

# How motion verbs are special: The interaction of semantic and pragmatic information in aspectual verb meanings

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*This paper focuses on a distinction between two kinds of information in verb meanings: a highly structured, templatic part of the meaning, based on aspectual properties of the verb, and a part of the meaning which contributes to filling gaps in the templatic information. The two kinds of information differ in the nature and degree of connections to encyclopedic world knowledge. This demarcation between the two kinds of information is related to the semantics/pragmatics distinction, and may be clearly articulated using Krifka's (1992) formalization of a homomorphism from objects to events. Motion verbs, for which the concept of distance plays a crucial role in the gap-filling information, are shown to be special in a number of ways, due to the special properties of distance as encoded in the world knowledge of the speaker. The possible universality of these findings is also discussed.*

## 1. Introduction

There has been a long-standing discussion about meaning in the philosophic literature. Can the meanings of words be analyzed componentially, into features or otherwise? Do words have fixed elements of meaning? More recently, a body of work has emerged independently in the linguistic literature, in the area of lexical semantics, leading towards representations of word meaning that do include fixed componential elements in the semantics? This linguistic research focuses on verbs. Verb meanings are a particularly fruitful problem for linguistic theory to tackle, because they appear to be structured in ways that are organized and regular across languages, and yield (in part) to a compositional approach involving a system of discrete representations. This research has involved analysis of recurring, cross-linguistically identifiable components of meaning, with reference to syntax as well as semantics.<sup>3</sup> It has

lead to fruitful identification and analysis of verb classes, and the general realization that significant linguistic generalizations may be stated over verb classes. Work on the linguistic representation of verb meanings has come from several branches of linguistic theory, including syntax, semantics, and computational linguistics. Although the representations proposed by these various authors differ in many respects, some elements of consensus have emerged; among these is the idea that the aspectual or temporal structure of the verb meaning is central. A long-standing recognition of the aspectual elements of verb meaning in the philosophic literature (notably, from Aristotle to Vendler 1967) has since entered into the work of linguists. Recent work on *event Structure*, the structure of events as represented by the verbs of natural language, has suggested that there is a small set of discrete possible temporal structures that verb meanings may have in human languages? This paper follows in the spirit of all this work, and assumes the existence of structured verb meanings and verb classes, and the importance of *event structure*.

This paper goes beyond the work described above, in arguing that an aspectually structured verb meaning reveals a distinction between two kinds of information in verb meanings. The first is a templatic, structured part of the meaning, based on aspect and temporal organization, which (following the work in *event structure*) is part of a finite set of such semantic structures universally available for verbs. The paper focuses only on one templatic type, based on what is described informally as a *measuring-out*, and formally as a homomorphism from an object to an event, following the work of Krifka (1992). The second type of information in these verb meanings is information that is left unspecified by the formal homomorphism, but is nevertheless part of the meaning that the speaker understands about the verb, and furthermore is necessary to the full interpretation of the templatic meaning. This is information that has to do with the nature of the relationship between the object and a *measuring-scale*. The first kind of meaning may be thought of as providing a template with gaps, and the second kind of meaning as filling those gaps. The template may be thought of as semantically underspecified. The templatic information is in a sense context-free, because once the template is selected as part of the verb meaning, it has a fixed form. The gap-filling information, by comparison, is context-dependent, since what material fills the gap is not fixed, and the interpretation may be influenced by context. The interpretation of this second kind of information is inextricably bound up with world-knowledge as it is encoded by the speaker in the meaning of the verb.

While both types of information have connections to world knowledge, the level and the nature of these connections differ. The templatic information having to do with the organization of temporal properties is certainly connected to a speaker's understanding of time, but its organization is highly structured linguistically, in one of a small and finite set of possible temporal semantic structures. The non-templatic information which contributes to the gap-filling has many more connections, and more complex connections, to world knowledge. The verb *drive*, for example has an aspectual part of its meaning, about which we may ask a simple question with a yes or no answer: Does *drive* refer to an event with an inherent endpoint in time or not? There are clear diagnostics for answering this question, as we shall see in section 2 of the paper. The verb *drive* also has as part of its meaning more complex information that must partake of general encyclopedic world knowledge. What do people drive? automobiles? horse-and-buggies? Where do they drive them? How do they drive them? One cannot know the full meaning of the verb *drive* without knowing something about culture, technology and even history; all things which cannot be completely analyzed into discrete compositional elements of linguistic analysis. From this point of view the verb *drive* might mean something very different in Los Angeles than it means in an Amish community of rural Pennsylvania. Yet in both communities it could have the same aspectual property of indicating an event with no inherent endpoint in time.

This distinction between the two kinds of information in these verb meanings correlates with one version of the semantics/pragmatics distinction: context-free versus context-dependent aspects of meaning, although this criterion is not unproblematic (Dascal 1983: 27-29). The distinction between these two kinds of meaning is not unrelated to another criterion for the semantics/pragmatics distinction: relevance to truth conditional aspects of meaning. The aspectual property associated with *measuring-out* has some truth conditional import, as we shall see, because certain entailments follow from it. It is more difficult to see what entailments are made possible by the non-templatic part of the meaning. The demarcation between semantics and pragmatics is particularly murky in this area? Nevertheless an understanding of this particular distinction between kinds of information within verb meanings must contribute crucially to our understanding of the semantics/pragmatics interface. It may well be the case that the interface actually is more complicated than a simple demarcation between the two areas; and the kind of distinction made here must enter into a theory of that interface. I will take as a

working hypothesis the idea that this distinction reflects a crucial aspect of that interface. Krifka's formalization of the homomorphism from objects to events gives us a precise way to characterize this particular distinction.

The distinction between the two kinds of meaning is reflected in the set of verb classes that can be identified. The templatic meaning gives us one general verb class: the class of verbs that share this templatic information as part of their meanings. This is a distinct and clearly demarcated class, which has been found to exist cross-linguistically. The second type of meaning divides this general verb class into three different classes, distinguished by three canonical types of gap-filling information. The *manner-of motion verbs*, which rely on the notion of distance as a *measuring-scale*, are one of these classes. The three verb classes are 'squishy'; in the last analysis they are not distinct classes, because what distinguishes them is so intricately bound up with world knowledge in all its complexity. Nevertheless we can make some generalizations about differences between the syntactic (and other) properties of these classes. The *manner-of motion* verbs turn out to be special in several ways, which hinge on certain special properties of *distance*, as part of the world knowledge encoded in speakers' minds.

The difference between the two types of information is also reflected in differences between the one general class on the one hand, and the three subclasses on the other. Associated with the first type of information and verb class are laws of grammar which are inviolable. Expressions violating these laws are not linguistically interpretable by a speaker (although they can be understood after a fashion by whatever means we employ to make some sense out of ungrammatical utterances). The idea of *modularity* has emerged in the linguistic literature, as the idea that there is a discrete and autonomous formal system which is somehow separate from other kinds of cognitive functions and knowledge that enter into linguistic *ability*.<sup>6</sup> The templatic information shows a limited kind of modularity. The generalizations distinguishing the three subclasses, on the other hand, are influenced by context, and can break down where the classes merge into one another. These generalizations are shown to follow from the world knowledge associated with the three canonical types of *measuring-scales* that distinguish the classes.

This paper does not rely on the assumption that world knowledge is universal, or that it is independent of linguistic conceptualization. It relies on the more conservative position that we are dealing with world knowledge, at least in part as encoded in verb meanings, and possibly as encoded in the speaker's more general linguistic conceptualizations. The first type of infor-

mation in verb meanings is regarded as part of a universal linguistic system for encoding meaning or world-knowledge. In this kind of meaning we clearly see world knowledge encoded linguistically, in the fact that the grammar represents the events captured in verb meanings as having or not having a definite endpoint in time.

For the second type of meaning it is an open question whether the three classes of verbs demonstrate the same generalizations and tendencies across languages, or whether these generalizations apply only to English speakers with the world knowledge of English speakers. I will suggest, as a possibility that this paper raises and as a challenge for further research, that some of the special properties of motion verbs which result from the special properties of *distance*, will be found to be universal.

Section 2 focuses on the single general verb class and the properties uniting it. Section 3 focuses on the three subclasses and the characteristics distinguishing them. In sections 2.1 and 2.2, the aspectual and temporal elements of meaning discussed in the paper — *measuring-out* and the *measuring-scale* — are introduced. The general verb class sharing these properties is introduced, and the three subclasses — the *incremental-theme verbs*, the *change-of-state verbs* and the *manner-of-motion verbs* are described. Section 2.3 introduces Krifka's formalization of the homomorphism from objects to events, and explains how it applies to the various verb classes. Section 2.4 introduces a formal linguistic principle associated with the templatic type of information; and an attempt made at violating this principle illustrates the limited modularity of the first kind of information.

In section 3 five differences between the three verb classes are discussed. These are related to the graduality of the event over time; the linearity of the object; the optionality of the temporally bounded reading and of the direct object; iterative readings; and the addition of predicates and arguments to obtain the temporally bounded reading. This section will illustrate that Krifka's homomorphism does not distinguish between the three classes nor does it predict these differences between the classes with respect to the properties listed above. This section will illustrate further that the differences have to do with what world knowledge predicts about the properties of the three canonical types of *measuring-scale*. The special properties of the *manner-of-motion verbs*, and how those properties depend on certain aspects of *distance*, are discussed in this section.

Section 4 is a conclusion, and also contains discussion of more general implications for the universality of these findings.

## 2. Measuring-out

### 2.1 *Measuring-out*

The ingredient of meaning that I focus on in examining these three verb classes is what I call *measuring-out*. This element of meaning is aspectual, depending crucially on the aspectual property of temporal boundedness as expressed by predicates of natural language.<sup>7</sup>

The linguistic literature on aspect has identified a class of verbs (or verb phrases) that describe a temporally bounded event. This aspectual property of temporal boundedness has been discussed by many authors, going back to Aristotle. More recent authors who have written on it include Dowty (1979), Hinrichs (1985), Verkuyl (1989 and 1993), Grimshaw (1990), Pustejovsky (1991), Vendler (1967), and van Voorst (1988). Verb phrases describing temporally bounded events are illustrated below. Compare the (a) and the (b) sentences. The (a) sentences in (1) and (3) allow only the unbounded reading, while (2a) is ambiguous, allowing either the bounded or unbounded reading. The (b) sentences on the other hand, allow only the temporally bounded reading:<sup>8</sup>

- (1) a. John ate at a sandwich for five minutes/\*in five minutes.  
b. John ate a sandwich up \*for five minutes in five minutes.
- (2) a. Godfrey washed the floor for five minutes in five minutes.  
b. Godfrey washed the floor clean \*for five minutes in five minutes.
- (3) a. Jacob walked for five minutes/\*in five minutes.  
b. Jacob walked to the bridge \*for five minutes in five minutes.

*Eating a sandwich up, washing the floor clean and walking to the bridge* are expressions that describe events having a definite endpoint in time — a temporally bounded event. These events continue until some temporal terminus is reached: the point at which the sandwich is consumed, the floor is clean, or the bridge is reached. At this point the event is completed. The temporal adverbial phrases *in five minutes* and *for five minutes* have been used by Dowty 1979 and others as diagnostics for temporal boundedness. The *for five minutes* adverbial phrases cooccur with unbounded events, while the *in five minutes* phrases cooccur with bounded events. The bounded reading can be made clearer by contradicting the existence of the temporal endpoint for the (b) sentences above. The sign % is used to indicate that these sentences are odd rather than strictly ungrammatical. They may be used jokingly, in which case their humor arises from the contradiction of expectations.

- (4) %John ate a sandwich up but didn't finish it.
- (5) a. %Godfrey washed the floor clean but it didn't get clean.  
       b. %Godfrey washed the floor clean but it didn't get washed clean.
- (6) %Jacob walked to the bridge but didn't get to the bridge.

Since in these sentences a bounded interpretation is necessary, the sentence is odd when that interpretation is contradicted.<sup>9</sup>

Each of the (b) sentences in (1)-(3) describes a temporally bounded event. They share an interesting further ingredient of meaning in their temporal or aspectual structure. These are events that may be described as being *measured-out over time*, with the direct or indirect object participating in that measuring in a crucial way.<sup>10</sup> The direct object in (1), *a sandwich*, participates in the bounded event structure by *measuring out* the event over time. The verb phrase *eat a sandwich* in (1a) has only the unbounded reading (which is forced by the particle *at*). However, in (1b) (where *eat* is used with the particle *up*, enforcing a bounded reading) the verb phrase describes a bounded event. In this case, the eating event could be measured in increments of the sandwich, reaching its terminus when the sandwich is entirely consumed. The sandwich, in a sense, *measures out* the event over time. There is a crucial difference between the bounded and unbounded reading of *eat a sandwich*; an entailment about the sandwich is possible in the bounded reading that is not possible in the unbounded reading; namely, that at the end of the eating-event the sandwich is completely consumed. The complete coverage or consumption of the object is crucial here. The sandwich makes a crucial contribution to defining the temporal end of the event because it encodes both the endpoint of the event and the progression towards it.

In (2) *the floor* also contributes to *measuring out* the event, by virtue of its achieving a state of clean-ness. The verb *wash* describes an unbounded or bounded event when used in isolation as in (2a), but when a resultative predicate such as *clean* is added in the (2b) example, the verb phrase can only describe a bounded event. The predicate *clean* participates in defining the temporal endpoint of the event by naming the property that holds of the object (the floor) at the event's temporal terminus. Like the sandwich in (1), the floor *measures out* the event over time in (2). In the bounded reading, an entailment holds of the floor at the end of the event; namely that it is clean. The progress of the event can be observed by following the degree of clean-ness being acquired by the floor through the course of the washing event. As with the sandwich in (1), an entailment is possible about the floor with the bounded reading (the floor is clean) that is not possible with the unbounded reading. In

both examples the end of the event could be recognized by observation of the change of state in the sandwich or the floor. The direct objects of the verbs of these two classes I will call *measuring objects*, because the implicit scale in the measuring-out of the event is to be found within them. The terminus of the event could be determined by watching only the sandwich or the floor through the course of the event.

A certain amount of thought will discover cases in which the *wash clean* and the *eat up* kind of measuring are not easily distinguishable. For example if one washes-clean the floor in a careful progression from one end of the floor to the other, the washing may be thought of as occurring over increments of floor. Or if one has eaten a sandwich, and the sandwich has disappeared, the sandwich may be thought of as having undergone a kind of change of state. These two classes may be not ultimately distinct, but may rather merge into each other. At a certain level of abstraction these two classes are one verb class. However, they are distinguishable as two canonical styles of *measuring-out*, associated with the canonical verbs of creation and consumption, and the canonical verbs expressing a change of state. In the former we find more emphasis on the extent of the *measuring object*, and in the latter we find more emphasis on the state of the *measuring object*. The incremental-theme verbs and change-of-state verbs represent two poles in the styles of *measuring objects*,

In (3) *the bridge* participates in defining the temporal endpoint by marking the end of the walking journey. The progress of the event can be measured in increments of distance traveled towards the bridge. There is an entailment involving the indirect object, *the bridge*, here, but it is slightly different from the entailments involving the direct objects in the preceding examples. In the bounded reading, the walking event is understood to terminate *at* the bridge. That is, the event is concluded when the walker has arrived at the bridge. The role played by *the bridge* here in defining the temporal structure of the event is not quite the same as that played by *the sandwich* and *the floor* in (1) and (2). The *path*<sup>11</sup> to the bridge, denoted by the prepositional phrase *to the bridge*, here *measures out* the event.<sup>12</sup> The verbs or verbal complexes<sup>13</sup> *eat*, *wash clean*, and *walk* illustrate the three verb classes of interest in this paper.

The basic temporal structure of the verb meaning is the same for these three classes at an abstract level — they all include the specification of temporal boundedness through some potential *measuring-scale* associatable with a direct or indirect object. Viewed in this way the three classes are really



one class of verbs — those that instantiate one possible temporal or event structure for verb meanings. At this level of abstraction, these verbs belong to one class. Yet at another level of examination, we have three different classes, instantiating three different canonical styles of *measuring-out*, as the next section elaborates.

## 2.2 Three verb classes; three kinds of scales

In each of these three examples there is a measurable quantity or property which is not temporal, and which is associated with the direct or indirect object, which the verb converts into a temporal measure of the event. In each of these three examples there is an implicit *scale* built into the verb's meaning. I shall assume that an ability to understand and use scales is part of the basic human cognitive capacity, here instantiated in a verbal meaning. The verbs differ in the nature of the scale and how it is converted to a temporal measure. In the expression *eat the sandwich up*, the sandwich is consumed in increments until it is entirely consumed. The implicit scale lies in the sandwich itself, or rather in its volume, which defines the extent of the event. Volume is a gradable property; we can talk about degrees of eaten-ness, as in *the sandwich is partly eaten* or *nearly all eaten*. *The sandwich* here is an *incremental theme* and this verbal complex illustrates the class of *incremental-theme verbs*. Other examples of incremental-theme verbs are illustrated below in (7). Incremental-theme verbs are typically verbs of creation or consumption, but may also include performance verbs such as *play* or *perform*. These verbs can all have senses in which the direct object (italicized below) is consumed, created, performed or destroyed over a period of time, the measure of the object being translatable into a temporal measure of the event.<sup>14,15</sup>

- (7) John built *a house*.  
 Phillip drank *a glass of beer*.  
 Maria consumed *the entire bowl of spaghetti*.  
 Martha read *a long book*.  
 Jennifer translated *a Greek poem*.  
 Carlota played *a sonata by Beethoven*.  
 The young actors performed *a Shakespearian tragedy*.  
 The professor graded *the problem sets*.  
 The girl scouts constructed *an igloo* on the ice.  
 The wreckers demolished *the old train station*.

In the expression *wash the floor clean* the floor undergoes a change of state defining the end of the event. The property of clean-ness provides an implicit scale of measurement. Since we can talk about properties being partly true of objects (*the floor is partly clean*) we can understand them as having degrees or gradations, as being gradable properties. The verbal complex *wash clean* illustrates the class of *change-ofstate verbs*. Other examples of change-of-state verbs are illustrated in (8) below. These are single verbs, rather than verbal complexes:

- (8) Mary melted *the ice cream* by leaving it in the sun.  
 John froze *the milk* by mistake.  
 The cleaner stiffened *the curtains* by adding a special substance.  
 The hikers dried *their socks*.  
 The photographer reddened *his photographs*.  
 The gardener ripened her *tomatoes* faster by clearing away branches blocking the sun.  
 Bill moistened *the towel* before using it to clean the wound.  
 Jane shrank *her shirt* by putting in the wash.  
 Mark stretched *his socks* by hanging them on the line.  
 Jim baked *four potatoes* for dinner.  
 Jeffrey cleaned *the kitchen* floor.

In each case above, the sentences are interpretable in a sense that the direct object (the italicized noun phrase) undergoes a change of state which marks the temporal end of the event. The change-of-state verbs and the incremental-theme verbs are very similar in that they both involve a canonical change of state taking place over the entire object, whether the change of state is one of creation or consumption or something less drastic. For incremental-theme verbs, the change of state is understood as progressing through the object along some axis, which is not necessarily so with the change-of-state verbs. (One is likely to eat a sandwich from one end of the sandwich to the other, but one does not usually melt ice cream in that fashion.) Certain of the verbs above could be interpreted either way: *cleaning the floor* for instance. Again, this suggests that the difference between these two classes is not a matter of a profound divide, but a matter of canonical styles of *measuring-out*.

In the expression *walk to the bridge*, the implicit scale lies in the path traveled to the bridge. The measurable quality here is distance. There is an implicit *path object* here (a subspecies of *measuring objects*) which may be

made explicit in, for example, *walk the distance to the bridge*.<sup>16</sup> Distance is certainly a gradable property, as every elementary school child faced with her arithmetic problems knows, and it is distinguished from volume by its linearity. *Walk* belongs to the third class of verbs of interest here; it is a *manner-of-motion verb*.<sup>17</sup> Other examples of manner-of-motion verbs are illustrated below. In all the sentences below, the verbs are accompanied by extra material in the verb phrase specifying that some translative motion took place over some finite distance.

- (9) Mary ran to the fence.  
 The five year old bounced downstairs.  
 Bill rowed five miles.  
 Jean paddled ten miles.  
 Laura hiked to the top of the ridge.  
 The men sauntered across the street.  
 The wheelchair racers rolled across the finish line.  
 The rescue dog swam to the overturned boat.  
 The women canoed to the border.  
 Erica drove from Colorado to Texas.

Looking at verb types in terms of *measuring out*, we arrive at these three verb classes. They instantiate, in three different ways, the same basic temporal event structure, involving a temporal terminus to the event, some implied *scale* along which the event is *measured out*, and some particular way in which the object or indirect object of the verb participates in measuring-out the event over time by being associated with a *scale*. The verb classes differ crucially in that the *scale* for change-of-state verbs is related to a property (that may hold of the object); the *scale* for incremental-theme verbs is related to a volume-like quantity (of the object); and the *scale* for manner-of-motion verbs is the linear one of distance. In the next section, a more formal approach to *measuring-scales* is introduced.

### 2.3 A formal approach to measuring-out: Krifka

The fact that certain classes of direct objects can determine the aspectual status of the verb phrase or sentence is well-known in the semantics literature;<sup>18</sup> and this fact is related to the notion of *measuring out*. Krifka (1992) employs a homomorphism from objects to events which captures the *measur-*

*ing-out* we see in incremental-theme verbs. This formula expresses the idea that, for an event  $e$  and an object  $x$  of which the mapping-to-events relation holds, every part of the object ‘consumed’ in the event corresponds to a part of the event (Krifka 1992: 39, example P30):

- (10) (mapping to events)  
 VR [MAP-E(R)  $\leftrightarrow \forall e, x, x' [R(e, x) \wedge x' \subseteq x \rightarrow \exists e' [e' \subseteq e \wedge R(e', x')]]$ ]  
 (where  $\subseteq$  represents a two-place relation *part*)

It is true of the expression *eat the sandwich up*, discussed above, that it describes a situation in which portions of the sandwich map to portions of the eating event. This formula applies straightforwardly to expressions involving incremental themes, if  $x$  is understood as an object. In this case, in the formula above,  $e$  will refer to an event of eating the sandwich up,  $x$  refers to the entire sandwich, and  $x'$  to a portion of that sandwich — say 60% of it. Then the expression says (in loose prose) that if there is a mapping from the entire sandwich to an eating-up-the-sandwich event, then there is also a mapping from 60% of the sandwich to 60% of the eating-up-the-sandwich event. We may also apply the mapping to events formula to our second verb class, the change-of-state verbs, if we understand  $x$  in a more abstract sense: as representing an absolute degree of a property, one which may hold of an object absolutely, or may hold of that object to varying degrees. For example, in the true change-of-state reading of the expression *washing the floor clean*, the interpretation will be that the floor becomes more and more clean as the event progresses, passing from a state of imperfect cleanliness, to less imperfect cleanliness, to perfect (for practical purposes) cleanliness. Under this interpretation, *washing the floor 60% clean* is a subpart of the event of *washing the floor 100% clean*, regardless of whether or not the floorwashing proceeds from one end of the floor to the other. In this case, in the formula above,  $e$  will refer to an event of washing the floor clean,  $x$  refers to a state of perfect or 100% cleanliness, and  $x'$  to a state of imperfect cleanliness — say 60% clean. Then we may loosely paraphrase Krifka’s formula as saying that if there is a mapping from a state of 100% cleanliness to an event of washing-the-floor-clean, then there is also a mapping from a state of 60% cleanliness to 60% of the washing-the-floor-clean event. One may imagine an advertisement for a detergent featuring a competition in which detergents are ranked not by how fast a housewife can progress across her floor while cleaning, but by how clean the different detergents make the floor in a specific time.<sup>19</sup>

Krifka's formula for mapping to events also applies straightforwardly to our third verb class, the manner-of-motion verbs, in an expression such as *walk to the bridge*, if we understand  $x$  to be a distance from some point to the bridge. Then portions of that distance to the bridge map to portions of the entire walking event to the bridge. In this case,  $e$  will refer to an event of walking to the bridge,  $x$  refers to the entire distance or path to the bridge, and  $x'$  refers to a portion of that distance or path, say 60% of the path. Again paraphrasing Krifka's mapping-to-events formula, the expression says that if there is a mapping from the entire path-to-the-bridge to an event of walking to the bridge, then there is also a mapping from 60% of that path to 60% of the walking-to-the-bridge event.

These three verb classes are unified under a class of *measuring-out* verbs, and this shared semantic property can be expressed using an approach such as Krifka's. They share a semantics involving a homomorphism from  $x$  to the event described by the verb, in which  $x$  is something measurable provided by the verb's direct or indirect object, informally referred to as a *scale* in the previous section.

What are the common properties of this measurable  $x$ , for the three verb classes? First, since the measuring-out verbs discussed here are by definition verbs describing temporally bounded events, they share the property that  $x$  is *finite*.<sup>20</sup> Second, *relative orderability* and *uniqueness* are at the heart of the measuring relation. Speaking from a different field of research, Caws (1959: 5) emphasizes the two ingredients of measurement as uniqueness and relative orderability:

- ★ **Measurement is the assignment of particular mathematical characteristics to conceptual entities in such a way as to permit (1) an unambiguous mathematical description of every situation involving the entity and (2) the arrangement of all occurrences of it in a quasi-serial order.**

The three verb classes share Caw's first property. Incremental-theme verbs have objects that may be measured incrementally on an unambiguous scale, be it volume, mass, or percentage of the total object. The change-of-state verbs discussed above focus on the acquiring of an absolute property (or achieving of a state in which the property holds) that could in principle be described unambiguously in terms of degrees. Measuring in the manner-of-motion verbs focuses on the consumption of distance, which is based on the relative difference between locations — another unambiguously assignable quality.

Caw's second property, the orderability of parts of  $x$ , is implicit in Krifka's treatment, and could be derived through the relation of the event to temporal structure. Temporal structure under Krifka's system is atomic, being made up of time points, and those time points have a linear ordering. A function that maps an event to its "run time" is a homomorphism, in a limited fashion. (See Krifka 1992: 33, for details.) Three elements of Krifka's system could be used to derive the relative orderability of parts of  $x$ : the linear orderability of times, the homomorphism from events to times, and the homomorphism from objects to events.

It should be mentioned that all the verbs discussed here share the property that  $x$  may be interpreted as a kind of graded scale. Since the scale associated with  $x$  has a spread to it, the homomorphism from  $x$  to  $e$  also has a spread, and the event consequently has a duration in time. This is not a necessary feature of verbal semantics; it is possible for a verb to represent an event of seemingly instantaneous change. This is the case with *achievement* verbs, which refer to events that seem to happen instantaneously. (See Vendler 1967 on achievement verbs.) The verb *die*, for instance, is most often understood as describing a change of state with only two values, alive and dead, so that *John died* means John changed from a state of being alive to a state of being dead. Under this interpretation, there are no intermediate states of not-quite-dead or not-quite-alive, and the transition of dying has no duration in time. This state of affairs is also subsumed in Krifka's formalism, even though we do not focus on such verbs here, since it is possible for  $x$  to be collapsed into a binary value.

Krifka's approach can formally capture the unifying features of the three verb classes; they each instantiate a semantics in which there is a homomorphism from  $x$  to the event. Krifka's formalism also gives us a distinction between two kinds of information in the verbal meaning: the homomorphism itself from  $x$  to the event, which is expressed in the formalism; and the nature of the relation between  $x$  and the direct or indirect object (the nature of the *measuring-scale*), which is not. Under this adaptation of Krifka's work, the homomorphism does not specify what  $x$  may be.  $X$  may be several possible things; apparently anything that can be construed as participating in a kind of scalar measurement. Even which of the three classes a verb belongs to might vary according to the inclination or imagination of the language user, since as we have seen, there is some fluidity between these classes.

#### 2.4 *Modularity of the first type of information*

The homomorphism from  $x$  to the event, captured in Krifka's formalism; and the relation between  $x$  and the direct or indirect object, which is not specified by the formalism, are two different kinds of semantic information. First, the homomorphism unifies our three verb classes semantically into one class, while the relation between  $x$  and the object distinguishes the three classes from each other. Second, the unified class of *measuring-out* verbs constitutes a clear and distinct class, with clear diagnostics to distinguish it from verbs that do not *measure-out* the event. As discussed in section 2.1, a long and respected philosophic and linguistic literature has identified the verbs associated with the aspectual property of temporal boundedness and related aspectual properties. The question of whether the verb or verbal complex describes (linguistically) a temporally bounded event or not is a question with a clear answer, as these cited authors would agree. But the distinction between a change-of-state verb and an incremental-theme verb may sometimes be blurred; or even between a manner-of-motion verb and one of the other two classes. The unified class of measuring-out verbs is a distinct class, while the three subclasses simply represent three canonical styles of measuring-out. And third, the homomorphism is part of a formal linguistic system including constraints on syntax and semantics applying generally across languages. Constructions that specifically indicate the existence of a temporal endpoint for an event are found in numerous languages and language families. Nedjalkov (1983) provides a survey of resultative constructions across languages as diverse as Tongan, Aleut and Dogon.<sup>21</sup> In the spirit of the current literature on *event structure* and *Lexical Conceptual Structure*, the homomorphism shared by the three classes is regarded as one template for a possible verbal semantics, provided by a formal linguistic system including some general constraints on the structure of verb meanings. A fuller fleshing out of such a system with these kinds of constraints is impossible here because of lack of space, but one such constraint would be:<sup>22</sup>

- (11) A verb may be associated with one and only one homomorphism between some  $x$  associated with its direct or indirect object and the event described by the **verb**.<sup>23</sup>

These general constraints on the structure of verb meanings (particularly temporal structure as elucidated in current work on *event structure*) give us a

limited range of options for meanings, and give us constraints that may not be violated. That is, these constraints are independent of pragmatics, context or world knowledge, and may not be overridden by them. In this section, I will try in a clumsy way, to violate the one-scale-per-verb principle in (11) above, to show what such a violation might be like. The limited modularity of the first kind of information will be illustrated in this way. Then in Section 3, I will show that there are certain other properties distinguishing the three verb classes one from another, which are indeed modifiable by context or world knowledge.

What would a violation of the one-scale-per-verb principle **look** like? Consider a verb with more than one *measuring-scale*. A change-of-state verb with this property might give us something like *paint the wall red blue*, meaning paint the wall twice; paint it red and paint it blue. Linguistic structure does not permit this. Pragmatics or world knowledge does permit it (one could certainly paint a wall red and then paint it blue) but the constraints of the formal grammar override world knowledge in this instance. The prohibition on more than one *measuring-scale* per verb is not violatable within the grammar, even given an appropriate context. Compare this with *paint the wall red and blue*; which **is** a grammatically possible linguistic structure, encoding a single merged scale referring to one painting event. Here the wall is understood to be both red and blue at the end of the painting event.

An incremental-theme verb with two *measuring-scales* might produce something like *eat up the sandwich the orange*, meaning eat the sandwich completely and eat the orange completely. Again, the formal grammar does not permit this, because a verb cannot have two direct objects, even though pragmatics and world knowledge certainly permits the eating of both a sandwich and an orange.<sup>24,25</sup>

A manner-of-motion verb with two homomorphisms from the distance traversed to the event should make it possible to say: *Mary walked to the bridge to the highway*. Again, this is not a possible grammatical construction, no matter how pragmatically reasonable or even salient it is to assume that Mary walked both to the highway and to the bridge. Again the formal grammar does not permit this. The one-scale-per-verb principle is not violatable by the influence of context or world knowledge.

This constraint is not attributable to a syntactic constraint prohibiting extra modifiers in the verb phrase. Other kinds of multiple modifiers are possible, describing manner, for instance:



- (12) Mary walked quickly and carefully to the bridge on Tuesday, holding two large boxes.

The formal linguistic system provides the *measuring-out* semantics, a homomorphism from  $x$  to the event, as one possible structure for verb meanings, with the constraint that only one *measuring-scale* is permitted per verb. The one-scale-per-verb constraint illustrates a kind of limited modularity, because it cannot be violated even when the outcome is pragmatically feasible or salient. The elements of meaning (and syntax) discussed in the next section hinge on the relation between  $x$  and the direct or indirect object (how the object encodes or represents a *measuring-scale*). These differences in how the verbs may be interpreted and what kind of structures they occur in, depend on or are influenced by pragmatics, context, or world knowledge in a way dramatically different from the one-scale-per-verb constraint. Not only that, the manner-of-motion verbs are special in a number of ways, because of the special properties of distance as a *measuring-scale*.

### 3. How verbs of motion are special

The three verb classes identified in section 2 are similar because at a certain abstract level, they all share the *measuring-out* ingredient of meaning, expressed in Krifka's single mapping-to-events formula. However, they behave differently in some interesting ways, because of differences in how the *measuring-out* is instantiated in each type of verb. These are differences in how the scalar element  $x$  in Krifka's formula is associated with the direct or indirect object, which the formula does not specify. The properties on which the verb classes differ are not specified in Krifka's mapping-to-events formula, and they are not part of the context-free templatic information provided in the formula. Krifka's formal homomorphism does not distinguish between the three classes, or predict the differences in their behaviour. What makes the three classes different depends on world knowledge encoded in the verb meanings and associated with the three canonical types of *measuring-scales*. The manner-of-motion verbs, which employ distance as a *measuring-scale*, are a special class for a number of reasons, illustrated in this section. What makes motion verbs special with respect to the properties discussed in this section depends on certain special properties of motion and distance that are part of a speaker's world knowledge.

We will see that these differences between the verb classes are largely tendencies, rather than fixed properties like those that distinguish the verb class discussed in the previous section. The verbal properties described in this section, having to do with how the verbs are interpreted and how they are used, are of interest to lexical semanticists, and illustrate some of the kinds of data used to investigate the lexical properties of verbs.

### 3.1 *Graduality*

All the verbs discussed above have an interpretation in which the event they describe has duration, because the scale associated with the direct or indirect object has spread. As mentioned above in section 2.3, this is not a necessary feature of verbal semantics; we may find verbs in which  $x$  has no spread, and the event is understood to take place instantaneously. The distinction between verbs that describe events with some duration and verbs that describe seemingly instantaneous events is not expressed in Krifka's mapping-to-events formula. These types of verbs would be unified under the one formula. Graduality is not a property that is specified as part of the context-free homomorphism in the verb meaning.

The general kinds of meanings associated with the three classes gives us three superclasses of verbs, which may include non-measuring verbs and verbs expressing events with no duration, as well as the measuring-out verbs expressing events with duration, which are the focus of this paper. These are the verbs generally describing a change in some property, the verbs of creation and consumption, and verbs describing some manner of motion. These three general kinds of meanings allow us to make some predictions about whether the verb will describe an event with duration or not. We will see that verbs describing manner of motion are distinctive in this respect.

Verbs describing changes of state may, and quite often do, express events without duration. *Die*, discussed above, may be understood as an achievement verb, as can *split*, *break*, and *snap*.

- (13) Susan split the log with an axe.  
       Martha broke the shovel on a rock.  
       John snapped the branch in two.

Compared with verbs describing changes of state, the general class of creation and consumption verbs (which includes the class of incremental-theme verbs) are less likely to be achievement verbs. It is difficult to envision an event of

consumption proceeding through a definite mass or volume, without consuming time. However, some instances can be found. The verb *create*, for instance, can be understood below as having duration (14a), or as happening instantaneously (14b).<sup>26</sup>

- (14) a. God created the world in six days.  
 b. God created the world in an instant.

However, verbs describing manners of motion, when they are used as measuring-out verbs, *always* describe an event with some finite duration. A sentence like *Jennifer VERBED to the highway* or *Jennifer VERBED home*, where *VERB* represents a manner of motion, must refer to an event of some duration, because it represents an event of traversing some distance. A scale of distance always has some spread, so the homomorphism from distance to the duration of the event, which is part of the semantics of these expressions, predicts the event to have internal parts associated with internal parts of the distance traversed.<sup>27</sup> This correlates with our world knowledge, which tells us that it is inherently true of distance that it has extent or spread, but not inherently true of a state that it has degrees of existence; or even of creation or consumption that an object must be created or consumed in increments. The difference between the manner-of-motion verbs and the change-of-state and incremental-theme verbs with respect to the graduality of the event described, is due to these considerations about the *measuring-scale*  $x$  that intersects with world knowledge.

### 3.2 Optionality

This paper focuses on *measuring-out* verbs, which by definition describe telic or temporally bounded events. I have discussed in section 2 the change-of-state *measuring-out* verbs, the incremental-theme *measuring-out* verbs, and the manner-of-motion *measuring-out* verbs. Verbs belonging to these classes may vary, however, in whether or not they are unambiguously interpreted as *measuring-out* verbs, with a temporally bounded reading, or whether they may also be used in a non-temporally bounded (atelic) sense. When we examine the three verb classes with regard to whether their members are obligatorily or optionally interpreted as *measuring-out* verbs, some differences emerge. The manner-of-motion verbs are always optionally measuring-out verbs and in fact, are non-measuring in their most basic sense, while the other two classes vary in this respect.

Since Krifka's mapping-to-events formula is employed here only for *measuring-out* verbs, which have a temporally bounded reading, it contains no information about verbs interpreted in a non-temporally bounded sense. It does not tell us why the verb classes differ as to the optionality of the *measuring-out* reading. This difference hinges on the properties of the *measuring-scales* associated with the verb classes.

To see this difference we must use the verbs with definite direct objects. A temporally unbounded reading may always be made available by using a bare plural object: *Susan ate eggs/repaired engines/crossed bridges for hours*, a fact which has been long noted in the literature.<sup>28</sup> This effect cuts across the three verb classes discussed here. The difference between the classes emerges when they are compared using objects that are unitary and specific, so we can see the verbal meaning as it applies to a single object in a single, minimal event. Therefore, I will put these verbs on an equal basis for comparison by using them with definite direct objects (introduced by the article *the*). This way we can abstract away from the effects of mass nouns and bare plurals.

Change-of-state verbs may be (and very often are) *obligatorily* measuring-out verbs. For most English speakers, the change-of-state verbs *melt* and *repair* are only interpretable as measuring-out verbs:

- (15) I melted the butter \*for five minutes/in five minutes.  
%I melted the butter but it remained partly unmelted/solid.
- (16) Jane repaired the window \*for twenty minutes/in twenty minutes.  
%Jane repaired the window but it was still broken.

It is possible for a verb to describe an ongoing change of state that is ambiguously interpretable as *measuring-out* or temporally unbounded (the verb *warm* for instance; *Jane warmed the pancakes to 100 degrees in five minutes/Jane warmed the pancakes for hours but they weren't very warm*) but the point remains that change-of-state verbs easily encode an endstate in their basic meaning, so that they are commonly found to be unambiguously *measuring-out* verbs.

Incremental-theme verbs may also be found, which are unambiguously interpreted in the temporally bounded sense, when used with a definite direct object. *Eat* is an incremental-theme verb with a consumed object, and *build* may be thought of as an incremental-theme verb with a created object. (*Eat* is for most speakers an incremental-theme verb even without the particle *up*):

- (17) Susan ate the egg \*for five minutes/in five minutes.  
%Susan ate the egg but it remained partly uneaten.

- (18) John built the house \*for five days/in five days.  
 %John built the house but it remained partly unbuilt.

It is possible for a verb with an incremental theme to be ambiguous; this is the case for the rare English speaker who can say *Susan ate the egg for hours without finishing it*. But the point again remains that incremental-theme verbs are usually *measuring-out* verbs, when used with a definite direct object.

The manner-of-motion verbs differ from the examples above in that they are not only *optionally* interpretable as *measuring-out* verbs, but they are *never* unambiguously *measuring-out* verbs, when used with a definite direct object. This class of verbs may take two kinds of direct objects: *apath-object* (*the Allegheny River* in 19a) that names the path traversed, or a *moved-object* (*the canoe* in 19b).

- (19) a. Mary paddled the Allegheny River.  
 b. Mary paddled her canoe.

Path-objects yield optional *measuring-out* readings; moved objects yield only non-measuring readings. (The reader can test this out generally; e.g.: *Mary paddled her canoe for hours/\*?in an hour.*) I focus on path-objects here.

Verbs that describe a simple manner of motion do not encode a terminal state, since the terminus in the *measuring-out* reading is a location. The following sentence is ambiguous between a temporally bounded reading and an unbounded reading:

- (20) Mary walked the Appalachian Trail for days/in three months.

Either <sup>\*</sup>adverbial is possible with the sentence above; and the sentence is not made odd by contradicting the assumption of a temporal bound:

- (21) Mary walked the Appalachian Trail for several weeks last summer but didn't walk the whole trail/ didn't get to the end of it.

Other verbs of motion follow the same pattern:

- (22) Mary hiked the Appalachian Trail for days/in three months.  
 Mary hiked the Appalachian Trail for several weeks last summer but didn't hike the whole trail/ didn't get to the end of it.  
 (23) Mary paddled the Allegheny River for days/in three months.  
 Mary paddled the Allegheny River for several weeks last summer but didn't paddle the whole river/ didn't get to the end of it.

- (24) Mary canoed the Allegheny River for days/in three months.  
 Mary canoed the Allegheny River for several weeks last summer  
 but didn't canoe the whole river/ didn't get to the end of it.

Manner-of-motion verbs, describing pure manner, cannot encode a locational terminus in their most basic sense, and therefore, in their basic sense, describe temporally unbounded events.<sup>29</sup> Manner-of-motion verbs are aspectually underspecified for describing temporally bounded events, in a more regular and systematic way than are the other classes of verbs.

Having considered the difference between these classes with respect to their aspectual behavior with definite direct objects, now compare them with respect to whether the objects involved in the *measuring-our* reading are optional or obligatory. Again, this is a property that Krifka's mapping-to-events formula can tell us nothing about. We must look to the nature of what it means to describe a 'manner of motion' for the answer.

Path-objects (like *the Appalachian Trail* or *the Allegheny River*) are optional for manner-of-motion verbs:

- (25) a. Mary walked the Appalachian Trail.  
 b. Mary walked.  
 (26) a. Mary hiked the Appalachian Trail.  
 b. Mary hiked.  
 (27) a. Mary paddled the Allegheny River.  
 b. Mary paddled.  
 (28) a. Mary canoed the Allegheny River.  
 b. Mary canoed.

The (b) sentences, without objects, in the examples above, have a basic reading that is temporally unbounded:

- (29) Mary walked for an hour/?in an hour.  
 Mary hiked for an hour/?in an hour.  
 Mary paddled for an hour/?in an hour.  
 Mary canoed for an hour/?in an hour.

The temporally unbounded reading is more basic for these verbs.

Change-of-state verbs like *melt* and *repair* cannot be used without the argument that is participating in the measuring-out. They require the presence of the object undergoing the change of state. If the verb is an ergative verb,<sup>30</sup> like *melt*, that argument may occupy the subject slot:

- (30) John melted the butter.  
John melted.

The sentence *John melted*, which lacks a syntactic direct object, is odd, but it is a possible sentence, and it is interpretable. We are forced to understand it to mean that John is the object that undergoes the change of state, instead of John being the causer of a change of state in something else. (The latter sense would be parallel to the interpretation of the sentence *John melted the butter*.) Although the presence of a syntactic direct object is optional with verbs like these, the presence of the *measuring* argument is not. This distinguishes them from the motion verbs above.

A verb like *repair* does not allow the ergative usage,<sup>31</sup> and the lack of a direct object makes the sentence unacceptable.

- (31) Jane repaired the window.  
\*Jane repaired.

The incremental-theme verbs vary as to whether they have obligatory measuring objects or not:

- (32) Susan ate the egg.  
Susan ate.
- (33) John built the house.  
\*John built.

To summarize, the manner-of-motion verbs are always optionally interpretable in a temporally bounded or a non-bounded reading. This is not true of the other classes. Also, the direct objects of the manner-of-motion verbs are always optional; not always true of other two classes. Why are these verbs distinctive in this way?

The manner-of-motion verbs contrast with the other two classes, in that they, in their simplest and most basic usage, are not *measuring-out* verbs. Lexically, they are aspectually underspecified. The optional interpretation introducing a temporal terminus requires the importation of additional material. This additional material may be a goal phrase introducing a bounded path and a definite goal, such as *to the river* in *Johannes walked to the river*; or a noun phrase introducing a linear bounded path such as *The Appalachian Trail* in *Mary hiked the Appalachian Trail*. Without this additional material, the unbounded reading prevails, and since the unbounded reading is more basic, the additional material is optional. This process of adding optional material in

the verb phrase to append a temporal terminus in the semantics, thus converting the verb to a *measuring-out* verb, is a productive process in English and many other languages.<sup>32</sup> This process may apply to all three classes of verbs (as will be further discussed in section 3.5). It has been insightfully articulated by Levin and Rapoport (1988), and by Jackendoff (1990), in the context of *Lexical Conceptual Structures* or *Conceptual Structures*.

Since in their primary lexical sense, these manner-of-motion verbs are describers of manner, and since the *measuring-scale* most readily available to them is that of distance, and since the endpoint of a distance is a location, these verbs standing alone cannot encode the temporal terminus required for a bounded event interpretation. The manner-of-motion verbs contrast with the other two classes in this respect.

These patterns of lexical specifications of meanings among the three verb classes correspond to elements of world knowledge: for instance, that we may have a change with or without an absolute change of state, or an incremental theme with or without complete consumption of the object; but *manner* of motion inherently has no potential terminus included in its meaning.

### 3.3 *Linearity*

With the manner-of-motion verbs, where the measuring-out interpretation is optional, this interpretation can depend upon whether or not the object is understood as being linear. This contextual or pragmatic knowledge affects whether the optional aspectual structure appending a temporal terminus in the semantics, is employed or not. The linearity of the object allows it to be interpreted as a *path object*, and the verbal complex to be interpreted as *measuring-out*. This is true for the manner-of-motion verbs, but not for the change-of-state verbs or the incremental-theme verbs. Krifka's formula for mapping-to-events does not indicate the linearity of the object, which is, rather, information encoded in the relation between  $x$  and the direct or indirect object. Krifka's formula for *measuring-out* does not therefore distinguish the manner-of-motion verbs from the change-of-state verbs and the incremental-theme verbs in this respect. This characteristic of the manner-of-motion verbs comes from the nature of the world knowledge associated with distance as a *measuring-scale*.

In the sentences below, the (a) sentences (with the linear objects *the Appalachian Trail* and *the Allegheny River*) make the bounded interpretation more salient than in the (b) sentences (with the nonlinear objects *the hills of Scotland* and *the lakes of Northern Maine*).



- (34) a. Mary walked the Appalachian Trail in three months/for three months.  
 b. Mary walked the hills of Scotland ??in three months/for **days**.<sup>33</sup>
- (35) a. Mary canoed (the length **of**) the Allegheny River in two weeks/for two weeks.  
 b. Mary canoed the lakes of Northern Maine ??in two weeks/for days.

With the verbs *melt*, *repair*, *build*, and *eat*, the linearity of the object makes no difference:

- (36) a. Susan melted the ice cream in five minutes/\*for five minutes.  
 b. Susan melted the frozen banana in five minutes/\*for five minutes.
- (37) a. Caroline repaired the engine in five hours/\*for five hours.  
 b. Caroline repaired the road to the cabin in five hours/\*for five hours.
- (38) a. Mary built the treehouse for her son in five days/\*for five days.  
 b. Mary built the road to the cabin in five days/\*for five days.
- (39) a. Janet ate the watermelon in five minutes/\*for five minutes.  
 b. Janet ate the long licorice stick in five minutes/\*for five minutes.

Our knowledge of the world tells us that there is only one way to progress, by traveling, through a linear object like the Appalachian Trail or the Allegheny River. There is more than one way to progress, by eating, through a watermelon or a licorice stick. Certainly one could eat the licorice stick from one end to the other, but one could also eat the middle part first, saving the ends for last. It is not possible to progress along a distance covering the middle first, and then the ends. Again, this is part of world knowledge; a fact the speaker has in their repertoire about the special properties of distances.

Because the *measuring-scale* for these verbs is based on distance, for the verb to be a *measuring-out* verb it must have a component of translative motion in its meaning. If the verb already has motion in its basic sense, then all that is required is to construe that motion as translative, and therefore as having a linear path. The linearity of the path object (together with its finiteness) triggers the *measuring-out* reading. Our world knowledge tells us that an object like the Appalachian Trail has in it an inherent linear dimension of distance. The change-of-state or incremental-theme verbs, in contrast, require no linear dimension in their objects for the change of state or consumption of the object to coincide with the end of the *event*.<sup>34</sup>

### 3.4 *Iterativity*

In the temporally unbounded interpretations of verbs describing some manner-of-motion, an iterated reading in which the path object is repeatedly traversed is optional, as described in section 3.2. If the object is finite and linear it can be understood as iterated or not, depending on world knowledge about the amount of time usually required to traverse it. Again, this is information unspecified in Krifka's mapping-to-events formula. The formula does not indicate iterativity of the event; in fact, since these iterative readings occur with temporally unbounded events, the formula does not apply in these cases.

In (40a) below, the most likely interpretation is to understand that Mary hiked along the Appalachian Trail for one month, rather than back and forth along it many times, because the speaker's knowledge about the Appalachian Trail is likely to include the information that it cannot be hiked from end to end in only one month. (40b) is more likely to be understood to mean that Mary walked back and forth across the bridge for five hours, because it is common knowledge that bridges are not usually long enough to take five hours to traverse. The iterative or non-iterative readings are undetermined by the verb, and left open to interpretation based on context or world knowledge.<sup>35</sup>

- (40) a. Mary walked the Appalachian Trail for one month.  
 b. Mary walked the bridge for five hours.

Again, with other examples of manner-of-motion verbs, we see that the following sentences are interpretable variously as multiple traversals of the same path (the *iterative reading*), or as incomplete single traversals of the path (what I will call the *wandering-around reading*). This facet of the meaning is not determined entirely by the verb, but is left to the listener's discretion, to fill in through context or world knowledge. (I for example, would expect *Jean paddled the Ohio River for a week* to have a non-iterative interpretation.)

- (41) Mary ran the race-route for an hour.  
 Jean paddled the Ohio River for a week.  
 Laura hiked the Long Trail for a week.  
 The women canoed Lake Memphramagog for several days.  
 Erica drove Highway One for a week.

We see a similar effect with the change-of-state verbs, when we examine those that have non-measuring interpretations. The interpretation is left open, in the case of the temporally unbounded reading, as to whether the same pancakes are being warmed over and over again, or whether they are only warmed once, without success:

(42) Jane warmed the pancakes for hours but they weren't very warm.

In general, I believe, one would expect the *wandering-around reading* more than the *iterative reading* in the case of these pancakes, but my experience with pancakes may be unusual. The *iterative reading* and the *wandering-around reading* are open to varying interpretations depending on the speaker's opinion or knowledge about pancakes.

It is possible to find some incremental-theme verbs in which the temporally bounded reading is available for some speakers. The single question mark indicates that only some English speakers may find this acceptable; more may find it marginal.

(43) ?Laura bought a five pound wheel of Dutch cheese. She ate the cheese for hours (and was still eating when I returned).

For speakers that find the unbounded reading acceptable with the verb *eat* in this sentence, the sentence must be interpreted to mean that Laura ate the same cheese once without finishing it. She did not consume the same cheese over and over again. This kind of iterative reading is not available for incremental-theme verbs because the object is understood to be consumed or created in the event described by the verb, and considerations of world knowledge do not generally allow the same object to be created or consumed twice. (The objects of these verbs do in fact undergo a kind of change of state in being created or consumed.)

For all three classes of verbs, when they are used to describe temporally unbounded events, context, world knowledge, or the speaker's inclinations govern whether they may be interpreted in the *iterative* or in the *wandering-around reading*. Both readings are in principle available, but the *iterative reading* is generally more difficult to get with the incremental-theme verbs, because our world knowledge tells us that many objects cannot be created or consumed twice. It is somewhat more available with verbs describing temporally unbounded changes of state, because some objects may undergo a certain type of change twice. However, the iterative reading is most readily

available with the manner-of-motion verbs, because in general, any distance can be traversed twice. It is a special property of distance as a *measuring-scale* in the lexical semantics of these verbs, that it may be easily traversed any number of times. A distance or a path undergoes no change-of-state in being traversed, nor is it created or consumed by being traversed. Although the iterative reading is in principle available for all three verb classes, it is highly accessible for the manner-of-motion verbs, because of the properties associated with the *measuring-scale* in the semantics of these verbs.

### 3.5 Addition of arguments versus predicates

Each of the three basic kinds of *measuring-out* verbs or verbal complexes (change-of-state, incremental-theme, or manner-of-motion) can be created by adding extra material to a simple verb. The new verbal complexes created all share the property of requiring a temporally bounded interpretation. These verbal complexes may be formed by adding predicates or by adding arguments, as demonstrated below. The additional material in the verb phrase imports an endpoint into the semantics, making the verb a *measuring-out* verb, and the event described a temporally bounded event. The additional predicate adds a terminal endstate to the semantics, while the additional argument adds a terminal point or location on the *measuring scale*.<sup>36</sup> The manner-of-motion verbs part company here with both the change-of-state and the incremental-theme verbs, because for the manner-of-motion verbs (but not for the other two classes) the addition of a goal argument is completely productive. Krifka's mapping-to-events formula does not indicate whether the temporal boundedness is introduced by an argument or a predicate, or whether it is implicit in the verb-object combination *alone*.<sup>37</sup> Krifka's formula can therefore give no account of why the manner-of-motion verbs are different in this respect. Again, we must look to the different properties of the *measuring-scales* associated with these verbs for the answer.

Incremental-theme and change-of-state measuring-out verbs may be created by adding a particle (a secondary predicate) like *up*. (These constructions have been discussed by Bolinger 1971 and Fraser 1976 among others.) Example (44) below illustrates this with the verb *chew*. The (a) sentence below shows that the verb *chew* is understood to indicate a temporally unbounded situation. In the (b) sentence, the particle *up* enforces a temporally bounded reading, making *chew* up a *measuring-out* verbal complex:

- (44) a. Jane chewed a sandwich for five minutes/\*in five minutes.  
 b. Jane chewed a sandwich up \*for five minutes/in five minutes.

The particle also imparts a sense of the object, the *sandwich*, being completely chewed. Compare (45a) and (b):

- (45) a. Jane chewed the sandwich for five minutes, and it was still partly unchewed.  
 b. ?Jane chewed the sandwich up in five minutes, and it was still partly unchewed.

This verb-particle construction in English is not fully productive, but is limited to certain lexically marked verbs. However, many examples can be found of the construction. More examples of this verb-particle construction are provided in (46) below. The reader can ascertain that they work the same way. The examples below include change-of-state verbs, incremental-theme verbs, and verbs that could be interpreted either way:

- (46) a. Jane gobbled a sandwich for five minutes/\*in five minutes.  
 Jane gobbled a sandwich up \*for five minutes/in five minutes.  
 b. Mary ate a peach ?for five minutes/in five minutes.<sup>38</sup>  
 Mary ate a peach up \*for five minutes/in five minutes.  
 c. John cleaned the kitchen for five minutes/in five minutes.  
 John cleaned the kitchen up \*for five minutes/in five minutes.  
 d. Bill washed the dishes for five minutes/in five minutes.  
 Bill washed the dishes up \*for five minutes/in five minutes.  
 e. Bill dried the dishes for five minutes/in five minutes.  
 Bill dried the dishes up \*for five minutes/in five minutes.  
 f. Jim wiped the table for five minutes/\*in five minutes.  
 Jim wiped the table off \*for five minutes/in five minutes.  
 g. Mark wrung his towel for five minutes/\*in five minutes.  
 Mark wrung his towel out \*for five minutes/in five minutes.  
 h. Martha dried her socks for five minutes/in five minutes.  
 Martha dried her socks out \*for five minutes/in five minutes.  
 i. Karen rubbed the horse for five minutes/\*in five minutes.  
 Karen rubbed the horse down \*for five minutes/in five minutes.  
 j. Jane scrubbed the bucket for five minutes/\*in five minutes.  
 Jane scrubbed the bucket out \*for five minutes/in five minutes.<sup>39</sup>

Likewise, a change-of-state measuring-out verb may be created from a verb like *wash*, by adding a secondary predicate like *clean*, which names the endstate achieved in the change of state. These have been referred to in the

Adding secondary resultative predicates to make a *measuring-out* verbal complex like *wash clean* is a fairly productive process in English. (48) below provides more examples:

- (48) a. Bill hammered the metal for five minutes/\*in five minutes.  
 Bill hammered the metal flat \*for five minutes/in five minutes.
- b. John pounded the metal for five minutes/in five minutes.  
 John pounded the metal flat \*for five minutes/in five minutes.
- c. Loren painted the wall for five minutes/in five minutes.  
 Loren painted the wall blue \*for five minutes/in five minutes.
- d. Bill scrubbed the floor for five minutes/in five minutes.  
 Bill scrubbed the floor clean \*for five minutes/in five minutes.
- e. Jennifer wiped the table for five minutes/in five minutes.  
 Jennifer wiped the table *dry* \*for five minutes/in five minutes.
- f. Jim rubbed the coin for five minutes/\*in five minutes.  
 Jim rubbed the coin clean \*for five minutes/in five minutes.
- g. Mark wrung his towel for five minutes/\*in five minutes.  
 Mark wrung his towel *dry* \*for five minutes/in five minutes.
- h. Louisa froze the milk for five minutes/in five minutes.  
 Louisa froze the milk solid \*for five minutes/in five minutes.
- i. Julia raked the ground for five minutes/in five minutes.  
 Julia raked the ground bare \*for five minutes/in five minutes.
- j. Thomas pushed the door for five minutes/\*in five minutes.<sup>41</sup>  
 Thomas pushed the door open \*for five minutes/in five minutes.
- k. Charles burned the kettle for five minutes/\*in five minutes.<sup>42</sup>  
 Charles burned the kettle black \*for five minutes/in five minutes.

These examples show that change-of-state and incremental-theme *measuring-out* verbs or verbal complexes are readily formed by adding predicates. The process is not entirely productive however. Not every verb expressing action on an object may take a secondary predicate (\*box *the packages square/big/pretty*, \*touch *the wall dirty*), and the action and the state change must be compatible (\*paint *the wall tall*, \*scrub *the floor empty*).

Predicates in the form of particles can also be used to make *measuring-out* verbal complexes from manner-of-motion verbs. (I will call these *goal particles*.<sup>43</sup>) Particles like these are not unnatural, but they form a restricted class, as these examples illustrate:

- (49) Ludwig walked home.  
 "Ludwig walked work.  
 \*Ludwig walked school.  
 "Ludwig walked bridge.  
 \*Ludwig walked town.
- (50) Garfield ran home.  
 \*Garfield ran work.  
 \*Garfield ran school.  
 \*Garfield ran bridge.  
 \*Garfield ran town.
- (51) Kimberly drove home.  
 \*Kimberly drove work.  
 \*Kimberly drove school.  
 \*Kimberly drove bridge.  
 \*Kimberly drove town.
- (52) Jonathan stumbled home.  
 \*Jonathan stumbled work.  
 \*Jonathan stumbled school.  
 \*Jonathan stumbled bridge.  
 \*Jonathan stumbled town.

Examples (44) through (52) show that in English, secondary predicates can be added to all three verb classes to add a temporal bound in the semantics and introduce a *measuring-out* interpretation. This process of adding a secondary predicate in English is fairly productive, but not completely so. This process seems to involve some lexicalization; that is, it is a property of individual verbs whether they can take secondary predicates and which ones they can take.

Now compare the options in adding arguments rather than predicates. It is not impossible to form change-of-state *measuring-out* verbs by adding goal-like arguments, as in these examples suggested by an anonymous reviewer:

- (53) The light changed to red  
Matters went from bad to worse.

However, in general, the endstates named by the secondary resultative predicates are awkward to unacceptable when introduced as nominal goal-like arguments:

- (54) ??Bill washed the floor to the point of cleanliness.

These may sometimes be improved by emphasizing the absolute nature of the endstate (as pointed out to me by another anonymous reviewer):

- (55) ?Bill washed the floor to a point of absolute cleanliness.

Nevertheless, it seems to be the case that states, which readily encode the temporal terminus for change-of-state and incremental-theme verbs, are more easily put into syntax as simple predicates rather than as phrases containing a goal-like argument (although we might think of the goal phrase itself as a predicate with the goal argument embedded in it).

Compare this with the manner-of-motion verbs. As mentioned in section 3.2, manner-of-motion verbs may be made into *measuring-out* verbs by the addition of a goal phrase, such as *to the river* in the sentence below:

- (56) Johannes walked to the river.

*The river* is a nominal argument here, which may be characterized as a *locational goal*.<sup>44</sup> The locational goal occurs naturally as an argument of motion verbs. In fact, it is an extremely common and productive phenomenon. Any manner-of-motion verb can be made into a *measuring-out* verb by adding a goal phrase containing a locational goal. Consider the verbs illustrated in example (57) (in some cases changed from the previous examples in (9) to include or emphasize goal phrases), where goal arguments are italicized:

- (57) Mary ran to *thefence*.  
The five year old bounced to *the bottom of the stairs*.  
Bill rowed to *the end of the lake*.



Jean paddled to *the end of the lake*.  
 Laura hiked to *the top of the ridge*.  
 The men sauntered to *the other side of the street*.  
 The wheelchair racers rolled to *the finish line*.  
 The rescue dog swam to *the overturned boat*.  
 The women canoed to *the border*.  
 Erica drove from Colorado to *Texas*.

These are all good sentences, all describing temporally bounded events. The addition of a goal phrase containing a goal-like argument, which is occasionally possible with change-of-state or incremental-theme verbs, is completely productive with manner-of-motion verbs. Why this difference between the verb classes? This is not predicted by the syntax, the grammar, or by the logical formula for measuring-out. The addition of a goal-like argument is linguistically, syntactically, and grammatically viable for all three verb classes.

We must look to the special properties of distance as a *measuring-scale*. The manner-of-motion verbs encode motion in their basic meaning. To complete the *measuring-out* semantics for these verbs, it is necessary to add to the meaning of the verbal complex a sense of translative motion (a linear path or distance) plus a locational terminus (the goal argument). We can do this productively. This is consistent with our knowledge of the world, which tells us that given a kind or a manner of motion, that motion may be easily understood as translative, traversing distance. Furthermore, once we have translative motion, we may always have some place or location where that motion ends. The productivity of the construction lies in the productivity of the associated world knowledge. We expect that one may always engage in some kind of motion that traverses a distance, but we do not expect that every action on an object is likely to produce a change of state. Furthermore, locations on scales are often redundant, or at least suggested by the rest of the verbal complex (*clean the floor to the point of absolute cleanliness; eat the apple to the point of complete consumption*) while manner-of-motion verbs do not contain reference to their geographic or locational endpoint in the basic verb. Rules for felicitous language usage which prescribe the avoidance of redundancy would not favor the usage of change-of-state verbs and incremental-theme verbs with goal arguments.

#### 4. Conclusion

This paper has focused on a distinction between two types of information in verb meanings. The first kind of meaning is templatic, highly structured, organized around temporal and aspectual information, and to a certain extent context-free and modular. The second kind of meaning contributes to a kind of gap-filling in the first, is relatively context-dependent, and is more deeply connected to general encyclopedic world knowledge. Since the first kind of information is relatively context-free and modular compared with the second, and since truth-conditional information about entailments is clearly contained in the first kind of information but not so obviously in the second, the distinction between them is related to the interface between semantics and pragmatics. The clarification of the exact nature of this relationship may need (and contribute to) a better understanding of that interface.

The kind of gap-filling discussed in this paper is different from the familiar kinds of gap-filling involved in deixis and indexicality. It is more than just filling in a gap with a time, location, speaker, or addressee. More information is involved, since more reference must be made to the world knowledge associated with the verb meanings, to decide on a plausible relationship between a *measuring-scale* and a direct or indirect object. In interpreting this gap-filling information, the speaker is engaged in choosing or recognizing some measurable aspect of the object or indirect object. He or she must be guided in this by world knowledge. The case can be made that the first type of information is part of a general, universal system for linguistically encoding and organizing certain kinds of world knowledge. What about the second type of information?

In this paper I have not adopted the assumption that world knowledge is universal, or that it is independent of linguistic conceptualization. The points made in the paper do not depend on that assumption. The properties of distance as a *measuring-scale* that distinguish the three classes and make motion verbs special may be reflections of the world knowledge of the English speaker, as it is encoded in the English language. Nevertheless, the paper does lead us to ask the question whether some of these properties might be universal. The differences discussed in section 3 between the three verb classes, and the ways in which manner-of-motion verbs are special are summarized below:

**Graduality:** Change-of-state measuring-out verbs often describe events with no duration; incremental theme measuring-out verbs sometimes do so; but manner-of-motion measuring-out verbs virtually always describe a gradual event, with duration.

**Optionality:** When used with definite direct objects, change-of-state verbs are often obligatorily measuring-out verbs; incremental-theme verbs are usually obligatorily measuring-out verbs; and manner-of-motion verbs are never obligatorily measuring-out verbs.

Change-of-state verbs and incremental-theme verbs may obligatorily require their direct objects; for manner-of-motion verbs the direct objects are always optional.

**Linearity:** For manner-of-motion verbs the linearity of the direct object can trigger the measuring-out reading. The linearity of the direct object is less relevant for the measuring-out reading of the change-of-state and incremental-theme verbs.

**Iterativity:** Manner-of-motion verbs are easier to interpret iteratively than change-of-state verbs and incremental-theme verbs. This is because a distance may be traversed more than once, more easily than an object can change state or be consumed more than once.

**Addition of arguments versus predicates:** Manner-of-motion verbs are inherently unspecified for temporal boundedness. This is not necessarily true of change-of-state verbs and incremental-theme verbs.

With the manner-of-motion verbs, the addition of a goal argument to form a measuring-out complex is fully productive. With the change-of-state verbs and incremental-theme verbs, the productivity of this process is limited.

What exactly are the special properties of distance that are associated with the special properties of manner-of-motion verbs listed above? These are summarized here:

**Graduality:** Distance is associated with duration because traversing distance consumes time.

**Optionality:** English provides us with a class of verbs which, in their primary lexical sense, describe some manner-of-motion, with no reference to a geographic or temporal terminus for that motion. We can ask the question about English: Why is there a fundamental distinction between manner-of-motion and terminus-of-motion encoded in verb meanings? This would **say** something about the separability of distance from other facets of verb meaning.

**Linearity:** Distance is associated with linearity because distance is consumed over time through translative motion, which proceeds along a linear path.

**Iterativity:** Distance is associated with iterativity because a distance or spatial path can always be traversed more than once; whereas an object cannot necessarily change state or be consumed more than once.

**Addition of arguments versus predicates:** Distance is associated with the productive 'addition of arguments' because traversal of a distance can always lead to a location. Moreover, a manner of motion may be easily transferred to a translative motion.

With the possible exception of *optionality*, the special properties of manner-of-motion verbs reveal clear ideas about distance: that traversing distance consumes time; that translative motion, which traverses distance, proceeds along a linear path; that a distance or spatial path can be traversed more than once; that one can always traverse a distance to some location; that if there is some manner of motion there can also easily be translative motion associated with it. We do not know that these ideas about distance are part of a universal world knowledge possessed by human beings.

On the other hand, we do not know that these ideas are not universal for human beings. Do these ways of organizing the properties of distance show up universally across languages and cultures? Is there independent evidence that can show us whether these ideas have their roots in general human cognition independent of, and more primary than, language? These ideas about distance would seem to be likely candidates for something that would connect up with general human cognition, since they would involve processing of the most **basic** kinds of knowledge about spatial and temporal properties of the world. We might expect this type of world knowledge to have survival value for other species which do not have language.

These questions are not answerable without further investigation. But this research provides a way to embark on such an investigation into the exact nature of the relation between language, cognition and world knowledge. It is quite possible that linguistic structure provides a precise set of narrowly structured templatic verb meanings, into which are squeezed the elements of more general world knowledge — world knowledge as it arises out of the application of human cognition to the world that humans live in. In the demarcation between the two types of information in verb meanings discussed in this paper, we have a candidate for one locus of the intersection of

language and general cognition. This paper leads us to pose these questions, and points towards some means of attacking them.<sup>45</sup>

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## Notes

1. See Fodor (1981) for some comments on this discussion.
2. See for example, discussions on *Semantic Representations*, *Lexical Conceptual Structures* and *Conceptual Structures* in Carter (1976), Hale and Keyser (1986), and Jackendoff 1990, respectively. Space prohibits my introducing these kinds of representations in depth here.
3. See Levin (1985) for a clear discussion of relevant methods and motivation for this research.
4. See, among others, on *event structure*, Grimshaw (1990). Moens and Steedman (1988), Pustejovsky (1991), Tenny (1994). Van Voorst (1988).
5. In fact, the term *semantic pragmatics* has been suggested for the kind of gap-filling involved in indexical reference (Cresswell 1973: 238).
6. For an exposition and discussion of this view, see Piatelli-Palmarini (1980).
7. The discussion of *measuring-out* follows Tenny 1987 and 1994. The property of temporal boundedness has also been referred to as delimitedness or telicity.
8. The data in this paper involve judgements about the properties of individual verbs. Since there is always some lexical variation among speakers of a language, the reader may find him- or herself uncomfortable with some of the judgements. These speaker variations are noted wherever possible, but regardless of the particular examples cited, speakers should find they have the same general set of verb classes, with the same general properties outlined in the paper.
9. It must be made clear that the *temporal boundedness of events* referred to here is linguistic and not metaphysical. The expression is used here, and by the authors cited, as referring to the way in which linguistic expressions (particularly verbs) *represent* events as structured in time. It does not refer to the way events *are* structured in the world.
10. See Tenny (1994) for a fuller discussion of the relation between *measuring-out* and the arguments of the verb.
11. The role of the path has been discussed in Gruber (1965), Talmy (1985), Jackendoff (1990), and others.
12. The bridge itself is not a *measuring-object*. This is a departure from Tenny (1987).
13. I use the term *verbal complex* because in many cases it is the verb together with other elements of the verb phrase, such as particles and objects, which bear these aspectual properties, rather than the verb alone.
14. The incremental-theme interpretation requires countable rather than mass objects, and it also is easier to see with verbs used in the past tense. Consequently the verbs in these examples are used in the past tense, with countable objects.

15. Some of these verbs may be used by some speakers optionally as incremental-theme verbs expressing a temporally bounded event, or as verbs expressing an event without a definite temporal bound: *Carlota played a sonata by Beethoven in an hour/for hours*. However, the temporally bounded incremental-theme reading should be available with all these verbs.
16. We can also see an implicit path made explicit in the *his way* construction. Manner-of-motion verbs can be created by adding the expression *his way* to certain kinds of English verbs. The verb provides the manner, and *his way* provides the path:

*Phillip talked his way through the crowd.*

*John flattered his way across the room.*

*Mary chopped her way through the undergrowth.*

*Bill lied his way to the top.*

*Susan fought her way to the top.*

The *his way* construction has been discussed by Jackendoff (1990) and Marantz (1992) among others.

17. Levin and Rappaport (1992) discuss verbs of motion, which they divide into three classes. The manner-of-motion verbs discussed here unify two of their classes: the manner verbs with protagonist control and the manner verbs without protagonist control, even though most of the examples I have used belong to the class of manner verbs with protagonist control.
18. See Dowty (1979). Hinrichs (1985). Verkuyl (1989, 1993). Krifka (1992). Jackendoff (1993) also specifically employs homomorphisms relating object and event, and Verkuyl (1993) presents a formal system capturing this relation between an object and an event.
19. Verbal expressions like *wash clean are* interesting because they allow both the incremental-theme and the change-of-state interpretation. One could also easily imagine the floorwashing proceeding from one end of the floor to the other, measured out in increments of floor, parallel to the *eating the sandwich up* case. This choice of interpretation is underspecified by the verb. A change of state verb like *melt* would lean more towards the change-of-state interpretation and less towards the incremental-theme interpretation, although one could imagine melting a popsicle on a stick from one end of the stick to the other. The choice of interpretation would depend in part on whether it was a popsicle or a lake, for example, that was being melted. It would appear that both options are in principle generally available, but in the incremental-theme verbs the options are collapsed into one, because the change of state is progressing through increments of the object. Again, this underscores the fact that these verb classes *are* one class at the level represented by Krifka's mapping-to-events formula.
20. I will not address the question here of whether non-temporally bounded verb meanings can be captured in Krifka's system, but the possibility may be considered.
21. The term *resultative* as used by Nedjalkov (1983) includes a wider range of phenomena than discussed here; it includes, for example, the perfect aspects as well as constructions that indicate *Aktionsarten* such as completed changes of state. Nevertheless numerous examples of resultatives as described here can be found in that work. For a discussion of the cross-linguistic recurrence of constructions incorporating reference to a temporal endpoint, see Tenny (1994).

22. But see Tenny (1994) for more discussion of general aspectual constraints on syntax and semantics.
23. Krifka provides a uniqueness constraint (uniqueness of objects) in his system (Krifka 1992: 39, example P27):

$$VR \{UNI-O(R) \leftrightarrow \forall e, x, x' [R(e, x) \wedge R(e, x') \rightarrow x=x']\}$$

Krifka: "Uniqueness of objects captures the fact that an event is related to a specific object, for example, a drinking of a glass of wine is related via the patient role to this glass of wine, and to nothing else".

24. Quantification and quantification-like effects may act on this single scale to multiply the event, as in *eat the sandwich twice*. These effects are outside the scope of this paper. The interaction of quantification and the *measuring-scale* is addressed in Heny and Tenny (1993).
25. Syntacticians may object that these expressions are bad because only one case may be assigned by a verb. First, instances in which a verb may assign two structural cases have been argued for (Baker 1988). Second, the chicken and egg question: the case constraint in syntax serves to reinforce the one-scale-per-verb constraint; why should the syntactic constraint be primary?
26. Since the term *incremental theme* refers to a theme consumed incrementally during the event, it might be said, by definition, not to occur with achievement verbs. Verbs expressing instantaneous creation or consumption seem almost like change-of-state verbs rather than pure incremental-theme verbs. This illustrates again that these two kinds of verbs are members of the same class at a certain level of abstraction.
27. A verbal complex expressing a change in location which may be understood as instantaneous is: *Beam me up, Scotty*. My intuitions are fuzzy here; I defer to the Trekkie community on whether or not *beaming up* involves translative motion, or motion at all. This example would seem to straddle the border between change-of-state verbs and manner-of-motion verbs, further underscoring the fact that at the right level of abstraction, these three classes are one class.
28. Among others, see Dowty (1979), Hinrichs (1985), Verkuyl (1993, 1989).
29. Other kinds of motion verbs besides the manner-of-motion class discussed here may encode a terminus. The *verbs of directed motion* such as *arrive, come* or *depart*, discussed in Levin and Rappaport (1992), describe temporally bounded events, presumably by virtue of the encoded direction, which serves to imply a bounded event.

Also, verbs exist which incorporate a terminal location for an event in which something is moved; *shelve the books, beach the boat, or table the proposition*. But observe that these verbs do more than describe a simple translative motion from one point to another. *Shelve the book*: means more than simply 'put the books on the shelf', since one may shelve the books on a chair. A *beached* whale has suffered more than simply arriving on a beach. Verbs encoding an *endstate* for a motion, once coined, have license to take on further specifications of meaning than simple translative motion (becoming in effect more like change-of-state verbs). We see this most fully developed in *table the proposition*, which means more than 'put the proposition on the table'. See Hale and Keyser (1992) and Jackendoff (1990) for a fuller discussion of these verbs.

Verb meanings do seem to emphasize either manner or result, but not both (a fact also observed by Talmy 1985, Levin and Rappaport 1990, and Pustejovsky p.c.).

30. The literature on this kind of causative alternation is too large to do justice to it. For an overview of the alternation and the relevant literature, see Levin (1993: 26-30).
31. Some English speakers, however, might be able to use this verb in the middle construction: *That kind of window repairs easily.*
32. See Nedjalkov (1983) for a variety of non-English examples.
33. Some speakers may treat these verbs as incremental-theme verbs. In this case, *walking the hills of Scotland* would be understood as a kind of act of consumption, where all the hills are walked over, until they have all been walked over. This interpretation makes the bounded reading possible. Note that quantification can play a role here in emphasizing complete coverage of the object: *walk all the hills of Scotland.*
34. A reviewer points out the following example, showing that properties of the object other than linearity can make the difference with other classes of verbs. *Use* is a verb of consumption (and a measuring-out verb) for glue, but not for tools. The speaker has to know that one consumes glue, but not tools: *Mary used the glue/??the tools in three days.* Quantifiers may also interact with direct objects in interesting ways: *Mary used all the tools in three days.* The interaction between quantifiers and direct objects is a separate phenomenon and is beyond the scope of this paper.
35. The direct objects *the Appalachian Trail* and *the bridge* are used with definite articles in these examples, in order to force the reading that it is the same object that is being traversed over and over. Again, in order to observe this phenomenon, definite countable objects must be used to abstract away from the effects of mass noun or bare plural objects.
36. As mentioned in section 3.2, this syntactic process of adding material in the verb phrase to append a temporal terminus in the semantics has been addressed by Levin and Rapoport (1988) and by Jackendoff (1990), in the context of *Lexical Conceptual Structures* or *Conceptual Structures*. Unfortunately, space prohibits my fully explaining these insightful accounts here, but I will provide a brief example. Levin and Rapoport describe a process of 'lexical subordination', in which an expression with no semantic reference to a temporal endpoint such as *Evelyn wiped the dishes*, is converted to one in which there is reference to a temporal endpoint such as *Evelyn wiped the dishes dry*. The *Lexical Conceptual Structures* employed by Levin and Rapoport (and others) employ certain basic predicates like BECOME and CAUSE, which were first introduced by Dowty (1979). It is the predicate BECOME, with the optional (AT), which provides a temporal endpoint in the semantics. The *Lexical Conceptual Structure* (LCS) of *Evelyn wiped the dishes* is:
- [x 'wipe' y]
- The LCS of *Evelyn wiped the dishes dry* is:
- [x CAUSE [y BECOME (AT) z] BY [x 'wipe' y]]
- 'Lexical subordination' is a productive rule applying to *Lexical Conceptual Structures*, by which the first LCS is converted into the second. For further discussion of these matters the reader should see the works cited.
37. These are facts more relevant to the syntactic construction of the sentence, which is not necessarily mirrored by the semantics in every respect. The degree and nature of the syntax-semantics connection in these kinds of sentences is an extremely interesting question, which I must leave open here.



38. The question mark indicates that speakers vary on the acceptability of this reading of *eat*.
39. For some speakers, expressions like *wring out*, *rub down*, *scrub out* have a temporally unbounded reading as well as the bounded one. But for these speakers as well, the temporally bounded reading is introduced by the resultative secondary predicate.
40. Only a small part of the literature on these constructions can be mentioned here. See: Bolinger (1971), Dowty (1979), Jackendoff (1990), van Voorst (1986), Halliday (1967), Green (1973), Rothstein (1979), Simpson (1983), Carrier and Randall (1992), and Hoekstra (1988).
41. The relevant reading of *in five minutes* here, for purposes of aspectual diagnosis, is the one in which the pushing of the door by Thomas consumed exactly five minutes; not the reading in which it took Thomas five minutes to get around to pushing the door.
42. For some speakers, *burn* is a measuring-out verb by itself, without the secondary predicate.
43. A reviewer points out that these are sometimes considered a species of intransitive preposition. The goal particles discussed here would be a special subclass of the intransitive prepositions referring to a location and introducing a bounded reading.
44. The *goal* thematic role is one of the most basic thematic roles, and is much discussed in the literature on verbal argument structure and thematic roles (See Gruber 1965, Jackendoff 1972, and Stowell 1981 for some earlier work; Rappaport and Levin 1988, Dowty 1991 and Jackendoff 1987 for more recent ideas about thematic roles). There have been various uses of the term *goal* in the literature. I am focusing here on goals of location, so I use the term *locational goal* to avoid confusion.
45. This paper has benefited immensely from the comments of three reviewers. I am grateful for their astute and insightful comments.

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