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Aspectual classes: past and present^{*}

Abstract

This paper provides an overview of some highly influential aspectual analyses of verbal predicates from the past few decades. First, it discusses Manfred Krifka's mereological approach in some detail. Then, it describes the central assumptions of the more recent scalar approach and some aspectual and argument realization consequences of the scalar – non-scalar contrast in the domain of dynamic verbs. Finally, it offers a brief discussion of why the two approaches should be integrated in future investigations of aspectual phenomena.

Keywords: aspectual classes, mereologies, scales

1 Introduction

The classification of verbal expressions into various aspectual classes has always stood at the forefront of research in lexical semantics. One of the most influential classifications was put forward by Zeno Vendler in his (1957) paper, where four predicate classes are distinguished, namely statives, activities, accomplishments, and achievements. Verbal expressions fall into one of these four classes based on whether or not they are associated with the properties of dynamicity, durativity, and boundedness. The table below illustrates this classification with examples and the three defining properties.

Aspectual Class	Verbal Predicates	Properties of Verbal Predicates		
		dynamicity	durativity	boundedness
Statives	<i>have, like</i>	-	+	-
Activities	<i>play, run, walk, eat</i>	+	+	-
Accomplishments	<i>run to the station, eat two apples</i>	+	+	+
Achievements	<i>find a key, reach the hilltop</i>	+	-	+

Table 1: The Vendlerian classification of verbal predicates

Class membership has important consequences for the grammatical behavior that predicates display. For example, the occurrence of a predicate with various temporal adverbials and its

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interaction with the progressive have both been shown to depend on how the event described by the predicate unfolds (i.e. what characterizes the aspectual structure of the predicate). As for the former, it has been well known since at least Vendler (1957) that predicates describing bounded events are compatible with time-span adverbials, while predicates describing unbounded events are compatible with durative adverbials. As for the latter, it is generally true that predicates describing momentary events (i.e. achievements) cannot be viewed progressively. Also, accomplishments and activities are associated with different entailment relations when expressed with progressive aspect. For more on this and other grammatical reflexes of the aspectual class of a predicate, see, for instance, Kearns (2000).

In this paper I provide an overview of some more recent approaches to the characterization of the aspectual classes or event structures that verbal predicates are associated with. More specifically, my objectives are twofold: (1) to review the mereological approach of Krifka (1998) and the scalar approach (Hay et al. 1999, Kennedy 1999, Kennedy & McNally 2005, Kennedy & Levin 2008, Rappaport Hovav 2008, Levin 2010), and (2) to argue for the integration of these approaches in aspectual analyses of verbal predicates.

The structure of the paper is as follows: In section 2 I provide a somewhat informal discussion of Krifka's (1998) mereological approach to the aspectual structure of verbal predicates. Then, in section 3, I go on to describe the more recent scalar approach, which is in a sense a revision of the mereological approach. In section 4, I give a preliminary description of how the two approaches can be integrated with the aim of accounting for a wide range of aspectual facts.

2 A mereological approach

It has long been known that there is a structural analogy between the denotation of verbal predicates and that of nominal predicates and that quantificational properties of nominal predicates determine the referential properties of verbal predicates. Following Krifka (1989), I illustrate the former by characterizing the referential properties of nominal predicates (and subsequently that of) verbal predicates through the notions of cumulativity and quantization. Specifically, a nominal predicate has cumulative reference if the sum of the denotations of the entities in the denotation of the predicate is also in the denotation of the predicate. For example, *water* and *tea* refer cumulatively since if there are two entities that can be referred to as *water* or *tea*, then the sum of these entities can also be referred to as *water* and *tea*, respectively. In contrast, *chair* and *key* in nominal predicate constructions do not have cumulative reference as the sum of two entities within the denotation of *chair* or *key* is not in the denotation of *chair* or *key*, respectively. Instead, these predicates have quantized reference. The same dichotomy can be observed in the verbal domain. Predicates like *walk* and *run around* resemble nominal predicates like *water* and *tea* since they do not specify how extended the denoted entity is, i.e. they do not specify where the denoted event culminates. Predicates like *reach the hilltop* and *break a chair*, on the other hand, provide specific information as to the endpoint of the events they describe, i.e. the hilltop and the broken state of the chair, respectively.

Related to this is the observation that the quantificational properties of certain nominal expressions determine the denotation of the verbal predicates in which they occur. Consider (1) and (2).

- (1) a. Kate ate apples for 10 minutes/*in 10 minutes.
 b. Kate ate two apples in 10 minutes/??for 10 minutes.
- (2) a. Peter drank beer for 10 minutes/*in 10 minutes.
 b. Peter drank two beers in 10 minutes/??for 10 minutes.

The examples in (1a) and (2a) contain the cumulative nominal expressions *apples* and *beer* and the corresponding verbal predicates *ate apples* and *drank beer* are interpreted as atelic, while the examples in (1b) and (2b) contain the quantized nominal expressions *two apples* and *two beers* and the corresponding verbal predicates *ate two apples* and *drank two beers* are interpreted telically.¹ This correlation between cumulative nominal expressions and atelic predicates, on the one hand, and quantized nominal expressions and telic predicates, on the other, does not obtain in the case of all verbal predicates, as is clear from (3) and (4), where the predicates are interpreted atelically regardless of the quantization properties of the internal arguments.

- (3) a. Kate pushed carts for 10 minutes/*in 10 minutes.
 b. Kate pushed the cart for 10 minutes/*in 10 minutes.
- (4) a. Peter carried apples for 10 minutes/*in 10 minutes.
 b. Peter carried two apples for 10 minutes/*in 10 minutes.

An interesting commonality between the predicates of (1) and (2) is that they all describe events that progress as the referents of their internal arguments disappear bite by bite and sip by sip, respectively, in an incremental fashion. The events they describe culminate when the referents of the incremental theme arguments disappear completely. This culmination point can be determined – and hence the predicates are interpreted telically — just in case the quantity of the incremental theme is specified, as in (1b) and (2b).

The above aspectual characteristics are given a very precise, formal account by Krifka (1989, 1998), who couches his analysis in an event-based semantics (Davidson 1967). He assumes that all entities belong to one of three domains, the domain of objects U_P , the domain of events U_E , or the domain of directed paths U_H . Objects, events, and paths are structured as complete join semilattices without a bottom element (Link 1983, 1987). The lattices are structured by the part relation “ $\leq$ ”, which is defined from the sum operation ($\oplus_P, \oplus_E, \oplus_H$). Entities may be related to each other via the part relation ($x' \leq_x x$), the proper part relation ($x' <_x x$), or the overlap relation ($x' \otimes_x x$). Non-overlapping events in U_E are ordered by a temporal precedence relation ($e' \ll_E e''$) and non-overlapping paths (of motion predicates) are ordered by a spatial precedence relation ($x' \ll_H x''$). If two subevents of motion events are (temporally) adjacent ($e' \infty_E e''$), their respective paths will also be (spatially) adjacent.

At the core of aspectual composition lies the idea that the part structure associated with the incremental theme argument is “reflected” in the lattice/part structure of the event argument (cf. (1) and (2)) thanks to structure-preserving mappings, or homomorphisms/incremental relations obtaining between the part structure of the incremental theme and that of the event argument. Homomorphic relations can be of different types depending on how the events encoded by the head verbs of predicates unfold. Verbs like *eat*, *drink*, and *read*, for instance, are characterizable in terms of encoding Incremental Relations (INCs), while verbs like *walk* and *run* encode Movement Relations (MRs). Movement relations differ from Incremental

¹ This correlation also applies in the motion domain (cf. *Peter walked* and *Peter walked the Appalachian Trail*).

relations in that the former have the properties of temporal and spatial adjacency. Another distinction concerns how restrictive these relations are. Strict Incremental Relations (SINCs) and Strict Movement Relations (SMRs) differ from other incremental and movement relations, respectively, in that they ensure a one-to-one mapping of the subparts of the event and the subparts of the entity that is traversed in the course of the event. For instance, verbs like *eat* and *drink* encode a SINC, which is due to the fact that a given subpart of any eating or drinking event corresponds to exactly one subpart of the incremental theme and any subpart of the incremental theme corresponds to exactly one subpart of the denoted event (i.e. such verbs encode isomorphisms). The same does not apply to verbs like *read*, which encode the looser INC, since it is possible for a subpart of the incremental themes of such verbs to correspond to more than one subevent. For instance, the predicate *read the book* can be applied to events in which parts (e.g. certain chapters) of the incremental theme *the book* are traversed (i.e. read) more than once. Verb like *push* and *carry*, on the other hand, do not encode a homomorphic relation between the part structure of their internal arguments and that of their event arguments and hence the quantificational properties of their internal arguments do not affect the denotation of the predicates headed by these verbs (see (3) and (4)). On this view a predicate is telic if it does not describe any subevent $e' \in U_E$ that does not contain the initial and final subparts of $e \in U_E$. Therefore, the prediction is that the consumption predicate *eat two apples* and the motion predicate *run from the bank to the station* are telic given that they do not describe any proper subevent of the event in their denotation. This is borne out since these predicates are compatible with time-span adverbials like *in 10 minutes* and incompatible with durative adverbials like *for 10 minutes*. By contrast, predicates like *eat apples* and *run around* are predicted to be atelic since there is always at least one proper subevent e' of e that is described by the predicate. This is again true to fact, which is evidenced by these predicates' compatibility with durative adverbials like *for 10 minutes* and their incompatibility with time-span adverbials like *in 10 minutes*. Finally, before I move on to discuss a more recent analysis of the aspectual structure of verbal predicates, I summarize what classes dynamic verbs fall into on the Krifkian view.

Verbs encoding a homomorphic relation		Verbs not encoding a homomorphic relation
Verbs encoding an Incremental Relation (INC): <i>eat, drink, read</i>	Verbs encoding a Movement Relation (MR): <i>run, walk, swim</i>	<i>push, carry</i>
Verbs encoding a Strict Incremental Relation (SINC): <i>eat, drink</i>		

Table 2: The classification of dynamic verbs on Krifka's mereological approach

3 Scales in verb meaning

More recent analyses of the aspectual structure of verbal predicates have proposed that it is the presence or absence of a scalar meaning component in verbs that fundamentally determines the aspectual make-up of the predicates headed by these verbs (cf. Hay et al. 1999, Kennedy 1999, Kennedy and McNally 2005, Kennedy and Levin 2008, Rappaport Hovav

2008). Additionally, there also seems to be a correlation between the presence or absence of scales in verb meaning and the type of argument realization patterns with which verbs are compatible. In what follows I briefly review the defining characteristics of scales, how they can be classified, and what consequences this classification has with respect to aspect and argument expression.

3.1 A novel classification of verbs: the scalar - non-scalar contrast

It has recently been suggested that, in the domain of dynamic verbs, a two-way distinction should be made between scalar verbs, which are characterizable in terms of describing an ordered set of changes in some direction in the values of some attribute (i.e. an ordered set of changes along some scale), and non-scalar verbs, which describe a set of complex changes (Rappaport Hovav 2008: 17). Consider (5) for illustration.

- (5) a. Scalar verbs: *warm, cool, lengthen, shorten, widen, tighten, empty, arrive*
 b. Non-scalar verbs: *run, walk, dance, exercise, play*

The scales encoded by the verbs of (5a) all express an ordered set of changes in some dimension; they are all characterizable in terms of having degree values of some attribute and an ordering of these values. For instance, the verb *lengthen* encodes a scale in the dimension of width, one that is associated with degree values measured in meter or foot, and an increasing ordering relation. The verb *cool*, on the other hand, is associated with a temperature scale associated with degree values corresponding to degrees in Celsius or Fahrenheit, and a decreasing ordering relation. Verbs like *dance* and *play*, on the other hand, express complex changes such that they are not characterizable in terms of progressing along a scale.

Scales can be of three types: (1) property scales are encoded by change-of-state verbs like *warm* and *cool*, (2) path scales are encoded by directed motion verbs like *fall* and *rise*, and (3) volume/extent scales are associated with creation/consumption predicates like *build a house* and *eat an apple*. As Rappaport Hovav (2008) shows, change-of-state verbs and directed motion verbs are similar in that they encode scales with all the defining properties associated with them (see above). Change-of-state predicates and directed motion predicates contrast with predicates encoding volume/extent scales in that in the case of the latter it is not the verb heading the predicate but the argument undergoing some change of state that encodes the scale traversed in the course of the event.² This contrast is often argued to be behind the argument expression differences observable between verbs encoding property and path scales, on the one hand, and verbs encoding volume/extent scales, on the other (see the discussion of (14) – (16) below). On this view, the most important aspectual property of predicates is whether they express a “specific amount” of change. If they do, this allows the listener to identify an endpoint to the denoted event and interpret the predicate as bounded/telic. Otherwise, an unbounded/atelic interpretation is available only. For instance, given that the predicate *lengthened the skirt to 50 centimeters* expresses that a specific amount of change of state (i.e. the lengthening of the skirt) took place such that the skirt ended up in a state where its length corresponded to 50 centimeters, a specific endpoint to the denoted event is identifiable and hence the predicate is interpreted telically. By contrast, the default interpretation of the predicate *lengthened the skirt* is atelic since it is not clear where the

² For an opposing view, see section 4.

denoted event culminates. In section 3.2 I discuss some other, similar or slightly different members of the class of scalar verbs and show what aspectual behavior is displayed by them.

3.2 A closer look at scalar verbs and their aspectual properties

There is an important distinction that is made in the class of scalar verbs. Specifically, some members of this class encode a scale associated with several degree values, while in the case of others the scale is characterizable in terms of having exactly two degree values. As for the former class, it is also grammatically relevant whether or not the scale has a specific endpoint inherent in the meaning of the verb. First, I illustrate the latter distinction. Consider (6).

- (6) a. Kate cooled the soup for 10 minutes.
 b. Kate cooled the soup in 10 minutes.
 c. Kate cooled the soup completely in 10 minutes/*for 10 minutes.
 d. Kate cooled the soup to 20 degrees in 10 minutes/*for minutes.

The verb *cool* exemplifies the class of scalar verbs that encode an open-range multi-point scale. As the examples in (6) show, a bounded interpretation of the predicate is guaranteed just in case there is some linguistic material (cf. the adverbial *completely* in (6c) or the prepositional phrase *to 20 degrees* in (6d)) in the predicate that provides specific information as to the endpoint of the event. Otherwise, it is an atelic interpretation that comes as most natural. In certain contexts an endpoint to the event can be identified even without some specific linguistic material as to the nature of the endpoint and a telic interpretation becomes available, which is why the time-span adverbial *in 10 minutes* is also compatible with the predicate *cooled the soup*, as shown by (6b). Such verbs contrast with verbs like *empty* and *straighten*, which encode closed-range multi-point scales. This means that such verbs are inherently associated with a scale that has a specific endpoint corresponding to the result state of the event participant that undergoes a change. The examples in (7) illustrate this.

- (7) a. #Kate emptied the fridge, but the fridge did not become empty.
 b. #Kate straightened the rope, but the rope did not become straight.

As (7) shows, the negation of the attainment of a specific result state (i.e. emptiness in (7a) and straightness in (7b)) yields semantic ill-formedness, which can lead us to the conclusion that the predicates *emptied the fridge* and *straightened the rope* entail that the fridge and the rope end up in the states of emptiness and straightness, respectively, at the culmination of their events. Put differently, the predicates of (7a) and (7b) are inherently telic, unlike predicates like *cool the soup*.

Another contrast that is worth mentioning in this discussion is that between verbs encoding multi-point scales (cf. *cool* and *empty*) and verbs like *die* and *arrive*, which encode two-point scales (i.e. scales having exactly two degree values) (Beavers 2002). Since one of the two values of two-point scales corresponds to the result state of the event participant that undergoes some change, predicates like the one in (8) are inherently telic. In this example, one of the degree values corresponds to the state of Kate's being alive, while the other degree value corresponds to Kate's being dead. The negation of the attainment of the state of death yields semantic anomaly.

- (8) #Kate died, but she did not become dead.

Furthermore, verbs having two-point scales contrast with verbs encoding a multi-point scale also in terms of the interpretation of the predicate when it contains a time-span adverbial. For illustration, I provide (9) and (10) below.

- (9) a. Kate cooled the soup in 10 minutes.
 b. Kate widened the gap in the pin in 10 minutes.
 (10) a. Kate died in 10 minutes.
 b. Kate arrived in 10 minutes.

The apparent difference between the examples of (9) and those of (10) is that while the adverbial *in 10 minutes* refers to the duration of the cooling event and that of the widening event in (9), the same cannot be said of (10a) and (10b). In the case of the latter, the adverbial phrase describes the time interval that precedes the culmination corresponding to the states of death and arrival, respectively.

Finally, before I describe some consequences of the scalar – non-scalar contrast with respect to argument realization, I summarize the verb classification of the scalar approach in Table 3 below.

Dynamic Verbs			
Scalar Verbs			Non-Scalar Verbs
Verbs encoding a multi-point scale: <i>cool, warm, empty, straighten</i>		Verbs encoding a two-point scale: <i>die, arrive, exit, enter</i>	<i>run, walk, play, dance</i>
Verbs encoding multi-point open-range scale: <i>cool, warm</i>	Verbs encoding a multi-point closed-range scale: <i>empty, straighten</i>		

Table 3: The classification of dynamic verbs on the scalar approach

3.3 Some argument expression facts of scalar and non-scalar verbs

Although scalar analyses have mainly helped us have a better understanding of the aspectual facts of dynamic predicates, there are a couple of interesting contrasts pertaining to the argument expression properties of scalar and non-scalar verbs. First, it is often noted in the literature that non-scalar verbs are generally compatible with a variety of result XPs, while scalar verbs allow only certain XPs, which serve to further specify where the denoted event culminates. The examples in (11) and (12) illustrate the former, while the example in (13) illustrates the latter.

- (11) a. We steamed the envelope open.
 b. We steamed the table cloth flat.
 c. We steamed the clothes clean.
 d. We steamed the clothes stiff. (Levin 2010: 11, (37a) – (37d))
 (12) a. John read.
 b. John read us all to sleep.
 c. John read his eyes sore. (Rappaport Hovav 2008: 24, (19a) – (19c))

- (13) *We dimmed the room empty. (Rappaport Hovav 2008: 23, (13e))

Another contrast in argument realization concerns the status of direct objects. Specifically, verbs not encoding a scale exhibit a flexible behavior when it comes to the licensing of object arguments. For instance, they allow object deletion, as shown in (14a) and (14b), and they can also occur with non-subcategorized objects, as in (15a) and (15b).

- (14) a. Kate ate.
 b. Kate drank.
 (15) a. Kate outate Peter.
 b. And together, I promise you - we can outeducate and outcompete any country on Earth.
 (taken from Barack Obama's speech at the 2012 Democratic National Convention)

Scalar verbs, on the other hand, are more restrictive in that they do not allow object deletion and they are not compatible with non-subcategorized objects. The examples below serve as illustration:

- (16) a. *Andy broke.
 b. *Andy outbroke Mandy. (Levin 2010: 15, (58b))

Having reviewed some basic assumptions of the scalar approach, I now offer a preliminary discussion of why a novel approach to verb meaning should be advocated such that it uses important facets of the mereological and scalar approaches.

4 A mereological take on scales

A central question of aspectual studies is how to represent change expressed by dynamic predicates. As we saw above, Krifka (1998) models change expressed by verbs like *eat* and *drink*, and also *walk* and *run* through homomorphic mappings between the part structure of the denoted events and those of the entities that are traversed in an incremental fashion in the course of the event. Advocates of the scalar approach, on the other hand, have introduced the notion of scalar change into the aspectual analysis of mainly degree achievements. What falls out of the closer investigation of these two approaches is that while the latter proves to be successful when it comes to the characterization of degree verbs like *cool* and *warm*, it is not clear how change associated with motion predicates like *run*, can be accounted for here (Filip 2012: 743). This question arises since, intuitively, one should be able to treat the path argument of verbs like *run* as some kind of a scale that is traversed in the course of the denoted event, similarly to what is proposed in the case of *cool* and *warm*. A major difference between the paths of *run* and *walk* and the scales of *cool* and *warm* is that the former can have partial ordering, while the latter are always totally ordered. Another issue that needs to be addressed concerns creation/consumption predicates. On the scalar view, the head verbs of these predicates are not associated with a scale; it is their incremental theme that describes the scale along which the event progresses. This, however, seems to miss the intuition that, for instance, eating and drinking events as expressed by *eat* and *drink*, respectively, always progress through the entity that undergoes consumption in an incremental fashion. The assumption that such verbs are not scalar seems to be at odds with this. A more recent

aspectual analysis, one that can offer solutions to these questions is provided by Beavers (2012), who proposes that all predicates of change be treated as scalar. On this analysis, scales are independent entities – they are arguments of verbs – such that they have a mereological part-whole structure. For instance, the verbal predicates of (17) are all associated with a temperature scale of their own, which also constitute a subpart of the part structure that all scales are a subpart of. This means that the part structure of the event argument in (17a) is a (proper) subpart of the part structure of the event argument in (17b), which is in turn a (proper) subpart of the part structure of the event argument in (17c).

- (17) a. Kate cooled the soup from 60 degrees to 30 degrees.
 b. Kate cooled the soup from 80 degrees to 20 degrees.
 c. Kate cooled the soup from 90 degrees to 10 degrees.

Furthermore, an analysis that has a mereological take on scales can better bring out similarities and differences between predicates describing momentary situations like *break a vase*, degree achievements like *cool the soup*, and creation/consumption predicates like *eat an apple*. The aspectual structure of predicates like *break a vase* is relatively straightforward on such a view. The part structure of the event argument of *break a vase* is associated with exactly two subparts, an initial subpart, which corresponds to the non-broken state of the vase and a final subpart corresponding to the broken, result state of the vase. Such predicates are inherently telic since they always provide specific information as to the culmination point of the denoted event. Predicates like *cool the soup* and *eat an apple* are somewhat different. The former has a temperature scale that is independent of the affected argument *the soup*, while the latter has the peculiar property that the scalar argument is intimately tied to the incremental theme argument in such a way that the part structure of the scale is specifically determined by the part structure of the incremental theme (Kardos 2012). Given that on such a view the identification of the final subpart of the scale ensures that a telic reading of the predicate is available, it follows that while the referential properties of creation/consumption predicates are dependent on the quantificational properties of their incremental themes (cf. (1) and (2)), the same cannot be said of degree achievements (cf. (6a)).

Finally, it is also worth noting that mereological approaches have the advantage that they provide very precise truth conditions for verbal predicates, i.e. they allow us to have a very close look at the internal structure of events. This is something that the scalar approach by itself falls short of achieving.

5 Conclusion

This paper has provided an outline of some of the developments that have occurred in research in aspectology in the past few decades. It has looked into two slightly related approaches and compared and contrasted how these approaches account for the aspectual behavior of various predicate types. It has eventually offered a brief discussion of some of the problems that are currently at the focus of aspectologists' attention and it has also provided a few arguments for a rather novel perspective of the aspectual structure of verbal predicates.

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