuals at shorter intervals than those at which individual-level predicates are true (Dowty 1979, 179).

The individual-level and stage-level distinction among state predicates shows up, for instance, in their differential behavior with temporal and locative adverbials:

(16) a. John had blue eyes #in the kitchen at midnight/#last week/#a year ago.
b. John was drunk in the kitchen at midnight/last week/a year ago.

While one's eye color is a permanent property which does not change during one's adult life (barring unusual scenarios like eye color changing surgery), being drunk is a transient property of individuals.

A key characteristic property of all state predicates is that they hold of individuals at *any* moment during the period of time at which they are true, that is, they have the property of homogeneity. However, there is an important difference between individual-level and stage-level state predicates in what exactly this means, which is tied to the different nature of states they denote and which influences the conditions under which they can occur in the progressive. Individual-level predicates indicate "a *potential* for having stage-properties of a certain kind at some future or hypothetical time. And this potential exists at any one moment during the whole interval of their truth as much as at any other moment," as Dowty (1979, 179) observes, also inspired by Quine's (1960, 222–223) treatment of "dispositional" state predicates like *soluble*: if *sugar is soluble* is true at time *t*, then it is true that if some sugar were in water at *t*, it would dissolve at *t* (Quine 1960). Unlike *soluble* and its stage-level correspondent *dissolve*, it is far less straightforward for many (perhaps most) individual-level predicates to identify

what are temporary stage-properties at some reference time of non-temporary properties they describe. There are at least two reasons for this. First, there may be many different stage-properties which count as manifestations of a given non-temporary individual-level property at a given time. Take *know French*, for instance, which may be realized in speaking, writing, understanding, or reading French, and each is describable by a different episodic stage-level verb (Ryle 1949). Second, for some individual-level predicates, such as *be a bachelor*, it may not be entirely clear what the corresponding episodic stage-property might be at a given time.

In contrast, stage-level states have truth conditions that depend on the state of the world at some reference time *t* (time point or interval) in a relatively straightforward way. One and the same predicate which inherently denotes stage-level states can be used in generic sentences describing a *potential* for having stage-properties of a certain kind and also in episodic sentences describing their particular manifestations at some specific reference time: *John was sad growing up* and *John was sad at 4 o'clock and so he decided to call me up*.

With this background in place, let us first examine the progressive uses of non-copular lexical verbs denoting individual-level states, such as *believe*, *love*, *know*, *resemble*, *weigh (120 kilos)*. If the main function of PROG(P) is to refer to a (nonfinal) stage of an eventuality in P at some reference time *t*, along the lines suggested in Carlson (1977) and Landman (1992; 2008), then it would follow that PROG cannot *directly* apply to any individual-level state predicate, because it has no stages in its denotation, and so its output will be undefined or empty. However, as Bach (1981) among others observed, all have some felicitous uses in the progressive, and some salient examples are given in (10)–(13). As a working hypothesis, Bach (1981, 78) suggests that their felicitous uses in the progressive refer to temporary realizations or manifestations, that is, stages in the sense of Carlson (1977), at some reference time *t*, which are "more or less directly connected" (Bach 1981, 78) with the meaning of their base non-temporary or "atemporal" state predicates. One way of understanding Bach's (1981) proposal is to say that such predicates must first undergo a shift into a suitable stage-level or temporary interpretation in order for PROG to apply to them.

For instance, verbs like *live*, *understand*, *believe*, *love* in the progressive form (as in (10a)–(10c) above) are naturally understood as expressing an assertion that a contingent stage-level property of living somewhere, understanding, believing, or loving something is true of a stage of an individual at some specific reference time *t*, while also implicating that the corresponding unchanging permanent state expressed by its nonprogressive counterpart does *not* hold of that individual at a larger interval that subsumes *t*. So the following is not a contradiction: *I'm currently living in London, but I don't live here permanently*. For such state verbs the connection between a non-temporary state property and its episodic stage counterparts is straightforward, which facilitates their shift into a stage interpretation required by PROG.

The requisite shift of such non-copular individual-level state verbs into an episodic, stage-level, interpretation may also be facilitated by degree adverbials, such as *more (and more)*, *gradually* (Leech 1971; Sag 1973; Comrie 1976, 36–37;

Quirk et al. 1985; Zucchi 1998, 355), as we see in (11) and (13). Here, the reference is not to permanent mental and physical states, but rather to changes in the degree to which they hold of stages of individuals at successive times. In order to understand, believe something, or resemble someone more and more, one must go through different stages of understanding, believing, or resemblance at successive times. The function of a progressive state predicate is to differentiate among different successive parts of an interval at which the relevant state holds of a stage of an individual to a different degree.

Let us now turn to copular state predicates in the progressive, as illustrated by the examples in (14). They are formed with "*be* + nominal/adjective XP," where the XP is either an individual-level predicate (e.g., *be intelligent*) or a stage-level state predicate (e.g., *be noisy*). Unlike non-copular state verbs in the progressive, such copular state predicates are felicitous in the progressive to the extent that their subject argument refers to a stage of an individual (viewed as) having agentive control over a temporary manifestation of a non-temporary state denoted by their base nonprogressive state predicate. This presupposes that *be* is not stative, but rather "semantically agentive, [and] selects for animate subjects only (its meaning is similar to the meaning of *act*)" (Partee 1977, 32). (See also "agentive *be*" in Dowty 1979, 185, or "*be* of action" in Parsons 1990, 35.)

For instance, the truth of *John was being noisy* directly depends on some temporary, episodic condition of John causing noise at some reference time *t*, and the accompanying cause may be expressed in a *by*-clause: … *by chatting/jangling wrist bangles together*. While making noise can be under volitional control of an agent, being ill or drunk are not, which motivates the unacceptability of # *Bill is being ill/drunk*.

For copular individual-level predicates, the connection between the non-temporary property they denote and what might be its temporary agentive stage-property at a given reference time may not be entirely clear. They seem acceptable in the progressive to the extent that such a connection can be established in context. For instance, *John is being a hero (by standing still and refusing to budge)* (Dowty 1979, 185) refers to a temporary stage-property of John. It may be paraphrased by "John is acting/behaving in a heroic manner," whereby the concrete manifestation of this behavior is described in the *by*-phrase. Generally, we may judge whether a given individual is a hero or intelligent based on concrete actions or behaviors of that individual's stages. In contrast, for *be a bachelor*, it is unclear what concrete volitional behaviors or actions we would consistently view as its associated stage-properties at a given time. This might be the reason why # *Bill is being a bachelor* is highly odd or unacceptable.

The chief observation to be made here is that copular state predicates in the progressive refer to stages of individuals who are viewed as having agentive control over a temporary manifestation of a non-temporary state denoted by their base nonprogressive state predicate. Such progressives need not entail any change, but they may arise or be acquired as a result of some change of state or they may involve a potential for a change, possibly an imminent change (Dowty 1979), precisely because the stages they refer to are construed as being under an agentive control of the referent of their subject argument. A test for drawing the line between agentive

be-type state predicates, which can occur in the progressive, and non-agentive ones, which cannot, is compatibility with active *do*: **John is being tall (*What John did was be tall)* versus *John is being polite (What John did was be polite)*; **The motor is being noisy* (**What the motor did was be noisy*) versus *The person next to me is being noisy* (*What the person next to me did was be noisy*) (Dowty 1979, 185; Zucchi 1998, 358).

That agentivity is the key licensing factor for acceptability of specifically copular state predicates in the progressive can be supported by two observations. First, nearly synonymous non-copular verbs are acceptable in the progressive despite being non-agentive: *he is (*being) ill with influenza* and *he is suffering from influenza* (Comrie 1976, 36). Second, if the subject of a copular state predicate denotes an inanimate entity, then agentivity is excluded (barring poetic anthropomorphizing uses), and therefore such a predicate cannot occur in the progressive. Neither can copular state predicates with inanimate subject arguments be coerced into a dynamic, change-of-state, interpretation required by PROG, under other conditions that sanction the use of PROG. For instance, **This motor is being noisy more and more as each day goes by* (Zucchi 1998, 351) is ungrammatical, even if the context of degree adverbials supports a dynamic, change-of-state, interpretation.

Finally, let us turn to state verbs of the *sit-stand-lie* class in Dowty's (1979) terms, such as *sit*, *stand*, *lie*, *perch*, *sprawl*, which are used in a variety of positional, locational, and existential statements. Their felicitous use in the progressive requires neither change nor agentivity: it is independent of "any apparent movement or other definite or indefinite change of state" (Dowty 1979, 174); but rather it is acceptable "to the degree that the subject denotes a moveable object, or to be more exact, an object that has recently moved, might be expected to move in the near future, or might possibly have moved in a slightly different situation" (Dowty 1979, 175). This is shown by the contrast between the pairs of sentences below:

(17) a. The book is lying on the table.

(Dowty 1979)

b. ?? New Orleans is lying at the mouth of the Mississippi.

(18) a. John is sitting at the top of the hill.
b. ?? John's house is sitting at the top of the hill.

The "movability" requirement may also be satisfied if what is (viewed as) movable is not the entity whose location is asserted in the sentence, but rather its observer so that the located entity momentarily comes into the moving observer's view (Dowty 1979, 175):

(19) When you enter the gate to the park there will be a statue standing on your right, and a small pond will be lying directly in front of you.

(Dowty 1979, 175)

Such perfectly natural uses of stative verbs of the *sit-stand-lie* class in the progressive lead Dowty (1979) to categorize them as *interval statives*, because unlike individual-level verbs, which are true at intervals and also at any of their moments, they "require access to information about the physical state of the world at at least two moments in time" (Dowty 1979, 168), that is, at an interval. That is, even if state verbs of the *sit-stand-lie* class entail no change, which makes them stative,

they are assimilated to episodic predicates that entail a change in physical properties of some sort, including motion in physical space. Dowty (1979, 176–177) explains the intuition that motivates this idea as follows: suppose you see a single frame of a motion picture film, frozen at a single moment of time, showing a book on a table. You would not be able to judge whether the book is stationary on that table, or possibly sliding across the table, and off onto the floor. While you can truthfully say *The book is on this table* at any time that the whole book is on the surface of the table, you can truthfully say *The book is lying/sitting on the table* only if you witness the book remaining stationary on the table for at least a short period, for more than one moment.

If *lie*, *sit* and *stand* are *interval* state verbs, it follows that *The book is lying/sitting/standing on the table* should be perfectly natural and acceptable, and make direct reference to one temporally limited book-stage located on the table. From this it also follows that #*New Orleans is lying at the mouth of the Mississippi River* is odd. The reason for this is that cities are stationary, that is, all their stages are at one and the same location. Given that all New-Orleans-stages must be at the mouth of the Mississippi River, it makes no sense to use the progressive to make an assertion about only one temporally limited New-Orleans-stage being located at the Mississippi River, but instead the corresponding nonprogressive (generic) sentence *New Orleans lies at the mouth of the Mississippi River* is the appropriate expression to use.

To summarize, STATE predicates interact with the progressive in complex ways, and almost all have at least some progressive uses that are perfectly acceptable, which, however, need not involve "successive phases," that is, "change" combined with "temporal duration." Hence, contrary to Vendler (1957) and others, the entailment of successive phases is not a necessary condition for a predicate to be used in the progressive. Rather, felicitous uses of state predicates require that they first shift into an appropriate stage-level, that is, temporary, contingent interpretation (Bach 1981, following Carlson 1977). The stage-property requirement is satisfied under two semantic conditions: if the result of a shifting operation is an episodic predicate that implies either (i) some change or at least a potential for an imminent change, including being movable (or at least moving in and out of the observer's view) without necessarily requiring agentivity, or (ii) agentive (volitional) control, without requiring any manifest change, but rather implying that the temporary stage-property may arise as a result of some change of state or may provide a potential for a change in the near future. The first condition applies to non-copular lexical verbs denoting individual-level STATES, and also to state verbs of the *sit-stand-lie* class, while the second condition applies to copular state predicates that are formed with "*be* + nominal/adjective XP," where the XP is either an individual-level state predicate or a stage-level state predicate.

4 Achievements and momentaneous events

4.1 The criterion of "truth at a moment of time"

Achievements have the following unique semantic property, which sets them apart from all the other aspectual classes and determines their interaction with the

progressive: they denote events that can be evaluated at "unique and indivisible time instants" (Vendler 1957, 155). The diagnostic test for this temporal property is straightforward compatibility with expressions that refer to specific moments of time, such as *at 4 p.m.*:

(20) a. He won the race at 4 p.m.
b. The ball/John reached the bottom of the slope at 4 p.m.
c. The train arrived at the station/left the station at 4 p.m.
d. John died at 4 p.m.
e. The detective found the victim's body at 4 p.m.
f. Kim spotted the plane at 4 p.m.

On some accounts, semelfactives also fall under achievements. Good examples are Bach (1981; 1986) and Mourelatos (1978) who use *flash (once)* and *hit*, respectively, as paradigm examples of achievements:

(21) a. The computer flashed an error message at 4 p.m., then crashed and went blank.
b. The bullet hit the target at 4 p.m.

The status of semelfactives with respect to Vendler's aspectual classes is not entirely uncontroversial. As we will see further below, Levin (1993, 148–150; 1999; 2009) assimilates them to activities, while Smith (1991, 20 and 28–29, and elsewhere) treats them as a fifth aspectual class *sui generis*. In order to obviate such controversies, here I will use Bach's (1986) term *momentaneous events* as a cover term for achievements in the narrow sense of Levin and Smith as well as for semelfactives.

For momentaneous events what is conceptualized as occurring at a moment of time is the transition *T* from the initial state ¬*p* to the final state *p* which may be a result state: ¬*p T p*. For instance, *arrive* entails a nearly instantaneous transition from not being at some location *l* to being at *l*. The time point adverbial *at 4 p.m.* indicates the single moment when the transition into the result state of being at some location *l* occurs. Semelfactives like *flash (once)*, *hit* denote "full-cycle resettable" events (Talmy 1985, 77). Their temporal schema is ¬*p T1 p T2* ¬*p*, which indicates that they lexically specify the return to the initial/original state, therefore they are not resultative. Crucially, the whole "cycle" is conceived of as happening at a single moment of time.

When speaking of eventualities occurring at single moments of time, we mean the time of "natural language metaphysics" (Bach 1981), that is, presupposing certain metaphysical assumptions about time that speakers of a natural language make, and which are inherent in natural language expressions, rather than time as understood by natural sciences. What we might view as one and the same situation in the real world is amenable to different descriptions in natural language, including its presentation as either instantaneous or temporally extended. This conceptual flexibility, however, does not make the criterion of temporal extent irrelevant for the cross-classification of aspectual classes (*pace* Verkuyl 1972; 1993, among others).

4.2 Predicates of momentaneous events in the progressive

If achievements, and momentaneous events generally, denote events that are viewed as nearly instantaneous, as all agree, then PROG cannot directly apply to them, because PROG(P) makes reference to a (nonfinal) stage of an eventuality in P at some reference time *t* (time point or interval), which presupposes that P has temporally extended eventualities in its denotation. Some such line of reasoning apparently led Vendler (1957) to propose that achievements are uniformly incompatible with the progressive.

However, predicates of momentaneous events are acceptable in the progressive, albeit not all to the same degree and under the same conditions, as was early observed by Dowty (1977; 1979, 130 fn. 8, 137), Mourelatos (1978), and is well known today (Rothstein 2004, among others). For instance, achievements like *reach*, *arrive*, *win*, *die* are perfectly natural in the progressive:

(22) a. The ball was reaching the bottom of the slope./John was reaching the summit.
b. The train was arriving at the station/leaving the station.
c. He is winning the race.
d. John was dying when the doctor arrived.

In contrast, achievements like *notice*, *spot*, *realize*, *recognize*, *explode* may be odd or unacceptable in the progressive in out-of-the-blue contexts, but they may be rendered felicitous under a "slow-motion camera" construal (borrowing the metaphor used in Partee 1999), zooming in on the transition *T* in $\neg p\ T\ p$ and expanding it so that it is conceptualized as a stage that their progressive form refers to:

(23) a. # Kim is noticing that it is raining/that Bill lost weight.
b. # John is spotting his friend.
c. # Nobody is realizing how important this is.
d. # The bomb was exploding.

(24) a. The critic is noticing (i) the new picture.
(ii) that the new picture is really good.
(Rothstein 2004, 56)
b. Mary is spotting her arch enemy at the party at the moment.
(Rothstein 2004, 56)
c. John is gradually realizing that you are right.
(Dowty 1979, 180)
d. As he was finding a place for his son's belongings he knocked over an old chest.[9]
e. One runner went down as he ran next to where the bomb was exploding.[10]

As Rothstein (2004, 56) observes with respect to the "slow-motion camera" progressive achievements, we can imagine someone describing what is happening in a film which is being played before us, possibly at a slow pace.

Another strategy for enforcing a temporally extended interpretation of achievements is by shifting them into the iterative interpretation (a connected series of

momentaneous events of the same type), possibly also facilitated by a plurality of the relevant participants:

(25) a. The editor is noticing mistakes and typos in the manuscript. iterative
b. Now I'm noticing more similarities between these two patterns.

A generic (habitual) interpretation also sanctions the use of achievements in the progressive, typically with an additional expressive meaning, which is often characterized in negative terms, implying a disapproval or complaint:

(26) John is always forgetting his keys. generic (habitual)

For semelfactive verbs like *hit*, *flash*, *jump*, *knock*, *tap* in the progressive the most natural interpretation is iterative, but a single "slow-motion camera" construal of a single eventuality may also be possible in the appropriate context:

(27) a. The pebble was hitting the water.
b. The beacon was flashing in the darkness.
c. The boy was just jumping/kicking the door when I came in.
d. Mary was knocking at my door.
e. John was tapping on the window.

The common assumption that *all* predicates of momentaneous events *uniformly* clash with PROG, because they all denote nearly instantaneous events (whose onset and end are viewed as coinciding in one moment of time) leads to proposals that this type mismatch triggers a contextually licensed repair, an aspectual type-shifting operation that minimally adds a preliminary process, or stage, to their inherent lexical meaning. One way of implementing this idea is by means of inserting a hidden *type coercion* operator, following some suggestions in de Swart (1998; 2011), which supplies the requisite stage component for the application of PROG:

(28) *The train was arriving at the station*.

FUNCTOR–ARGUMENT CLASH:	[PROG [arrive (the_train)]]
COERCION:	[PROG [$C_{[-\text{STAGE} \rightarrow +\text{STAGE}]}$ [arrive (the_train)]]]

where "$C_{[-\text{STAGE} \rightarrow +\text{STAGE}]}$" is a coercion operator mapping momentaneous eventualities lacking stages onto protracted eventualities with stages

Another implementation is proposed by Rothstein (2004, ch. 2), where the progressive triggers an aspectual type-shifting operation (*type raising*), shifting an achievement into an accomplishment, capitalizing on the idea that accomplishments denote protracted eventualities that consist of successive stages leading to some outcome or result that coincides with their lexically specified "terminus" or culmination.

The achievement-to-accomplishment type-shifting operation is plausible for the analysis of progressive achievements like *be reaching the top/winning/arriving/dying*.

Just like progressive accomplishments, progressive achievements naturally have no iterative interpretation with a singular Theme argument, they denote a singular ongoing eventuality and induce the imperfective paradox (Dowty 1977; 1979) or partitive puzzle (Bach 1986):

(29) *Progressive achievements*
  a. The train was arriving at the station
     … but it split in two for an unknown reason and crashed.
     ↛ The train (had already) arrived at the station.
  b. John was dying
     … when the operation was performed that saved his life.
     (Dowty 1991)
     ↛ John (had already) died.

The paradox or puzzle is that a given progressive sentence can be true even if its corresponding nonprogressive counterpart is false, and can never be true. So *The train was arriving at the station* can be true even if *The train (had already) arrived at the station* is false, and can never be true. Or, put in mereological terms (Bach 1986), *The train was arriving at the station* might be true even if only a *part* of what counts as a *whole* eventuality of the train arrival at the station takes place or will ever take place in the actual world. This is confirmed by the observation that *The train was arriving at the station* can be continued without contradiction with a denial of the result state of having reached the station, that is, it does not entail *The train (had already) arrived at the station*. Similar observations obtain for *John was dying*.

However, "slow-motion camera" progressive achievements do not behave like progressive accomplishments. As the following sentences show, they cannot be continued with their corresponding negated simple forms without oddity or contradiction (Smith 1991; Levin 1999; 2009; Rothstein 2004):

(30) a. The critic is noticing the new picture #but she hasn't noticed it yet.
  b. Mary is spotting her arch enemy at the party #but she hasn't yet spotted her.
  c. Dafna is realizing that her mother has come to pick her up from kindergarten, #but she hasn't realized it yet.
  (Rothstein 2004, 7)

This means that progressive achievements like *be noticing/spotting/realizing* do not induce the imperfective paradox/partitive puzzle, and on their "slow-motion camera" construal they exhibit a similar inferential pattern to that which progressive activities do. This provides a compelling argument against an analysis of such progressive achievements in terms of progressive accomplishments.

Similar observations apply to progressive semelfactives like *be knocking*, which have a default iterative interpretation. They cannot be analyzed as shifted progressive accomplishments, because they do not induce the imperfective paradox/partitive puzzle (Smith 1991, *pace* Rothstein 2004, 184). As we see below, progressive semelfactives like *John is knocking at my door* cannot be continued with their corresponding negated simple form without oddity or contradiction, which

is one of the reasons why Levin (1999; 2009) assimilates semelfactives to activities (see also below):

(31) John is knocking at my door, #but he hasn't knocked at my door yet.

In sum, as we have seen above, progressive achievements systematically exhibit at least three different interpretation patterns, which is not expected on the common assumption that all their members have the same lexical semantic structure, which involves a punctual transition between two states of affairs, and are subject to a uniform coercion or type-shifting operation triggered by their type mismatch with PROG. Their different interpretations in the progressive cannot be treated as merely pragmatic in nature, because they are not (easily) cancelable in a suitable context. Therefore, it is plausible to explore the possibility of grounding such differences in their interaction with the progressive in the differences in their respective lexical meanings. Specifically, such interactions suggest that predicates of momentaneous events fall into at least three clearly distinguishable classes: culminations and happenings, using Bach's (1986) terms (which together correspond to Vendler's achievements), and semelfactives.

(32) *Momentaneous events in the progressive*

		Imperfective paradox	default iterative interpretation
Culminations:	*die*, *reach the top*	+	−
Happenings:	*recognize*, *notice*	−	−
Semelfactives:	*flash (once)*	−	+

Unlike in Bach (1986), semelfactives are here severed from happenings, because they have different interpretations than happenings, both in their progressive and simple forms (see below).

Bach's (1986) culminations (*reach the top*, *die*) roughly correspond to Smith's (1991) "achievements with an associated process," that is, achievements that "conventionally" require (relatively short) preliminary stages (Smith 1991, 31 and elsewhere), which lead to a result state (Dowty 1979; Levin 1999; 2009; Rothstein 2004). In Ryle (1949, 150), these are achievements with a "subservient task activity." For example, for somebody to reach the summit, there must be a preceding climbing stage, and in *John was reaching the summit*, the progressive makes direct reference to the climbing stage right before John got to be at the summit.

Bach's happenings (*recognize*, *notice*) can be aligned with Smith's achievements that merely contextually allow preliminary stages. For example, *find your watch*, as Smith (1991, 31) observes, "may occur after some preliminary searching stages, or without them." The observation that preliminary stages may be merely contextually determined, rather than "conventionally required," with achievements like *find* might also be the reason why the judgments of native speakers concerning their acceptability in the progressive differ: compare *? Mary was finding her watch* (Smith 1991, 172) with *The librarian is finding the book* [following some established procedure] (Rothstein 2004, 147), *Dafna is finding her shoes* (Rothstein 2004, 36).

Compelling though such observations might be, Smith (1991) nevertheless treats both types of achievements as falling under one aspectual class, following Vendler (1957), and associates both with the same temporal schema, leaving the differences between them at a pre-theoretical level:

(33) Temporal schema of achievements: … ER …

(Smith 1991, 30)

where the dots following ER indicate the entailed resultant stage, and the dots preceding ER indicate (possible contextually determined) preliminary stages

However, such a uniform lexical representation is not satisfactory, as has been observed above. Instead, culminations (*reach the top*, *arrive*, *leave*, *win*, *die*), that is, achievements that "conventionally" require (relatively short) preliminary stages (Smith 1991, 31), are better analyzed in terms of an aspectual structure that minimally consists of two parts: distinguishable preliminary stages and a transition into the resultant state. While this would make the lexical meaning of culminations close to that of accomplishments, the two are different in so far as culminations impose specific lexical constraints on both their lexical parts, which motivate their different semantic and syntactic properties when they are used in the progressive as well as in the simple form. In what follows, let me briefly mention three salient properties of culminations, which separate them from accomplishments.

First, culminations (just like *all* predicates of momentaneous events) entail a transition between two states of affairs that is conceptualized as happening at a moment, or at a nearly minimal interval, while accomplishments entail that it occurs over a large(r) interval, in multiple temporally successive steps (see Dowty 1979, 81, 141). Although the distinction between the two is not always easy to draw (as Dowty also observes), one robust grammatical reflex of this distinction is the straightforward compatibility of culminations in their simple forms with time-point adverbials like *at 4 o'clock*, as observed at the outset of this section.

Second, the stages lexicalized by culminations are relatively short, with effects on their interpretation in the progressive which differ from those of accomplishments. For instance, (34a) is felicitous, but not (34b), in a situation in which Mary has set out on an hour's walk to the station (Rothstein 2004, 53 and 55):

(34) a. Mary is walking to the station. accomplishment
b. Mary is arriving at the station. culmination

Moreover, progressive culminations, unlike progressive accomplishments, are odd when modified by *halfway through* (Manfred Krifka p.c.; Rothstein 2004, 44), on a single-event interpretation.[11]

(35) a. She is halfway through walking to the station. accomplishment
b. #She is halfway through arriving at the station. culmination

Finally, accomplishments freely occur in the perfect progressive, in the non-iterative and nongeneric context, while culminations in the same context are

odd, although adding temporal *for*-adverbials may improve their acceptability (Rothstein 2004, 44):

(36) She has been cooking dinner (for half an hour). accomplishment

(37) a. # Fred and Susan have been leaving. culmination
b. ? Fred and Susan have been leaving for an hour.

(Rothstein 2004, 44, exx. 26b, 26c)

Assuming that culminations like *arrive*, *win*, *reach the summit*, *die* lexically specify both (relatively short) preliminary stages and a momentaneous transition into a result state has the distinct advantage that their perfectly natural progressive use, and the imperfective paradox/partitive puzzle it induces, is a direct consequence of their lexical semantic structure. It predicts that PROG should directly apply to them, and obviates the need for an aspectual type-shifting operation that adds an implicit stage component (following some suggestions in de Swart 1998; 2011) or for a shift to accomplishments (Rothstein 2004). The latter is also problematic given that progressive culminations differ from progressive accomplishments, as we have just seen.

The above observations strongly suggest that we revise the common assumption that all achievements lexically specify a set of nearly momentaneous events, that is, their lexical structure only specifies that events in their denotation have an onset and end coinciding in one moment of time. While achievements such as *arrive*, *win*, *reach the summit* (culminations) and *spot*, *notice*, *recognize* (happenings) all share the entailment of a momentaneous transition into a new state, only achievements like *arrive*, *win*, *reach the summit* (culminations) are resultative, as all agree, and here we propose that they also lexically specify (relatively short) preliminary stages leading to a result state.

Consequently, Vendler's (1957) two key aspectually relevant features, namely, "successive phases" (here preliminary stages), and "terminus" (which amounts to result or culmination on Vendler's view of accomplishments), cut across the class of his achievements. But this means that "successive phases" (stages) and "terminus" (aka result) cannot be used to neatly cross-classify among Vendler's four aspectual classes (*pace* Filip 2012, and also Rothstein 2004), if we were to recast them as privative aspectual features. The feature "successive phases" (stages) is now shared by activities, accomplishments, and culminations, and the latter two also entail a "terminus."

As has been observed above, the status of semelfactives with respect to membership in one of the aspectual classes is a matter of some disagreement. Here, we propose to treat them as a subclass of momentaneous events (in the sense of Bach 1986) together with culminations and happenings, given that all three share the entailment of a *momentaneous* transition to some end state, which, on this account, motivates the observation that when they are modified with time-point adverbials like *at 4 p.m.* such adverbials specify the (idealized) moment of time of that transition. No other aspectual classes have these semantic and grammatical properties.

Semelfactives constitute a special subcase of momentaneous events, because they have a number of semantic and distributional properties that separate them from culminations and happenings. Unlike culminations and happenings, semelfactives have a default iterative interpretation in the progressive, as we have seen above. Moreover, when they are used in the simple form, they exhibit at least four properties which set them apart from culminations and happenings. Such differences between semelfactives, on the one hand, and culminations and happenings, on the other hand, have to do with the observation that semelfactives denote "full-cycle resettable" events (Talmy 1985, 77). Their temporal schema can be roughly represented as $\neg p\ T1\ p\ T2\ \neg p$, indicating that they lexicalize the return to the initial state, but the whole cycle is still conceptualized as occurring at a single moment of time.

First, semelfactives in the simple past tense can naturally receive an iterative or a single-event interpretation. In contrast, culminations and happenings in the simple past tense are most naturally understood as describing singular events. For instance, while (38a) and (38b) are most likely understood as describing a single event of noticing the buried treasure and a single arrival, respectively, the semelfactive in (38c) can be understood as describing either one blink or a series of blinks:

(38)	a. Tim arrived to class late.	culmination:	[+single event]
	b. John discovered the buried treasure (*for six weeks).	happening:	[+single event]
	c. Tim blinked.	semelfactive:	[± single event]

With culmination and happening predicates in the simple past tense, the reference to the plurality of events can be induced by their plural or mass arguments:

(39) a. Guests arrived throughout the afternoon for the wedding.
b. John discovered fleas on his dog/crabgrass in his yard (for six weeks). (Dowty 1979)
c. Tim noticed spots./Detectives noticed the spot/spots.

Second, with an explicit iterative adverbial (*repeatedly*), semelfactives in the simple past tense naturally tend to describe a single situation consisting of a connected series of events of the same type, yielding predicates of multiple-event activities (Smith 1991, 50), while culminations and happenings in the same context are most naturally understood as describing a plurality of separate events (see also Levin 2009):

(40)	a. John repeatedly arrived late.	culmination: PL of events
	b. The court repeatedly found a violation of this Article.	happening: PL of events
	c. Tim blinked repeatedly.	semelfactive: SG complex event

Third, culminations and happenings entail the kind of momentaneous change of state that is conceptualized as a single transition between two distinct states of affairs $\neg p\ T\ p$, whereby with culminations, p is always some outcome, a new

resultant state (e.g., Smith 1991). Both culminations and happenings sanction continuations asserting the return to the initial state: " … and then [the initial state] ¬*p*" (Talmy 1985, 77), provided they denote events that are resettable with one and the same participant. In contrast, semelfactives cannot be continued with " … and then [the initial state] ¬*p*" without oddity or contradiction, which indicates that they denote "full-cycle (resettable)" events in Talmy's (1985) terms, namely events ending with the return to the initial state: ¬*p T1 p T2* ¬*p*.

(41) a. John arrived and then left. culminations
b. John found his watch and then lost it. happenings
c. ? The beacon flashed (once) and then went off. semelfactives

Finally, some languages have morphological means to distinguish verbs with a semelfactive (single-event) interpretation. A case in point is the Slavic semelfactive suffix, in Russian *-nu-*, which forms verbs that are grammatically perfective and only have single events in their denotation, while their base imperfective form is unmarked in this respect, and may receive a single-event (including progressive) or an iterative multiple-event interpretation, depending on context:

(42) Russian
a. prygnut' (PFV) 'jump once'
b. prygat' (IPFV) (i) 'jump more than once'; (ii) 'be jumping (once)'

As far as I know, no language seems to have morphological markers on the verb to specifically signal that it denotes culminations or happenings.

4.3 Semelfactives

There are different perspectives on the analysis of semelfactives which also illustrate one general point concerning different taxonomies of aspectual classes that have been proposed since Vendler (1957): namely, the number and nature of aspectual classes is determined by which semantic properties are taken to be aspectually relevant, and how they are used to characterize particular aspectual classes.

For instance, Levin (1993, 148–150; 1999; 2009) argues that semelfactives are best assimilated to activities, because when interpreted iteratively, they pattern with activities, not achievements, with respect to aspectual diagnostics. Both are compatible with temporal *for*-adverbials (*run for three hours*, *flash for an hour* (i.e., repeatedly)), and for both, whenever *X is VPing* is true, then *X (has) VPed* is true, which is taken to mean that semelfactives, like activities, are manner, not result verbs. This is also confirmed by the observation that progressive semelfactives do not induce the imperfective paradox or partitive puzzle. According to Levin, semelfactives and activities are assigned the same event structure template, characterized in non-aspectual terms, differing only in durativity: activities are necessarily durative, but semelfactives are underspecified for durativity.

However, if semelfactives were *underspecified* for durativity, it would remain mysterious why semelfactives fail to have interpretations that activities do, which

are inherently durative. For instance, *John ran at 4 o'clock* (activity) is acceptable provided *ran* shifts into the inchoative interpretation of 'began to run'. This shifted inchoative interpretation is unavailable for semelfactives like *The light flashed at 4 o'clock*, which cannot mean 'The light began to flash (multiple times) at 4 o'clock.'[12] If semelfactives were *underspecified* for durativity, then both the single-event and the inchoative interpretation of a multiple-event activity should be freely available, but they are not. If instead we assume that part of the inherent meaning of semelfactives is the reference to (sets of) single momentaneous events (as many do, including Mourelatos 1978; Bach 1981; 1986; and Smith 1991), the lack of the shifted inchoative interpretation with the *at α time* adverbial follows.

Smith (1991, 20 and 28–29, and elsewhere) argues that semelfactives constitute a fifth aspectual class, in addition to Vendler's four classes:

(43) *Smith's (1991, 20) feature-based classification of aspectual classes*

	Static	Durative	Telic
State	+	+	−
Activity	−	+	−
Accomplishment	−	+	+
Achievement	−	−	+
Semelfactive	−	−	−

According to Smith, while both semelfactives and achievements denote instantaneous single-stage events, that is, both have the feature "[−durative]," only achievements are "[+telic]," understood in the sense of resultativity, and represented by the event constant ER in their temporal schema:

(44) a. Temporal schema of semelfactives: E

(Smith 1991, 29)

b. Temporal schema of achievements: … ER …

(Smith 1991, 29)

Treating semelfactives as a fifth aspectual class is unsatisfactory, because it effectively delegates them to an exceptional outlier among aspectual classes. Moreover, as (43) above shows, this move requires three binary features for the cross-classification of five aspectual classes,[13] hence generating some unattested cases: nothing can be simultaneously static and telic, or static and non-durative.

For both Levin (1993, 148–150; 1999; 2009) and Smith (1991), the single most important feature that disqualifies semelfactives from being subsumed under achievements is that they fail to entail a result state. Both presuppose Dowty's (1979) BECOME analysis of Vendler's (1957) achievements, on which the abstract predicate BECOME represents a definite change of state into a result state (possibly some other outcome). However, Vendler (1957) does not characterize achievements as result verbs, that is, entailing a "terminus," but rather, their hallmark property is that they describe events that "occur at a single moment" (Vendler 1957, 147). Vendler's achievements subsume verbs that are not resultative, such

as *spot* or *recognize*. On Vendler's view, semelfactives would seem unproblematic members of achievements.

An entirely different view of achievements is provided by Mourelatos (1978). Building on Vendler's original view of achievements, for Mourelatos (1978, 209) the key requirement for an achievement is that it "fall under SORTS that provide a PRINCIPLE of count." But this means that for him semelfactive verbs like *snap*, *blink*, *hit* are the paradigm examples of achievements, rather than problematic outliers. In Mourelatos' taxonomy (1978, 201), the countability criterion is the hallmark semantic property of the aspectual class of events, which are divided into Vendler's achievements (Mourelatos' "punctual occurrences"), on the one hand, and Vendler's accomplishments (Mourelatos' "developments"), on the other hand. The property of countability became the key property for the cross-classification of aspectual classes in mereological theories of aspect (starting with Bach 1981; 1986).

Given such diverse perspectives on semelfactives, it is unsurprising that there should be different opinions about whether they are telic or atelic. The decision clearly depends on the theoretical background within which they are analyzed, and the particular understanding of the central notion of "telicity." If telicity is understood in the sense of some result, culmination, outcome, then all culminations and also happenings – being resultative – are telic. Semelfactives are clearly not resultative, and therefore not telic on this view. If, on the other hand, what it means for a given predicate to be telic is to specify what is one whole countable event in its denotation (Mourelatos 1978 and mereological formalization by means of the property of quantization in Krifka 1986; 1989, and elsewhere), then all culminations, happenings, and semelfactives are telic.

4.4 Delimiting achievements from accomplishments

As Dowty (1979) argues, the line between accomplishments and achievements ought to be drawn "irrespective of agency or multi-part change of state" (Dowty 1979, 183). The key meaning component that separates the two is the causal entailment of accomplishments, which is also in agreement with Vendler (1957) (Dowty 1979, 183).[14]

Dowty's accomplishments denote situations involving "multi-part change of state," or temporal extent (*build a house*, *the rains destroyed the crops*) and also momentaneous situations (*shoot someone dead*, *break the window*) (Dowty 1979, 183, 124). Unlike Vendler's achievements which are (intended to be) momentaneous, according to the temporal schema he proposes, Dowty's achievements (his *single* or *singulary* change of state predicates) need not be (e.g., *melt*, *freeze*, *dry*, *grow*).

As far as agentivity is concerned, both Dowty (1979) and Vendler (1957) agree that agentivity is orthogonal to both accomplishments and achievements; this is in contrast to much subsequent work, perhaps also fraught with some misunderstandings in this regard (e.g., Piñón 1997). Dowty's accomplishments denote events that are either agentive (*build a house*, *shoot someone dead*) or non-agentive (*the rains destroyed the crops*, *the collision mashed the fender flat*) (Dowty 1979, 183, 124).

Dowty's and also Vendler's achievements are either agentive or non-agentive. Their agentive achievements include *start/stop running deliberately/carefully* (Vendler 1957, 148–149), *kill*, *point out* (Dowty 1979, 184), *reach the finish line*, *arrive in Boston* (Dowty 1979, 183), which is shown by the observation that they are compatible with agent-oriented adverbs:

(45) a. Sam carefully reached the edge of the cliff. agentive achievement
b. Kim deliberately arrived with much aplomb and poise.[15]
c. Only one hunter deliberately stopped running and shot at a troll.[16]
d. When he carefully reached the third step from bottom he shouted "freeze!"[17]
e. He stated that players had deliberately lost the game after being in a commanding position.[18]

That achievements include agentive verbs is often not understood, based on the erroneous idea that intentional activity must be temporally extended (e.g. Piñón 1997, 281). However, there is no notional incompatibility between "punctuality" or "momentaneous event" and intentional activity (or agentivity): achievements describe events involving an instantaneous transition between two states of affairs, and such instantaneous actions can be deliberately brought about, and one can be forced or persuaded to do them.

Achievements like *notice*, *realize*, *ignite* (Dowty 1979, 183), *spot*, *recognize*, *die* (Vendler 1957, 149 and fn. 6) "cannot be regarded as voluntary (or involuntary)", as Vendler (1957, 149) observes, and therefore are odd with agent-oriented adverbs:[19]

(46) ? Kim intentionally/attentively/deliberately recognized Sam.

The key difference between Dowty's accomplishments and achievements, as he argues, rests on accomplishments having the CAUSE predicate in their lexical decomposition, which achievements lack. This analysis is inspired by Lewis' (1973) notion of causation. CAUSE is a bisentential predicate [ϕ CAUSE ψ], where ϕ is an activity sentence and ψ an achievement sentence, represented by means of BECOME. Contrary to Dowty (1979), however, many subsequent studies reject a causative analysis of accomplishments, arguing that the notions of accomplishment and causation are independent of each other (Pustejovsky 1991; Van Valin and LaPolla 1997; Hay, Kennedy, and Levin 1999; Levin 2000; Rappaport Hovav and Levin 2002; Rothstein 2004; Levin and Rappaport Hovav 2005; among others). Causation is neither a necessary nor a sufficient property of accomplishments, because there are accomplishments that are arguably not causative (Van Valin and LaPolla 1997; Levin 2000; among others): for example, directed motion predicates like *Susan ran to the house* (Dowty 1972; 1979, 207–213, 216), or combinations of incremental verbs with a quantized Incremental Theme argument like *Susan ate an apple*. It is counterintuitive to analyze the first as Susan caused herself to be in

the house, and the second as Susan did something to the apple (which includes its diminishing in quantity) which caused it to be inside her (Levin 2000). Neither is causation a sufficient property of accomplishments, because there are causatives that are not accomplishments: for example, *Robin flew a kite for an hour/#in an hour*, *Lee bounced the ball for 10 minutes/#in 10 minutes* (Levin 2000).

A fundamental challenge for a causative analysis of accomplishments is also posed by the lack of agreement on what constitutes empirical evidence for treating a predicate as causative, cross-linguistically and in a particular language (Alexiadou, Anagnostopoulou, and Everaert 2004). For example, Dowty (1979, 184) classifies *kill* as an achievement, i.e., an agentive, single change of state verb, and hence not causative, while others treat it as a prototypical lexical causative verb (e.g., Levin 2000). Finally, if causation were the single most decisive element distinguishing accomplishments from achievements, as Dowty (1979) argues, then the line between the two would be problematic, given that causation itself lacks a compelling characterization.

According to Dowty (1979), what accomplishments and achievements share is the abstract predicate BECOME in their lexical structure, which represents a definite change of state, and subsequently became identified with the core of telicity (e.g., Pustejovsky and Tenny 2000): BECOME ϕ is true at a (minimal) time interval t at whose initial bound $\neg\phi$ holds and at whose final bound ϕ holds (Dowty 1979, 139–145). In this respect, Dowty improves on Vendler's classification where achievements and accomplishments are fundamentally, and mistakenly, disjoint (Dowty 1979, 54), and builds on intuitions behind Kenny's (1963) "performances," which subsume Dowty's accomplishments and achievements (Dowty 1979, 77–78). However, Dowty's logical structure of an accomplishment (decomposed into a bisentential predicate [ϕ CAUSE ψ], where ϕ is an activity and ψ an achievement) led to a common misunderstanding of what an accomplishment is: namely, it is often mistakenly understood as having the BECOME part which simply corresponds to the logical structure of an achievement. Dowty (1979) himself makes a number of observations that this is not so; however, they remain at a pre-theoretical level. For instance, Dowty (1979, 186, 187; Dowty 1979, preface to new ed., xx) mentions that not all accomplishments (i.e., complex definite change-of-state predicates) can be analyzed as having BECOME in their translations, which models a transition into some result state or outcome. Moreover, as I note, not all achievements entail some outcome or result. For instance, *notice* or *start* do not. As Dowty (1979) also informally observes, while achievements entail a definite change-of-state happening at a nearly minimal interval, with accomplishments it occurs "over a large(r) interval in multiple temporally successive steps" (Dowty 1979, 181), even if it is not always clear how to draw the line between the two (see Dowty 1979, 181 for more discussion). Nevertheless, this difference cannot be delegated to pragmatic factors, with accomplishments and achievements merged into one aspectual class (Verkuyl 1993). One robust grammatical reflex of the distinction is that only achievements, but not accomplishments, in simple forms can be straightforwardly modified with adverbials that refer to specific time points like *at 4 o'clock* (see (2) and (3)).

5 Durative adverbial modifiers

5.1 Vendler: durative adverbials are modifiers of activity and state predicates

Modification with durative adverbials, including *for*-adverbials like *for an hour*, tests for atelicity. In Vendler (1957) this test is first and foremost used to distinguish activities from accomplishments. We repeat, for convenience, examples from section 2:

(47) a. Sam {ran | pushed the cart} for half an hour. activity
b. Sam {drew a circle | ran a mile} #for half an hour. accomplishment

Only activities, but not accomplishments, can be straightforwardly modified with *for*-adverbials, which indicates that their denotations have no set terminal point, and this in turn motivates a kind of downward inference: "if it is true that someone has been running for half an hour, then it must be true that he has been running for every period within that half-hour" (Vendler 1957, 145–146). In general, activities denote situations that go on "in a homogeneous way; any part of the process is of the same nature as the whole" (Vendler 1957, 146).

Also states can be straightforwardly modified with durative adverbials, such as *for*-adverbials or *until I was 7*, as Vendler (1957, 147) observes. For Vendler, the reason why this should be the case is however different than for activities. States can be directly modified with *for*-adverbials not because they are homogeneous, but rather because they hold "for a short or long period" (Vendler 1957, 146), which is what separates them from achievements. We again repeat, for convenience, some examples from section 2:

(48) a. Zeno believed in the stork until he was 7/for 7 years. state
b. John spotted Mary *for a few minutes. achievement
(Rothstein 2004, 8)

In sum, in Vendler (1957), compatibility with *for*-adverbials differentiates activities from accomplishments and also states from achievements, but a key generalization is missed, namely that felicitous occurrence with *for*-adverbials groups activities and states into one natural superordinate class. This is presumably due to Vendler's initial mistake of drawing a fundamental line between activities and states, based on his belief that only activities, but not states, may occur in the progressive. Consequently, for Vendler (1957), the question about the proper restriction on the domain of application of *for*-adverbials that would cover both activities and states does not arise.

5.2 Homogeneity is not applicable to activities, only to states

As all now agree, Vendler's (1957) notion of "homogeneity" does not in fact apply to activity predicates, but rather only to state predicates. This then raises the question: what is the property of durative adverbials, such as *for*-adverbials,

that adequately characterizes their domain of application which subsumes both activity and state predicates?

Let us first consider Vendler's (1957) notion of homogeneity as characterized for activity predicates. Recast in interval semantic terms, it means that if an activity predicate is true at a given interval, it is also true at any subinterval and any moment of that interval. In Bennett and Partee (1972, 72), this corresponds to the subinterval property of VPs:

(49) *Subinterval property of VPs*
If they are the main verb phrase of a sentence which is true at some interval of time *I*, then the sentence is true at every subinterval of *I* including every moment of time in *I*.

(Bennett and Partee 1972, 72).

In contemporary mereological terms, the downward inference that Vendler (1957) and Bennett and Partee (1972/1978/2004) have in mind is formalized as the cross-categorial property of divisivity (or divisibility) (see Champollion and Krifka 2016, among others):

(50) $\text{DIVISIVE(P)} =_{\text{def}} \forall e[P(x) \rightarrow \forall y[y < x \rightarrow P(y)]]$
(Grimm 2012; Champollion and Krifka 2016)[20]
$\text{DIVISIVE(P)} =_{\text{def}} \forall e[P(e) \rightarrow \forall e' [e' < e \rightarrow P(e')]]$
A predicate *P* is divisive if and only if whenever it holds of something, it also holds of each of its proper parts (the "downward" closure property').

"$<$": the proper part relation: $\forall x,y \in U\ [x<y \leftrightarrow x \leq y \wedge x \neq y]$
"$\leq$": the part relation: $\forall x,y \in U[x \leq y \leftrightarrow x \oplus y = y]$
"$\oplus$": the binary sum operation, it is a function from $U \times U$ to U, idempotent, commutative, associative.

Homogeneity, however, is often taken to be defined in terms of divisivity and cumulativity (Moltmann 1991, among others). Therefore, it must not be confounded with Vendler's (1957) "homogeneity" which is intended as a downward inference only, and therefore akin to divisivity.[21] The properties of homogeneity, divisivity, and cumulativity are characterizing properties of reference types of predicates (Krifka 1986/1989, and elsewhere); they are cross-categorial properties applying to nominal and verbal predicates. They are defined as follows:

(51) $\text{HOM(P)} =_{\text{def}} \text{DIV(P)} \wedge \text{CM(P)}$

(52) a. $\text{CUMULATIVE(P)} =_{\text{def}} \forall x,y[P(x) \wedge P(y) \rightarrow P(x \oplus y)]$ "cumulative"
(Quine 1960)

b. $\text{CUMULATIVE(P)} =_{\text{def}} \forall e,e' [P(e) \wedge P(e') \rightarrow P(e \oplus e')]$
A predicate P is cumulative if and only if whenever it holds of two entities, it also holds of their sum. Examples: *water*, *apples*; *run*, *stand*, *live*.

Cumulative and divisive reference stand in a dual relation to each other: cumulative reference "looks upward" from the parts to the sum, whereas divisive

reference "looks downward" from the sum to the parts (Champollion and Krifka 2016, 525).

The property of cumulativity is a defining property of mass nominal predicates (Quine 1960) and atelic verbal predicates. Mass nouns like *water*, which are the simplest type of nominal predicates, are cumulative: the sum of two quantities to which we can apply *water* is describable by *water*. Similarly, activity verbs like *walk* and state verbs like *stand*, *live* are cumulative, and both correspond to atelic predicates.

The property of divisivity, however, does not apply to activities, but only to states (Taylor 1977; Bach 1981), contrary to Vendler (1957). Similarly, the subinterval property does not apply to activities, but only to states, contrary to Bennett and Partee (see Bach 1981). If an activity predicate is true of its argument at a given interval, it will not be true at *any* subinterval and *any* single moment during that interval. Take activity verbs like *walk*, *run*, *stroll*. If we consider only one instant contained in some interval of *x*'s walking, the verb *walk* will not hold for *x* at that instant alone. Imagine seeing one frozen frame from a video clip showing a person lifting one foot: you would not be able to judge whether that person is walking, running, strolling, and the like, or simply lifting one foot. What qualifies as being describable by *walk*, *run*, *stroll*, or *jog*, for instance, takes up a certain minimal interval of time. This means that if an activity predicate holds for its argument at a given interval, it will not hold at any single moment of that interval, but rather at some "sufficiently large" subinterval (Taylor 1977). But just what is "sufficiently large" to count as walking or running, what is the lower limit on such an interval, depends on a particular activity predicate and its context of use (Taylor 1977, 218; Bach 1981) as well as world knowledge, and cannot be specified once and for all for any given predicate. This is the essence of the *minimal-parts problem* raised by activities (Taylor 1977; Bach 1981, 71; Filip 1993; 1999; Champollion and Krifka 2016; among others).

The minimal-parts problem affects all activity predicates, including so-called "homogeneous" activities in the sense of Taylor (1977), such as *fall*, *blush*, *ponder*: "even a microsecond within a period of falling is plausibly reckoned as itself genuinely a period of falling, even though it can be told as such by means of normal empirical criteria only indirectly, via the knowledge that it does indeed come within some wider period long enough for those criteria to be applied" (Taylor 1977, 212). Most activity verbs are "heterogeneous" (in the sense of Taylor 1977). They include *walk*, *chuckle*, *giggle*, *talk*, which clearly are not divisive, because they have proper parts too small to count as falling under *walk*, *chuckle*, *giggle* or *talk*.

While the property of divisivity does not apply to activity predicates, as we have just seen, it applies to state predicates in a virtually unconstrained way. If a state predicate is true of an individual at a given interval, it will also be true at all subintervals and moments of that interval (Bach 1981, 71). Interestingly, this corresponds to the intuition behind Vendler's (1957) characterization of "homogeneity" of his activity predicates. The divisivity of state predicates is captured in Vendler's (1957) temporal schema for states: "'*A* loved somebody from *t*1 to *t*2' means that at *any* instant between *t*1 and *t*2 *A* loved that person" (Vendler 1957, 149).

In sum, Vendler's (1957) "homogeneity," which in formal (mereological) terms corresponds to the downward entailment property of divisivity, is not the right property to be used to characterize the domain of application of durative adverbials, such as *for*-adverbials. For instance, the meaning of *for an hour* cannot require that the activity predicate it modifies be true at all parts of the hour (at all subintervals and moments), contrary to Vendler (1957), but the truth at all parts of the hour is guaranteed if it is applied to a state predicate (*The shoes were in the middle of the hallway for an hour*). This then raises the question: what is the property in the semantics of durative adverbials, such as *for*-adverbials, that adequately specifies the semantic property of their input predicates?

5.3 Durative adverbials apply to cumulative predicates and derive quantized ones

As many semanticists agree, constructions with durative adverbials like *for one hour* are analogous to pseudo-partitive constructions with measure phrases like *5 pounds of apples* or *1 liter of water*. Such durative adverbials and measure phrases cannot be applied to telic predicates or to singular count nominal predicates, respectively, because, intuitively, "we do not use the expressions that chunk up our experience with (singular) expressions that provide that experience already chunked up," as Bach (1981, 74) observes:

(53) a. Kim walked/stood on the corner for an hour.
b. Kim walked to the castle/noticed the mistake *for an hour.

(54) a. 5 pounds of apples
b. 1 liter of water
c. *5 pounds of a boy

This perspective on adverbial modification is common in the studies of aspectual classes that are informed by parallels and differences between the verbal domain and nominal domain (for early studies see Allen 1966; Taylor 1977; Carlson 1981; Vlach 1981; Bach 1981; among others). Some of the most insightful formal analysis of such parallels are proposed in mereological or algebraic semantics (starting with Bach 1986; Link 1987; Krifka 1986/1989; 1989 and elsewhere).

There are various proposals regarding the property that is shared by verbal predicates that durative adverbials modify. They can be divided into two main groups depending on whether the input predicate of durative adverbials is taken to satisfy some upward inference property like cumulativity or some downward inference property like divisivity, aka "homogeneity" (in the spirit of Vendler's 1957 original proposal).

On Krifka's (1989) view, we can analyze durative *for*-adverbials as applying to non-quantized, or alternately cumulative (Krifka 2001; 2007), predicates. This idea is implemented within mereological semantics, in which natural language predicates take their denotation from a single domain algebraically structured by means of a complete join semi-lattice, undetermined with respect to atomicity (in departure from the double-domain ontology, atomic and non-atomic, originally

proposed by Link 1983). Such a join semi-lattice is based on the part relation "≤" which defines it in terms of a partial order relation, and which is in turn defined from the sum operation "⊕" (see above). Assuming such algebraic notions, Krifka defines two types of predicates: cumulative and quantized. The cumulative reference property of predicates is defined in section 5.2, and the quantized one is defined below for both nominal and verbal predicates:

(55) a. $\text{QUANTIZED(P)} =_{\text{def}} \forall x,y[P(x) \wedge y < x \rightarrow \neg P(y)]$
b. $\text{QUANTIZED(P)} =_{\text{def}} \forall e,e'[P(e) \wedge e' < e \rightarrow \neg P(e')]$
A predicate P is quantized if and only if whenever it holds of something, it does not hold of any of its proper parts.

Quantized predicates are derived from cumulative predicates by means of extensive measure functions, such as LITER, KILOGRAM, or MINUTE, which supply the requisite quantitative criterion for what counts as one discrete entity in their denotation. The property of quantization is a defining property of singular count nominal predicates (*apple*, *boy*) and telic verbal predicates (*arrive*, *build a house*).

In physics and measurement theory, an extensive measure function is one whose magnitude is additive (see Krantz et al. 1971). (See also monotonic measure functions in Schwarzschild 2002 and elsewhere.) For instance, POUND, which measures weight, is additive: if you add 3 pounds of berries to 5 pounds of berries, you get 8 pounds of berries. (For a mereological definition of an extensive measure function see Champollion and Krifka 2016, section 13.21.)

Apart from extensive measure functions, there are also intensive measure functions, which are not additive. A good example is DEGREE CELSIUS which measures temperature: if a quantity of water has 60°C and another quantity 20°C, they do not add up to a quantity of water that has 80°C.

Expressions of extensive and intensive functions are in complementary distribution in the grammar of natural languages. Extensive measure functions form pseudo-partitive constructions, while intensive measure functions form compounds:

(56) a. 2 pounds of apples
b. *40 degrees Celsius of water
c. *2 pound(s) apples
(Krifka 1989; 1998)
d. 10 degree Celsius water

Krifka (1989) analyzes extensive measure functions as "quantizing modifiers" that derive quantized predicates (*one liter/bottle of water*) from cumulative (or non-quantized) ones (*water*). The key supporting argument has to do with the observation that extensive measure functions cannot apply to natural language predicates that already involve an extensive measure function:

(57) a. 100 grams of flour
b. *100 grams of 500 meters of wool
(Krifka 1998, 202, ex. 12c)

(58) a. 5 pounds of sugar/apples
b. *5 pounds of a boy/#5 pounds of boy

On Krifka's (1989; 1990 and elsewhere) theory, durative adverbials, including *for*-adverbials, can be analyzed as directly applying to predicates that satisfy non-quantization (Krifka 1989), or alternately cumulativity (in later work, e.g., Krifka 2001; 2007). Cumulative verbal predicates correspond to atelic predicates, which under Krifka's definition of cumulativity subsume both activity and state predicates. This yields the right result for the application of *for*-adverbials, and also explains why atelic, but not telic, predicates can be modified by *for*-adverbials, as our initial examples show: *Kim walked/stood on the corner for an hour* versus * *Kim walked to the castle/noticed the mistake for an hour*. If HOUR is an extensive measure function, and if *walk* is cumulative, then the predicate *walk for an hour* = $\{e \mid e \in \text{WALK} \wedge \text{hour}(e) = 1\}$ is a quantized set, whereby all quantized predicates are telic (but not vice versa). Similarly, given that the state predicate *stand on the corner* is cumulative, it satisfies the application condition of *for an hour*, and hence we get *stand on the corner for an hour*, which also denotes a quantized (and hence) telic predicate.

Accomplishments and achievements, which are telic, and mostly also quantized, given that, on this view, telic predicates need not entail a result state), can be used as inputs to durative adverbials like *for*-adverbials, just in case they first shift into a cumulative interpretation:

(59) a. Bill ate the apple bit by bit for 10 minutes (and still didn't finish it).
(Jackendoff 1996)
b. She ate the sandwich in 5 minutes/for 5 minutes.
(Hay, Kennedy, and Levin 1999)
c. Jane wrote three short essays every week for 6 months.

Cumulativity can also be satisfied by a shift into an iterative reading (Krifka 1989, 94):

(60) a. We noticed odd-looking signposts for several hours.
b. Visitors arrived for an hour.
c. Three visitors arrived #for an hour.

The possibility of an iterative interpretation depends on the resettability of the denoted eventuality. For example, achievements denoted by *explode* are not resettable with one and the same object token. A given bomb token can explode at most once. Moreover, the "density" and allowable number of iterated eventualities depends on the length of the measure phrase in a *for*-adverbial and the length of time typically associated with each eventuality denoted by the base predicate in its scope (for more details see Filip 1993; 1999): *Visitors arrived for 5 minutes/for an hour/for a year*.

5.4 Durative adverbials apply to homogeneous predicates

Landman and Rothstein (2012a; 2012b) argue that the input predicate of durative adverbial modifiers like *for*-adverbials must satisfy the downward inference

property, which they refer to as homogeneity. However, what homogeneity means to them differs from Vendler's (1957) original idea. First, for state predicates homogeneity means that they are true at intervals as well as at any of their subintervals. Second, for eventive predicates, including activity predicates, they propose an "incremental homogeneity," which is a dynamic notion of homogeneity. It captures the idea that the predicate characteristics are preserved for each denoted eventuality from its onset through all its incremental development stages. When activity predicates are modified by *for*-adverbials, their meaning "spreads down" to appropriate subintervals, rather than to every moment and every subinterval, of intervals in the denotation of the *for*-adverbial. This, of course, poses the question about what the "appropriate subintervals" are, that is, the minimal-parts problem (see above).

Champollion (2017) also assumes a downward inference property to account for the distribution of durative adverbials. The guiding idea is that the constructions with durative adverbials exclude bounded predicates through a parametrized constraint which is introduced through certain words including *for*. The constraint is formulated in terms of a higher-order property, "stratified reference," which requires a predicate that holds of a certain entity or eventuality to also hold of its parts along a certain dimension and down to a certain granularity. Dimension and granularity are understood as parameters which distributive constructions can set to different values.

6 Telicity: lexical aspectual classes and aspectual composition

6.1 Telicity and the imperfective paradox, aka partitive puzzle

The imperfective paradox (Dowty 1977; 1979) or partitive puzzle (Bach 1986), introduced above in section 4.2, is systematically induced by telic predicates that denote eventualities separable into stages σ(e) and a terminus τ(e), whereby the attainment of the terminus proceeds gradually via distinguishable successive stages. Paradigm examples of such telic predicates are accomplishments, such as *cross the street*, *run a mile*, *draw a circle*, *build a house*, *read a novel*, and culminations (using the term coined by Bach 1981), a subclass of achievements, such as *reach the top*, *win*, *arrive*, *die*. Consider the following examples, adapted from Dowty (1979, 133):

(61) John was drawing a circle — accomplishment
… but he never finished drawing it.
↛ John had already drawn/drew a circle.

(62) John was pushing a cart — activity
*… but he did not push it.
→ John (had already) pushed a cart.

John was drawing a circle can be true even if its corresponding non-progressive counterpart *John had already drawn/drew a circle* is false and can never be true. In contrast, the activity predicate *push a cart* is atelic, it denotes eventualities that are

"realized as soon as they begin" (Garey 1957, 106) therefore, if *John was pushing a cart* is true, so is *John (had already) pushed a cart*.

If P is a telic predicate that lexically specifies stages leading to a terminus, interaction with PROG introduces a modal constraint that *e* is a stage of (a complete) *e*′ in P, if *e* develops into *e*′ in a world similar to ours (Landman 1992; 2008). For example, the accomplishment *draw a circle* denotes complete drawings of a circle, and, on some theories, also partial drawings during which only a part of the whole circle comes into existence (e.g., Parsons 1990). When applied to *draw a circle*, PROG yields the set of (nonfinal) stages of these drawings. *John was drawing a circle* refers to a stage *e* of drawing of a circle, but if John gets interrupted and never finishes drawing that circle, what validates the assertion of *John was drawing a circle* is not a stage of an actual eventuality that leads to a complete drawing expressed by *John drew a circle*, but instead merely a stage of a whole drawing eventuality *e*′ in a world similar to ours.

6.2 Telicity as a constructional property of VPs and sentences

Vendler's (1957) examples of accomplishments are VPs consisting of a transitive verb and a singular count direct object (DO) that is essential to specifying the requisite terminus. In other examples of accomplishments, this function may also be carried by the subject argument or some adjunct XP (Verkuyl 1972; 1993; Declerck 1979; Dowty 1979; 1991). Some examples illustrating these points are given below:

(63) John drew a circle/made a chair/ate a bagel. DO

(64) a. At the turtle race, the winning turtle crossed the finish line in 42 seconds. subject
(Dowty 1991, 671)

b. John entered the icy water (very slowly).
(Dowty 1991, 570 and fn. 15)

c. The crowd exited the auditorium (in 21 minutes).
(Dowty 1991, 570)

(65) a. John walked {a mile/to the park}. adjunct
b. John drove a truck into the ditch.

That the accomplishment (telic) interpretation of the above VPs and sentences cannot be due (just) to their main lexical verbs can be clearly shown by the observation that the same (classes of) verbs are used with equal ease also in activity (atelic) predications, when they are combined with bare plural or mass arguments in the argument DPs or adjunct XPs:

(66) John only ate {bagels | soup for lunch} for weeks on end/#for a week. DO

(67) Panicky crowds exited the stadium in frantic droves for an hour/#in an hour. subject

(68) a. The team flew into different cities for a month/#in a month. adjunct
b. The plane flew over water for two hours/#in two hours.

A similar alternation between telic and atelic interpretations of complex predicates obtains with achievement verbs, when they combine with singular count versus bare plural or mass arguments, for instance:

(69) a. John discovered the buried treasure in his back yard #for six weeks. (Dowty 1979)
b. John discovered {fleas on his dog | crabgrass in his backyard} for six weeks.

(70) a. John discovered that quaint little village #for years. (Dowty 1979)
b. Tourists discovered that quaint little village for years.

(71) a. The guest arrived at the hotel in an hour/#for an hour.
b. Guests arrived at the hotel *in an hour/for an hour.

Moreover, a contrast like that between *draw a circle* (accomplishment/telic) and *push a cart* (activity/atelic) shows that a singular count DO is not sufficient for telicity of a complex predicate. Rather, one of the necessary determining factors for the accomplishment/telicity of a verbal predicate is the lexical aspectual class of its main lexical verb. In addition, in English, for instance, VPs that contain a singular count DO can be either telic or atelic, due to ambiguity or polysemy of the main verb, as well as their context of use, as Bennett and Partee (1972) observe:

(72) a. to play a sonata telic
b. to play a piano (= to perform on a piano) atelic

(73) a. to keep (= to hold to) a promise atelic
b. to keep (= to make good) a promise telic

Based on such examples, three main conclusions are drawn. First, Vendler's (1957) *aspectual classes* are not just properties of surface verbs, contrary to his claim (Dowty 1979, 62), but they are also properties of VPs and Ss.

Second, one and the same verb form can be used with equal ease in telic or atelic predications. One of the main puzzles and challenges for the theory of lexical aspectual classes is to make correct predictions about the ways in which the (a)telicity of VPs and sentences arises from the aspectual properties of *verbs* (taken as lexical items) interacting with their nominal arguments and adjuncts, modulo pragmatic factors.

Third, in English, telicity is a constructional property of VPs, and also of sentences. That is, in accomplishment predicates and also in many culminations, the terminus is lexically specified externally to the main lexical verb. This seems

to be true for accomplishments in a number of natural languages. Whether accomplishments are systematically expressed by simple root verbs in any language is an open question (Kratzer 2004).

Such conclusions raise fundamental questions about the inherent aspectual class of verbs and their integration into larger linguistic units. Among the main options that have been explored are:

(74) i. lexical entries of verbs are not specified for aspectual classes, but instead are categorized with respect to aspectually relevant properties or features from which aspectual classes are derived at the level of larger linguistic units (VPs and Ss);
ii. verbs as lexical items are specified with respect to aspectual class, but single lexical items are associated with multiple lexical entries (ambiguity) or senses (polysemy), which may be related by general lexical rules to capture systematic relations among them;
iii. verbs as lexical items are specified with respect to aspectual class, but undergo semantic type shifting, sort shifting, or coercion operations that generate new meanings from single basic lexical meanings, possibly involving formation rules with zero morphology.

6.3 Aspectual composition

6.3.1 Philological precursors

Observations related to systematic interactions and constraints between verbs and nominal arguments that induce what we today understand as (a)telic interpretations of complex predicates can be found in philological studies as early as the nineteenth century (for a historical perspective see Verkuyl 2005, also Kratzer 2004). Garey (1957), who coined the term "telic," observed that telicity of a VP may depend on the count/noncount properties of its verb's argument, and consequently a VP and its head verb may differ in their telic/atelic feature (examples adapted from Mourelatos 1978, 204):

(75)	a.	play	atelic (activity) V
	b.	He played a Mozart sonata.	count DO $\rightsquigarrow$ telic VP
	c.	He played a little Mozart.	noncount DO $\rightsquigarrow$ atelic VP

Focusing on French, Garey (1957) formulates the intuition behind aspectual composition:

> If there is a direct object, and if this object designates something that has a structure with a temporal ending to it – a game of chess or of tennis, a Beethoven sonata – the expression verb-plus-object is telic. In the contrary case, if the complement of the verb is atelic – aux échecs 'chess', du violon 'the violin', du Beethoven 'some Beethoven' – or if there is no object … the expression is atelic. (Garey 1957, 107)

Leech (1969, 137) speaks of "semantic concord" in such cases.

6.3.2 Verkuyl: telicity of VPs and sentences via the internal DO argument

The term "aspectual composition(ality)" was coined by Verkuyl (1971; 1972), who also offered the first analysis of this phenomenon in contemporary linguistics. It is couched in a feature-based framework of Generative Semantics (see also Verkuyl 1989; 1993 and elsewhere).[22] Verkuyl's aspectual composition rule, in one of its formulations, roughly amounts to the following: If a V is marked with the [+ADD TO] feature (which marks eventive or dynamic verbs, in contrast to [−ADD TO] marking stative verbs), then the nominal [+SQA] (Specified Quantity of A(rgument)) feature of one of its arguments yields a terminative (i.e., telic) VP or a terminative sentence; otherwise, the VP or sentence is non-terminative (i.e., atelic).

(76)	eat	three sandwiches
	[+ADD TO]	[+SQA] ⇒ [+TERMINATIVE]
	want	three sandwiches
	[−ADD TO]	[+SQA] ⇒ [−TERMINATIVE]

The semantic information "(un)specified quantity of *x*" is directly or indirectly linked to the time axis, which allows for the quantities of *x* to be expressible in terms of linearly ordered sets of temporal entities (Verkuyl 1972, 111). Hence, the general rule for aspectual compositionality is also applicable to VPs and sentences with motion verbs and performance verbs:

(77) a. walk (*from the train station to the university) for an hour
b. play (cello concertos/*a cello concerto) for an hour

A key insight of Verkuyl's theory of aspectual composition(ality) is that telicity is a "constructional" or syntactic property that is introduced in the formation of VPs and sentences following a general rule schema. It is governed by the constraint that telicity can only arise in the context of an (internal) DO argument marked as [+SQA]. Therefore, only transitive or unaccusative verbs can induce telicity of a VP or a sentence; if the verb is transitive, then its subject must also be [+SQA], because a single negative feature in a given sentence yields the composite feature [−TERMINATIVE]. This has a profound consequence for the nature of telicity and aspectual classes in the grammar of natural languages: namely, telicity is a property of VPs and sentences, and verbs as lexical items are unspecified for the telic/atelic distinction; there is no place for *lexical aspectual classes* in the grammar of natural languages.

Subsequently, the (internal) DO argument plays a central role in defining telicity in syntactic approaches to aspectual classes and grammatical aspect (Tenny 1987; 1994; Travis 1991; Pustejovsky and Tenny 2000; Kratzer 2004; Borer 2005, and references therein; among others). The contribution of lexical meanings of verbs is either minimized (as in Verkuyl), or the lexical meaning of verbs is "invisible" to the workings of (an inflectional head above VP linked to) telicity, or verbs can project into any aspectually defined syntactic (VP) configuration, provided they are compatible with it, but how exactly it is ensured is left unexplained. A major

problem with such theories is that generalizations about the interactive effects of verbs with nominal arguments that generate (a)telicity may appear accidental in some cases, and more importantly, overgeneralize in a significant number of cases. For instance, Verkuyl's aspectual composition rule predicts a telic interpretation for all VPs and sentences that contain only positive [+ADD TO] and [+SQA] features. This, however, is not borne out. Consider the two sentences below, which only differ in their main lexical verbs, *eat* and *carry*. The difference in telicity between these two sentences must, therefore, be due to a difference in the lexical meaning of their main lexical verbs.

(78) a. Kim carried two bagels/all the bagels/a bowl of soup *in an hour. atelic
b. Kim ate two bagels/all the bagels/a bowl of soup in an hour. telic

However, there is no mechanism in Verkuyl's theory to capture this difference, because both *eat* and *carry* are assigned the same episodic [+ADD TO] feature, which predicts that both should yield a telic VP, given that both are combined with a DO argument marked with the [+SQA] feature. This overgeneralization problem carries over to many current syntactic theories of aspect in which the telic/atelic distinction is taken to be a property of an aspectual syntactic configuration, often having a functional projection above the VP (see Borer 2005 and references therein), and in which the contribution of the lexical semantics of verbs is minimized or even excluded.

One of Verkuyl's (1999, and references therein) important insights is that natural languages parametrically differ in the source of the [+SQA] feature assigned to the (internal) DO argument. In English, for instance, the [+SQA] feature is determined by the constituents of the (internal) DO argument. In Russian (and most other Slavic languages), the DO may acquire its [+SQA] feature from the verbal prefix on a perfective verb, on the (not entirely uncontroversial) assumption that perfective verbs uniformly denote telic predicates (see also Bertinetto 2009; Filip 2017; among others). For Russian, this idea was fully developed in Schoorlemmer (1995; 2004). However, she also argues that there are Russian perfective verbs the telicity of which cannot be derived through agreement with an internal DO argument, contrary to Verkuyl's original aspectual composition rule. A case in point is the class of Russian semelfactives, which are marked with the suffix *-nu-*, as in *prygnut'* 'to jump once'. They are perfective, but lack an internal DO argument. Consequently, for Russian, there are two distinct sources of perfectivity/telicity: grammatical (compositional) and lexical. The latter concerns verbs which are always telic regardless of the type and presence of the internal direct object argument.

As Filip (1992; 2000; 2004; 2005) argues, and also others more recently, the telicity of Slavic verbs is not predictably linked to a set of prefixes with which they are formed. Prefixes occur on perfective verbs which are not telic insofar as what they denote has no terminus or result; moreover, prefixes are used to form imperfective verbs, which prima facie speaks against the view that prefixes are markers of perfectivity. Slavic telicity is a property of verbs taken as lexical items. In contrast,

in English, telicity is largely a constructional property of VPs and sentences (see, e.g., Filip and Rothstein 2005).

6.3.3 Krifka: the mereological approach to aspectual composition

Krifka (1986; 1989; 1992) argues that aspectual composition has its source in the lexical meaning of a well-defined class of episodic verbs: namely, verbs that have as a part of their meaning structure-preserving mappings between the mereological part structure (lattice structure) associated with their eventuality argument and the part structure of their Theme argument (see Krifka 1998, section 4.2, for the mereological formalization of the mappings). Some examples are: *eat*, *drink* (verbs of consumption), *burn*, *consume* (verbs of "destruction"), *build*, *compose* (verbs of creation).

Take, *eat an apple*, for instance. In the simplest terms, *eat an apple* entails an isomorphism (one-to-one mapping) of subparts of an apple and an eating eventuality of that apple. The apple gradually disappears, and each bite from the apple corresponds to one subevent of eating of that apple. Mereologically speaking, *eat* in *eat an apple* maps every part of an eventuality of eating of an apple to exactly one proper part of that apple (*mapping to sub-objects*), and it also maps each subpart of that apple into exactly one unique proper sub-event of eating that apple subpart (*uniqueness of sub-events*). In addition, verbs like *eat* entail two further key mapping properties, namely *uniqueness of objects* and *mapping to sub-events*, which together amount to an isomorphism of subparts, a one-to-one mapping, and characterizes a class of "strictly incremental" relations (Krifka 1998, 213, ex. 51). The argument for which a verb entails these four mappings has the property of a "Strictly Incremental Theme."[23]

Closely related is the class of verbs like *read*, *examine*, *iron*, *wash*, *comb*, *polish*, *explain*, *decorate*, and verbs like *perform*, *copy*, *memorize*, *photograph* (which take what Dowty 1991 dubs a "representation-source theme"). *Read*-type verbs are incremental, but not strictly, because they entail no one-to-one mapping of subparts. The object denoted by their Theme argument undergoes a change in distinguishable separate sub-events, but one and the same object token denoted by their Theme argument and its subparts can be subjected to the same type of eventuality more than once. For example, put simply, while you can eat a given apple at most once, you can read a given book, and its subparts, more than once. Therefore, for *read*-type verbs we cannot assume *uniqueness of events*.

An argument for which a verb entails (strictly) incremental structure-preserving mappings is lexicalized as the direct object or the subject of that verb. Given the mappings, aspectual composition straightforwardly follows, on the assumption that predicates of objects and eventualities are of either a quantized or a cumulative type (defined above):

(79) *Aspectual composition* (Krifka 1986; 1989; 1992)
When the Incremental Theme is cumulative, the whole predication is cumulative (atelic); when the Incremental Theme is quantized, the predication is quantized

(telic), provided ϕ is a singular predication, i.e., the existential closure over the eventuality argument *e* is not a plural quantification:
$\phi = \lambda e \exists x\, [\alpha(e) \wedge \delta(x) \wedge \text{Incremental\_Theme}(e, x)]$

(adapted from Krifka 1992)

ϕ is quantized/cumulative if δ is quantized/cumulative
Example: $[\![\textit{eat two apples}]\!] = \lambda e.\ \exists x\, [\text{eat}(e) \wedge \text{two-apples}(x) \wedge \text{Incremental\_Theme}(e,x)]$
'a set of sums of eating eventualities to the amount of two apples'

If *eat* is a strictly incremental relation, and given that *two apples* is quantized (i.e., it does not have proper parts which are two apples), it follows that *eat two apples* is quantized, and hence also telic (i.e., none of its proper sub-events is an event of eating of two apples). All quantized verbal predicates are telic, but not vice versa (Krifka 1998). It also follows that *eat soup/apples* is cumulative (atelic), given that bare mass and plural terms like *soup* and *apples* are cumulative (Link 1983). Therefore, incrementality does not guarantee quantization (telicity).

Krifka's mereological theory of aspectual composition also predicts when there will be no interactions or mutual constraints between verbs and their nominal arguments. In the following examples, both the VPs are atelic, which follows given that *carry* is non-incremental, and therefore there is no structure-preserving mechanism to "transfer" the quantization or cumulativity property of its DO argument to the whole VP. As *carry* is atelic, the VP is then atelic, as well.

(80) a. Kim carried two bagels/all the bagels/a bowl of soup *in an hour. atelic
b. Kim carried water to the pilgrims from a nearby spring *in an hour. atelic

Among the innovations of Krifka's mereological theory, there are two that made a profound impact on the theory of aspect. First, telicity and atelicity are explained in a novel way in terms of quantization and cumulativity, respectively. One guiding intuition behind this idea is that what it means for a predicate to be telic concerns its inherent individuation criterion, its "direct or intrinsic countability" (Mourelatos 1978, 429–430), in analogy to what makes a noun count (*three cats/#three muds*). In this respect, Krifka (1986; 1989; 1992; 1998) follows Bach's (1986) mereological event semantics program, which subscribes to an alternative perspective on telicity to the older one (influential since Vendler 1957; Garey 1957; and Dowty 1979; among others), according to which telicity is characterized in terms of some terminus, culmination, result or other outcome.

However, unlike Bach (1986), Krifka argues that the individuation and countability properties of predicates are not reducible to atomicity. For verbal predicates, the reasons are as follows (e.g., Krifka 1998; 2001):

(81) a. Atomicity does not guarantee telicity:
e.g., *eat apples* is atelic, but given that *apples* denotes atoms and their sums, via aspectual composition, the predicate *eat apples* applies to atomic eventualities (each involving one apple) and their sums.

b. Nonatomicity does not guarantee atelicity:
e.g., *eat a bowl of soup* is telic, but *a bowl of soup* would be treated as mass and nonatomic in Bach (1986), all else being equal.

The recasting of the telic/atelic distinction in terms of the mereological quantization/cumulativity distinction implies that they are mutually incompatible notions, and not each other's opposites, because quantization and cumulativity are mutually incompatible notions. In contrast, most theories of aspectual classes focus on what it means for a predicate to be telic, and assume that atelic predicates fail to have the relevant property. Occasionally, atelicity is analyzed in terms of homogeneity which positively characterizes process and state predicates, while event predicates are nonhomogeneous (Verkuyl 1993; Piñón 1995; de Swart 1998). This in effect amounts to grounding the telic/atelic distinction on homogeneity, but there are several reasons for rejecting this idea. Strictly, speaking, homogeneity only holds for states, as has been shown above (section 5). With processes (aka activities), homogeneity raises the minimal-parts problem. Even if we had a proper solution for it (which we do not, as far as we know), homogeneity would have to be defined differently for processes and for states. This in turn would complicate the statement of the conditions for the application of modifiers and operators that select for both process and state predicates. For instance, it would complicate the application condition of *for*-adverbial temporal modifiers (see above). Among the reasons why defining atelicity in terms of homogeneity is not viable, we may also mention predicates that contain vaguely quantified Incremental Theme arguments, like *eat a lot of soup in an hour/*for an hour*. Such predicates behave like telic predicates, as they are compatible with *in an hour*, and yet they satisfy both the defining properties of homogeneity, namely, cumulativity and divisivity (albeit only down to certain sufficiently large subparts).[24]

The second main insight of Krifka's mereological approach is the idea that eventualities can only be *indirectly measured*, in contrast to objects that can be *directly measured* (see also Krifka 1990). Concrete material entities like apples or sugar possess some measurable property like volume or extent, with respect to which they can be measured and individuated into discrete countable quantities (for details see Sutton and Filip 2016; Filip and Sutton 2017, and references therein). Formally, this can be represented by applying extensive measure functions like POUND, HOUR, MILE to cumulative predicates of objects:

(82) Direct measurement of objects: $x \rightarrow \mu(x)$,
where μ is a free variable over measure functions like POUND, HOUR, MILE
Example: $[\![\textit{a pound of sugar}]\!] = \lambda x[\text{SUGAR}(x) \wedge \text{POUND}(x) = 1]$

In contrast, eventualities per se have no measurable dimension as part of their ontological makeup (see also Zucchi 1999; Kratzer 2004).[25] Eventualities in the denotation of verbal predicates can be indirectly individuated as discrete countable entities via measure functions which are induced on them by measure

functions on times and paths. This is done by a structure-preserving mapping *h*, which establishes a mapping between the part structure of an eventuality and the part structure of some measurable dimension of an entity to which they are related (see also Krifka 1990).

(83) Indirect measurement of eventualities via "object-induced measures":
$e \rightarrow h(e) \rightarrow \mu(h(e))$
h: free variable over structure-preserving mappings between the lattice of eventualities and another lattice to which some measure function μ is applicable, for example, run times measured by the temporal trace function τ, paths measured by the path trace function π.

The structure-preserving mapping *h* can be an entailment of a verb (*eat*, *read*) for its (Strictly) Incremental Theme argument, and it may also arise from the interaction of other lexical material in a sentence with pragmatic factors. The algebraic device of structure-preserving mapping *h* allows us to motivate a variety of ways in which accomplishment predicates are constructed. For instance, we can individuate eventualities via their temporal trace (*sleep for two hours*), that is, we can use measure functions on times (e.g., HOUR) as derived measure functions on eventualities based on the temporal trace function τ, or measure functions on paths (e.g., MILE) as derived measure functions on eventualities based on the path trace function π:

(84) a. $[\![\textit{sleep for two hours}]\!] = \lambda x,e[\text{SLEEP}(e) \wedge \text{THEME}(e,x) \wedge \text{HOUR}(\tau(e)) = 2]$
'a set of sums of sleeping events to the duration of 2 hours'
b. $[\![\textit{walk a mile}]\!] = \lambda x,e[\text{WALK}(e) \wedge \text{AGENT}(e,x) \wedge \text{MILE}(\pi(e)) = 1]$
'a set of sums of walking events to the amount of one mile'

6.3.4 Revision of aspectual classes and scales

Krifka's theory of aspectual composition is predicated on the assumption that quantization (telicity) and incrementality (structure-preserving mappings) are independent of each other:

(85) *Incrementality does not guarantee quantization (telicity)*

a.	Kim ATE [= strictly incremental relation] apples/soup *in an hour.	atelic
b.	John PERFORMED [= incremental relation] sonatas *in a year.	atelic

(86) *Incrementality is not a consequence of quantization (telicity)*
Quantized predicates that are not incremental: *make a dot, notice, find, recognize*

If incrementality and telicity are independent of each other, and if all verbs have lexical entries specified for an aspectual class, this raises the following question: what is the aspectual class of (strictly) incremental verbs?

Filip (1989 and elsewhere) argues that (strictly) incremental verbs are lexically unspecified with respect to the telic/atelic distinction, and, of course, also the quantized/cumulative distinction. Quantization is treated as a binary/equipollent

feature, [+quantized], [−quantized] and underspecification as a third option [±quantized] (see Filip 1993; 1999, section 3.7):

(87) [−quantized] states: *believe*, *know*, *be a hero*, *sit*
processes: *smile*, *walk*, *rain*, *push*, *carry*
[+quantized] events: *notice*, *recognize; flash (once)*
[±quantized] incremental eventualities:
(i) strictly incremental *eat*-type: *eat*, *burn*, *build*, *write*
(ii) incremental *read*-type: *read*, *perform*, *examine*, *iron*, *wash*

(Strictly) incremental verbs are neither [+quantized] nor [−quantized], and so neither telic nor atelic, nor ambiguous between the two. Rather they constitute a new aspectual class, in addition to processes, events, and states in the sense of Bach (1986), characterized by structure-preserving mappings, aka incremental relations. (strictly) incremental verbs cannot be assimilated to atelic processes (aka activities) like *carry*, *push*, *smile*, *dance*, because these entail an indefinite change of state in one of their arguments, but no structure-preserving mappings. If (strictly) incremental verbs were assimilated to atelic processes, the difference in telicity that we see below between sentences headed by *carry* and those headed by *eat* could not be explained:

(88) a. Kim carried two bagels/all the bagels/a bowl of soup *in an hour. atelic
b. Kim ate two bagels/all the bagels/a bowl of soup in an hour. telic

Second, (strictly) incremental verbs cannot be identified with telic verbs, at least not in English and other Germanic languages. The reason is that verbs (taken as lexical items on their own) that are telic here correspond to Vendler's achievements like *notice*, *find*, *recognize* (Filip 2004; Kratzer 2004). They denote events that are conceptualized as having no proper parts, and consequently cannot be incremental (barring the trivial case of a structure-preserving mapping between an event as a whole and the relevant whole "object"). This also means that (strict) incrementality is not a consequence of telicity, contrary to Higginbotham (2000). Neither can (strictly) incremental verbs be identified with accomplishments, because being an accomplishment is a property of VPs in Germanic languages, perhaps in most other languages (Kratzer 2004). (But see Bar-el 2005; Bar-el, Davis, and Matthewson 2005.) It makes no sense to speak of "lexical accomplishments" with respect to VPs like *eat an apple*, *build a house*, *read a book*. Neither does it make sense to speak of "lexical accomplishments" with respect to verbs like *knit*, *read* on their own, given that as such they behave like atelic verbs: *knit/read for two hours/?in two hours*. (*Eat in two hours* is perfectly acceptable, because it is conventionalized to mean 'eat a meal in two hours'.)

Third, (strictly) incremental verbs cannot be viewed as ambiguous between a telic and an atelic sense, and having this ambiguity resolved by their direct object argument (see also Filip 2011; 2012), contrary to Higginbotham (2000):

(89) *Higginbotham (2000)*

a. telic *eat (<e1,e2>)*: For some α/X
e1 is a process of eating directed toward α/X;
e2 is the state of α's/measure $\mu_K(X)$ being properly inside the agent.

b. atelic *eat (e)*: For some α, *e* is a process of eating directed toward α.

Just as it is unmotivated to treat *eat* as causative when its Incremental Theme argument is quantized, and noncausative otherwise (Levin 2000), so it is unmotivated to postulate a telic sense for *eat* for when its Incremental Theme argument is quantized, and an atelic sense otherwise. Moreover, Higginbotham's (2000) ambiguity proposal for *eat* taken to its logical conclusion would require a massive proliferation of lexical telic/atelic ambiguity for English stem verbs, given that a large number can be used in a telic or an atelic predication depending on the properties of arguments with which they combine.

The above three considerations, among others, lead me to conclude that (strictly) incremental verbs constitute an aspectual class *sui generis* (Filip 1993; 1999). At the same time, it is important to emphasize that incremental object–eventuality relations may have varied verb-external sources. As Krifka (1986; 1992) and Dowty (1991) observed, what counts as the requisite "incremental participant" (Krifka 1998) need not be syntactically realized as a single argument, direct object (*knit a sweater/sweaters*), subject (*John entered the icy water*), or an adjunct (*walk a mile*). For instance, in sentences with directed motion predicates, the "incremental participant" is the implicit path whose end point is referred to by the Goal-PP, *to Paris* and *into the living room* in the example below:

(90) Sam drove to Paris/waltzed into the living room.

The structure-preserving mappings then hold between the part structure of eventualities and the part structure of the path.

The mappings may also involve the part structure of an implicit scale that measures a property, such as consistency, of the referent of a Theme argument, and whose upper bound may be expressed by the result XP:

(91) The candy bar melted into a gooey mess./The water {cooled to 10°C | froze solid}.

In (92a) and (92b), the relevant scale may be viewed as an abstraction over a diagnostic examination consisting of ordered examination steps (Filip 1993; 1999), or an education course consisting of the successive stages one goes through to reach the architect status (Dowty 1991):

(92) a. The doctor examined the patient (in an hour).
(Filip 1993)

b. John was becoming an architect but was interrupted before he could finish his degree.
(Dowty 1991)

A scale whose part structure stands in structure-preserving (incremental) relations with the part structure of an eventuality may also be lexically associated with the numerical phrase, such as *17 zebras* in the example below, which functions as an argument of a verb, such as *see*, that does not denote an incremental relation:

(93) Mary saw 17 zebras (in 3 minutes).

(adapted from Krifka 1992)

Although Krifka and Dowty acknowledge that incremental relations that are used in deriving the telicity of VPs and sentences may have other sources than the lexical entailments of (strictly) incremental verbs, they do not try to integrate this insight into their theoretical apparatus. Given this insight, Filip (1993; 1999, ch. 3) argues for extending the source of incremental relations from verbs to grammatical constructions, which amounts to the claim that incremental relations have two sources in the grammar of natural languages:

(94) i. an entailment of a well-defined lexical aspectual class, (strictly) incremental verbs, as in Krifka's (1986; 1989; 1992) and Dowty's (1989; 1991) theories;
ii. an entailment or implicature associated with certain grammatical constructions (in the spirit of Fillmore, Kay and O'Connor 1988). They have as a part of their meaning structure-preserving mappings between the lattice structure associated with the denotation of their eventuality argument and the lattice structure associated with a SCALE with respect to which successive stages of described eventualities can be distinguished, and which generalizes over:
(α) paths in a physical or "representation-source" domain, or
(β) degrees to which a participant possesses a gradable property.

The division of labor between these two sources of incremental relations is motivated by the different ways in which they influence the ways in which (a)telic interpretations of complex predicates are derived. Only when incremental relations are entailed for a single (Strictly) Incremental Theme argument of a verb, which is lexicalized as the direct object or subject, is the telic/atelic interpretation of the predicate a result of aspectual composition, that is, determined by compositional rules working on syntactic structures and the meanings of their constituents. In this case, semantically speaking, the (a)telic interpretation of complex predicates directly depends on the quantization/cumulativity properties of a (Strictly) Incremental Theme argument whose part structure, which tracks its extent/volume, stands in incremental relations to the part structure of the eventuality argument.

In contrast, as Filip (1993; 1999) argues, incremental relations which are an entailment or implicature of grammatical constructions involve a scale which is construed from the lexical material of a grammatical construction, and possibly also in interaction with contextual factors. The incremental relations holding between the parts of the scale and the parts of described eventualities are a property of grammatical constructions, which allow us to integrate (lexical) semantic, syntactic, and pragmatic information in the calculation of telic and atelic readings of complex predicates. The main burden of the analysis is on identifying the appropriate scale.

6.3.5 Quantization puzzles and context-sensitivity of telicity

Telicity cannot be reduced to quantization pure and simple, as originally defined by Krifka (see (55) above). Among the problems, let me briefly mention three. First, there are telic predicates that fail to be quantized, which in English include directed motion predicates like *drive to Boston*, and degree achievements based on closed scale adjectives like *darken*. If they apply to an event *e*, then they will also apply to the latter half of *e*, hence they turn out not quantized (according to (55)). In order to solve this problem, (Krifka 1992, 36; 1998, 207, ex. 37) proposes a notion of telicity which is weaker than his quantization: namely, a telic predicate P applies to events *e* such that all parts of *e* that fall under P are initial and final parts of *e*.

Second, there are complex predicates that are built with (Strictly) Incremental Theme arguments that fail to be quantized (when analyzed in isolation), and therefore should not yield quantized predicates by aspectual composition, as given in (79). Nevertheless, they behave like quantized predicates with respect to the diagnostic temporal adverbials:

(95) a. Kate wrote [$_{\text{NON-QUANTIZED}}$ a sequence of numbers] #for 10 seconds/in 10 seconds.
b. Kate drank [$_{\text{NON-QUANTIZED}}$ at least three bottles of wine] #for an hour/in an hour.
c. Kate ate [$_{\text{NON-QUANTIZED}}$ many apples/a lot of bread] #for an hour/in an hour.

This quantization puzzle arises in two cases. First, the NP/DP that saturates the (Strictly) Incremental Theme argument is grammatically singular count (e.g., *a sequence of numbers*), but fails to be quantized, because its head noun (*sequence*) lexically does not determine once and for all what is one entity in its denotation (Partee p.c. to Krifka; Zucchi and White 1996; 2001). Second, the NP/DP in the (Strictly) Incremental Theme argument slot fails to be quantized on its own due to its determiner phrase.[26] Salient examples include vague determiner quantifiers like *many*, *a lot*, *(a) few*, *some*, and *most*, and cardinal numericals combined with approximative modifiers like *at least/at most*.

Zucchi and White (1996; 2001) focus on indefinite NPs/DPs that raise this quantization puzzle, and propose to solve it by treating all such indefinite NPs/DPs as denoting Maximal Participants in a given eventuality, that is, they introduce the largest individual in the denotation of an indefinite NP/DP participating in an eventuality described by the relevant VP at the reference time *t*. This solution, however, makes a wrong prediction about the range of admissible readings for atelic sentences like the one below. As Rothstein (2004) observes, it wrongly predicts that the object satisfying the indefinite description must be the same Maximal Participant in the course of the 20-year interval. That is, on this implausible reading, the sentence is true just in case the same three children were carried on the bicycle during the interval of 20 years:

(96) This bicycle carried three children around Amsterdam for 20 years.
(Rothstein 2004)

Third, there are (Strictly) Incremental Theme arguments that are quantized (according to (55)), and yet they do not force a quantized interpretation on the predicate, contrary to aspectual composition, as given in (79). That is, a complex predicate may have an interpretation that is not quantized (atelic) in an appropriate context, despite being composed with a quantized (Strictly) Incremental Theme argument (Filip 1993; 1999; Partee 1999; Filip 2004; Kratzer 2004):

(97) a. Bill ate the apple bit by bit for 10 minutes (and still didn't finish it).
(Jackendoff 1996)

b. She ate the sandwich in 5 minutes/for 5 minutes.
(Hay, Kennedy, and Levin 1999)

(98) a. He read a book in/for an hour.
(Fillmore 1971, in Dowty 1979, 61)

b. Kim polished the silver tray in 5 minutes/for 5 minutes.

c. He washed the car in 30 minutes/for 30 minutes.

As Filip (2008) argues, the derivation of a quantized (telic) verbal predicate by aspectual composition (79), that is, of a verbal predicate that is obligatorily quantized (telic) consistently in all its occurrences, occurs under rather narrow conditions: its main lexical verb is a strictly incremental relation whose Strictly Incremental Theme argument slot is saturated by a DP that contains some expression of quantification, cardinality or measure, provided the predicate describes singular episodic eventualities: for example, *eat three apples in an hour/*for an hour*.

7 Scales and paths

Starting with Vendler (1957), aspectually relevant properties have been considered largely or even exclusively properties of time intervals and instants. Aspectual classes are commonly viewed as constraints on "temporal contours" entailed by predicates of eventualities. Bach's (1981; 1986) and Krifka's (1986; 1989; 1992, and elsewhere) enrichment of event semantics with mereology brought about a shift in the grounding of aspectually relevant properties to nontemporal mereologically defined notions and relations: quantization/cumulativity, measurement (by extensive measure functions), incremental relations (aka structure-preserving mappings).

Subsequently, debates centering on the context-sensitivity of telicity led to extension of the inventory of aspectually relevant properties to further notions that are not time-based. They prominently include properties based on the notion of scale (Filip 1993; 1999; Hay, Kennedy, and Levin 1999; Filip and Rothstein 2005; Beavers 2008; Filip 2008; Kennedy and Levin 2008; Rappaport Hovav 2008; Kennedy 2012) and the topological adjacency path relations (Krifka 1990; 1998; Beavers 2012; 2013). Such developments stimulated new venues of research in lexical aspect and in the interface between lexical semantics and syntax, and solidified the recognition that a purely temporal grounding of aspectual properties is insufficient in motivating empirically adequate taxonomies of aspectual classes.

One unifying thread behind recent semantic analyses of telic and atelic predications is that there are some kind of structure-preserving relations between an eventuality argument and one other semantic argument with respect to which the progress of that eventuality can be tracked, and also its upper bound determined, possibly in interaction with context. The nature of such relations depends on the lexical semantic properties of the main lexical verb. Three main cases have been distinguished (early suggestions can be found in Tenny 1987; 1994):

(99) i. (Strictly) incremental verbs entail relations between the parts of an eventuality and the parts of an object (denoted by their Theme argument), whereby the changes in its extent/volume track the progress of that eventuality.
   a. Kim ate 3 hamburgers in 10 minutes. aspectual composition
   b. Kim read three books in a week.

ii. With motion verbs, we have figure/path constellations, and the structure-preserving relations obtain between the parts of an eventuality and the parts of a path. The path is implied by a locative measure phrase, Source- or Goal-PP, and the changing location of the figure along the path tracks the progress of that eventuality.
   a. Sam drove 500 miles/from Boston to New York.
   b. We flew over the lake in an hour/over water for hours.
   (Talmy 1985)
   c. Kim crossed the desert/hiked the Appalachian Trail.

iii. With degree achievement verbs, aka scalar verbs and "latent incremental theme verbs" (Levin and Rappaport Hovav 2005), the structure-preserving relations obtain between the parts of an eventuality and the parts of a scale that measures the degree to which some property (other than extent/volume) holds of a Theme argument:
   (α) *degree achievement verbs* aka *scalar verbs*
      a. We cooled the metal from 90°C to 20°C/for an hour (hot–cold scale)
      b. The room darkened. (light–dark scale)
      c. The temperature rose in/for six days. (hot–cold scale)
   (β) a. John wiped the table clean. (clean–dirty scale)
      b. The snow melted in/for six days. (solid–liquid scale)
      c. The doctor cured/examined the patient (in an hour). (healthy–sick scale)
      d. The witch turned Bill into a frog.

It is important to emphasize that (strictly) incremental verbs (e.g., *eat*, *read*) and scalar verbs (e.g., *cool*, *darken*) are two separate lexical aspectual classes, one lexically entailing incrementality and the other lexically associated with a scale. (Strictly) incremental verbs entail structure-preserving mappings that relate two denotational domains, each structured by the mereological part relation "≤" and modeled as a join semi-lattice. The part relation is defined from the mereological sum operation, and it is antisymmetric, transitive, and reflexive, that is, a partial order relation. Such algebraic structures are clearly distinct from the notion of a

scale, which is a total order, a linearly ordered set, or a chain. Scalar verbs are lexically associated with a scale, as all agree, but also they arguably entail incremental relations that hold between the parts of a scale and the parts of an eventuality.

Hay, Kennedy, and Levin (1999), Kennedy and Levin (2008) propose that a variety of telicity phenomena can be analyzed in a uniform way in terms of the notion of a scale that measures a change that a specific participant undergoes in the course of described eventualities. They take degree achievements (DAs) as the basic case, with the intention to extend the account developed for them to other cases. The telic and atelic interpretations of predications with DAs appeals to one major classificatory parameter: namely, whether a DA entails a closed scale or an open scale:

(100) i. a closed scale (a scale with a maximal or a minimum element, or both): *flatten*, *straighten*, *darken*, *empty*, *cross*, *traverse*;
ii. an open scale (a scale that lacks both a maximal and minimum element): *cool*, *widen*, *brighten*, *grow*, *rise*.

DAs lexically associated with closed scales have default telic interpretations, but atelic interpretations are also possible, as we see in the sentences below, where the upper bound of the lexically associated scale can be denied without a contradiction:

(101) a. The sky darkened in an hour (but it wasn't completely dark).
(Kearns 2007)
b. I emptied the tub but not completely.
(Rappaport Hovav 2008)

Open scale DAs have default atelic interpretations, which merely require some change of the referent of their Theme argument but not a change to some specific degree on the associated scale. The stronger telic interpretation requires the context and our world knowledge to fix what counts as the maximal degree of change in the relevant property at a given situation. The telic interpretation depends on whether the referent of the Theme argument has undergone a change which corresponds to a "bounded" *difference value* (a measure of the degree to which an object changes). It may also be expressed by measure phrases denoting quantized quantities like *17 degrees*:

(102) a. The water cooled in/for 10 minutes.
b. The water cooled 17 degrees in/*for 10 minutes.

But notice that DAs with a "bounded" difference value may still be atelic if their Theme is a bare plural or mass argument:

(103) a. The council widened the road by 2 metres in three months.
b. The council widened roads by 2 metres for some years (in order to make room for the new bicycle lanes).
(Rothstein 2016)

Krifka (1998) adds to his original "static" theory (Krifka 1986; 1989; 1992), which he dubs "telicity by sums and parts" (Krifka 1998), a "dynamic" theory of "telicity by precedence and adjacency" (Krifka 1998) in order to account for the telicity of dynamic predicates that express changes in space, as in *Sam drove 500 miles/from Boston to New York*, and in various qualitative properties of objects, as in *We cooled the metal from 90°C to 20°C*. This division is roughly aligned with two types of telicity distinguished in Filip (1993; 1999) (see section 6.3.4 above): namely, telicity induced by (strictly) incremental verbs that trigger aspectual composition (79), on the one hand, and telicity which is a property of grammatical constructions and which is calculated with reference to the part-structure of a SCALE, in interaction with pragmatic factors, on the other hand. In Krifka (1989), "telicity by precedence and adjacency" relies on a notion of a PATH, which is a convex and linear notion enforced by adjacency (Krifka 1998, ex. 15). Temporally adjacent sequences associated with an eventuality are tracked with respect to spatially adjacent segments along a PATH, and the two are related by means of a (strict) movement relation (Krifka 1998, exx. 69 and 71). For example, in *Mary hiked the Vernal Falls Path*, the verb *hike* relates the parts of a path to the parts of an event, which ends when Mary reaches the end of the path. The analysis of motion predicates describing motion of Themes in a physical space provides a basis for the modeling of changes in other domains, an idea which is inspired by the Localist Theory (Gruber 1965, and its offshoots in Conceptual Semantics, Jackendoff 1991; 1996). Result XPs like *clean*, as in *wipe the table clean*, provide end points of property scales which can be assimilated to Goal PPs, as both Result XPs and Goal PPs can be modeled as end points on abstract paths.

Beavers (2012) extends the model of telicity in Krifka (1998) to include a class of ternary figure/path theta relations that allow for double, interdependent Incremental Themes that are implicated in the derivation of (a)telic interpretations of predications that involve complex figure/path constellations. For a predication of this type to be telic, the figure must have quantized reference and the path must be bounded:

(104) a. The earthquake shook a book off the shelf #for/in a few seconds. (Filip 1993; 1999)
b. The earthquake shook books off the shelf for/#in a few seconds.
c. The earthquake shook a book for/#in a few seconds.
d. The earthquake shook books #for/in a few seconds.

Filip and Rothstein (2005), Filip (2008) propose a generalized scalar account of telicity within which the originally central case of telicity derived by aspectual composition (Verkuyl 1971; 1972; Krifka 1986; 1989; 1992; Dowty 1991) is treated as a special case of telicity when a scale is lexically associated *only* with a (Strictly) Incremental Theme argument.[27] The main motivation for such a generalized scalar account is to provide a *uniform* solution to the problem of the quantization puzzle in English, illustrated by examples in (95) (section 6.3.5), and also by parallel puzzles for the semantics of perfectivity in Slavic languages analyzed in terms of

quantization (Filip 2000). Recall that the English quantization puzzle is raised by (Strictly) Incremental Theme arguments that are not quantized, when analyzed on their own, and yet force a quantized interpretation on the predicate. Similarly to Zucchi and White (1996; 2001) (see above), Filip and Rothstein (2005), Filip (2008) rely on the notion of maximization to motivate a quantized (telic) interpretation of verbal predicates.

However, unlike Zucchi and White (1996; 2001) who built maximization into the meaning of the problematic indefinite DPs/NPs by requiring that they uniformly denote Maximal Participants in some eventualities, Filip and Rothstein (2005) treat it as a property of complex verbal predicates. On their account, (Strictly) Incremental Theme arguments, which are not mass or bare plural, introduce a SCALE of objects, on the standard assumption that quantified and (implicitly) numerical DPs are lexically associated with a scale (Gazdar 1979; Levinson 1984). The mechanism of aspectual composition is recast in terms of scalar semantics: the structure-preserving mappings now obtain between the parts of a scale of objects and the parts (and running time) of an eventuality denoted by the complex predicate. The scale of objects induces a total ordering on eventuality stages in the predicate's denotation, which then serves as an input into the maximization operator MAX_E. By pragmatic inference, MAX_E singles out the largest unique eventuality stage leading to the most informative proposition among the relevant stage alternatives at a given context. Such maximal events are properties of quantized (telic) predicates.[28]

As a consequence, on the scalar account of aspectual composition proposed by Filip and Rothstein (2005) and also Filip (2008), complex predicates formed with incremental verbs like *eat* or *read* can be quantized (telic) by aspectual composition just in case their (Strictly) Incremental Theme argument is lexically associated with a scale of objects, which in turn induces a scale on eventuality stages. Such a scalar account of aspectual composition covers unproblematic cases of Krifka–Dowty aspectual composition, as in *eat three apples*, as well as the quantization puzzle cases that it cannot handle, such as *eat at least/at most three apples in an hour/#for an hour* (see examples in (95)).

Moreover, it has the advantage that the recourse to the notion of a scale allows us to generalize the incremental scale–eventuality relations to a variety of telic predicates. The generalized scalar account of telicity in Filip and Rothstein (2005), Filip (2008) may be extended to the core cases of scalar accounts of telicity (Hay, Kennedy, and Levin 1999; Kennedy and Levin 2008) which include the telicity of predicates headed by degree achievements, such as *cool*, *straighten*, and also to directed motion constructions like *walk to the post office* (spatial progress scale) and resultatives like *wipe clean* (cleanliness property scale). Finally, it can capture the observation that virtually all non-incremental verbs have at least some contextually determined uses in which they form complex telic predicates. A good example is *Mary saw 17 zebras (in 3 minutes)* (adapted from Krifka 1992; see also (93) above). While *see* is non-incremental, the numerical phrase *17 zebras* is lexically associated with a SCALE which facilitates a contextually determined telic interpretation of the whole sentence, provided that context also sanctions an incremental relation between the parts of this scale and the parts of the described seeing eventuality.

Notes

1. As some observe (Verkuyl 1971/1972; Dowty 1979, 62; 1991, 571, fn. 15; Declerck 1979), the properties of the subject argument may determine the aspectual class of a sentence. The most compelling evidence comes from sentences headed by inherently transitive verbs, such as *cross*, *pass*, *permeate*, or *enter*: cf. *John entered the icy water in 5 seconds* (Dowty 1991) versus *A steady stream of crowds entered the memorial site for hours*.
2. For Carlson (1977), a progressive verb phrase denotes the property of being an individual such that there is a stage (i.e., manifestation or realization) of that individual of which the basic predicate holds.
3. This idea can be seen as related to Comrie's (1976, 38) proposal that at least a part of the function of the progressive in English is to indicate a contingent situation.
4. Bach (1981) uses '?' to indicate the semantic anomaly or oddity of this sentence: *? John is believing that the earth is flat*.
5. Comrie (1976, 39) marks this sentence with *.
6. Zucchi (1998, 369, fn. 21) marks this sentence with ??.
7. According to Zucchi (1998), **John is resembling his father* is ungrammatical, i.e., he marks it with *.
8. https://www.fanfiction.net/s/13121034/6/Island-of-Pearls-and-Roses, accessed October 15, 2019.
9. https://en.wikipedia.org/wiki/Jacob_Hopewell, accessed October 15, 2019. See also Bach's (1981, ex. 9) *Mary was finding a unicorn*.
10. http://www.jeffhead.com/2013%20Boston%20Bombing/, accessed October 15, 2019
11. On an iterative interpretation, progressive culminations can be modified by *halfway through*: *The BRITS are in full swing, and Adele is halfway through winning all the awards going (she's won two thus far)*. (http://entertainment.ie/music/news/Watch-Adele-publicly-supported-Kesha-during-her-BRITS-acceptance-speech/377611.htm, accessed February 26, 2017).
12. One might speculate that the high conceptual complexity of the associated shifted interpretation that involves both a shift into a multiplicity of events as well as a shift into its onset *at α time* motivates why it may be highly marked and also dispreferred.
13. Three binary features allow us to distinguish 2^3 elements, while two binary features allow us to distinguish 2^2 elements.
14. Having CAUSE in the logical representation is correlated with acceptability in *x finished V-ing*.
15. For sentences like *Casey deliberately/intentionally arrived a few minutes early/late*, Gyarmathy (2015, 170) argues that the intentional adverbial does not modify the arrival, but rather the temporal adjunct, and therefore, such examples do not constitute an argument for the agentive uses/meanings of achievement predicates like *arrive*. It is the lateness/being a few minutes early that is deliberate, not the arrival itself.
16. https://www.reddit.com/r/dwarffortress/comments/1agzxv/the_new_guy_the_manor_or_dangling_last_night_saw/, accessed October 15, 2019.
17. http://fictionaut.com/stories/larry-strattner/johnny-dangerously, accessed October 15, 2019.
18. https://en.wikipedia.org/wiki/Mazhar_Majeed, accessed October 15, 2019.
19. Ryle (1949) drew a similar line between agentive achievements like *win*, "[f]or a runner to win, not only must he run but also his rivals must be at the tape later than he" (Ryle, 1949, 150), and non-agentive "purely lucky achievements" (1949, 151), "which are prefaced by no task performances" (1949, 150) like *hit the target*.

20. See also *Cheng's condition* (Cheng 1973), and its precursors, namely suggestions in Aristotle's *Metaphysics* 1016b17–24; 1052a32) and in Frege (1884, 66).
21. Homogeneity is also used in the sense of divisivity, albeit appropriately constrained to avoid the minimal-parts problem, among others, in Landman and Rothstein (2010; 2012a; 2012b).
22. See Platzack (1979) for another feature-based analysis of aspectual composition.
23. In Krifka's (1986; 1989; 1992) original proposals, this thematic relation is referred to as "Gradual Patient" and "Successive Patient." Dowty (1987, 1991) coins for it the term "Incremental (Path) Theme."
24. Moreover, if we were to state the conditions for the application of *for*-adverbial modifiers in terms of homogeneity (albeit modified for processes), then this would wrongly predict that they can also apply to predicates like *eat a lot of soup*. Hence, defining atelicity in terms of homogeneity is not viable (see also Landman 2008; Landman and Rothstein 2010; 2012a; 2012b).
25. As Strawson (1959) observes, situations in the world do not provide "a single, comprehensive and continuously usable framework" of reference of the kind provided by material objects, which at least partly grounds the mass/count distinction in natural language. See also Davidson (1969) for individuation of events.
26. Related observations were made by Carlson (1981), Mittwoch (1988), Dahl (1991), and Moltmann (1991).
27. A scalar account of incremental theme verbs is proposed in Kennedy (2012).
28. This proposal differs from Zucchi and White's (1996; 2001) solution, discussed in section 6.3.5. It also differs from Rothstein (2004; 2012) who posits a complex accomplishment event which is the sum of an activity event and a structured event of change, where a homomorphism from the event of change to the activity event determines the running time of the event as a whole.

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