The Syntactic Representation of Linguistic Events

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What is an event? We can talk about events in one of two ways—real world events and linguistic events. Real world events are the things that happen. Linguistic events are the linguistic representations of the things that happen. In this paper I will summarize linguistic research about (linguistic) events, focusing on two questions: What are the primitive elements of (linguistic) events, and where in the grammar are events represented? This paper reviews the extant semantic and lexical proposals about the representation of events, with the goal of elucidating their implications for how events are represented in the syntax.

Most research on the linguistic representation of events has associated events with either of the two modules that link language to conceptual experience:

- The lexicon. The earliest thinking about events suggested that eventhood had to do with lexical category: Insofar as nouns denote things and verbs denote actions (it was thought), verbs should encode events. More currently, argument structure theory assumes that the verb controls the "what's happening" of the sentence, insofar as the theory assumes that the verb determines the participants in the event (i.e., its arguments).
- The semantics. The semantic component of language represents sentence meaning. Sentence meaning is tightly connected to the characteristics of the event; therefore, the event is represented in the semantics.

Work during the last several years has suggested a third possibility for where events are encoded:

- The syntax. Recent work on events has demonstrating that syntactic operations are sensitive to eventive properties implies that the event is encoded in the syntax. In particular, event initiation and termination are intimately connected to the purely syntactic functions of Case and agreement, and therefore the event might best be represented in the syntax where Case and agreement are represented.

This paper examines the more significant work done within each of the three main possibilities for event representation--the lexicon, the semantics, and the syntax.

The main body of the paper reviews the various attempts to explain how and where language represents events. Section 2 reviews the semantic approaches to event

structure; semantic approaches identify the event as a primitive element in the logical semantics of a sentence. Section 3 reviews lexical approaches to event structure; lexical approaches identify the elements of the event with the particular lexical arguments of the verb. Finally, Section 4 reviews the evidence that the clausal functional projections in the syntax encode specific components of the event; prior semantic and lexical studies of events have provided the crucial insights that led to recent models in which events are encoded in the syntax. The final section of the paper discusses the interactions among the lexical, syntactic, and semantic approaches to event interpretation.

The terms *aspect*, *event*, and *eventuality* have all been used in different ways in the literature, and it is sometimes difficult to sort out exactly what is meant in a given use of each term. The term aspect has been used in two distinct ways, and only Smith (1991) has clearly delineated the two uses. In her terminology, viewpoint aspect focuses on a temporal perspective of the event, and includes the progressive and (im)perfective. Situation aspect refers to the atemporal contours of the event, such as whether the event has a natural terminus; situation aspect is atemporal because the timeframe is irrelevant to the natural unfolding of the event. In order to keep distinct these two notions of viewpoint and situation, I will reserve the term "aspect" for viewpoint aspect and "event structure" for situation aspect. I will have little to say about viewpoint aspect, except to suggest at the paper's end that (viewpoint) aspect may in fact be related to event structure in ways that research has not yet fully identified.

Within investigations of event structure, the term event is usually used to refer to all non-statives, but event also may be used more narrowly to refer to events with a terminus or delimitation (Parsons (1990), for example). I will use the term event to refer to all non-statives, regardless of termination. Finally, the term eventuality is often used in the literature to encompass both events and states (Bach 1986); I will follow this usage when referring to events and states together.

1. Event classification

Before turning to the three main theoretical approaches to the study of events, I will summarize a long and very influential line of research aimed at classifying events. Event classification research has the goal of identifying a small number of event types into which all events can be classified. This research, however, is not explanatory: It does not address how events are represented in the grammar; nor does it try to determine where events are encoded—within the lexicon, the semantics, or the syntax. Explanatory or not, event classification research has pinpointed the basic features of events that need to be represented, and has established a vocabulary for event characteristics that has been used in virtually all investigations into event representation.

Probably the largest portion of the research on events attempts to classify sentences, predicates, or verbs into a small number of event types. The goal of this line of work is to identify a very small number of types of eventualities that encompasses all propositions. Event classification in and of itself does not explain event structure; that is, it does not investigate how language represents events. Event classification has,

however, described the basic features of events that need to be explained. In reviewing the extensive classification work, I focus on efforts to identify characteristics of the event that have proven useful in understanding how events are represented.

1.1. Classes as event primitives

Aristotle (1984) proposed the first event-based classification of verbs. His main insight was the distinction between states and events, and between events that have a terminal (or culminating) point and those that are ongoing with no definite terminus. Aristotle proposed three event types: An *actuality* expressed "the existence of the thing." I take an actuality to be a state. A *movement* was an incomplete process, an event lacking an inherent terminus. And an *action* was a process with an inherent end. Critically for current research, Aristotle distinguished between states on the one hand and events on the other, and, regarding events, he distinguished between those that have an inherent end and those that do not (movements).

The more recent philosophers Ryle (1949) and Kenny (1963) adopted Aristotle's description of the range of events that language can denote, and then examined events in more detail. Kenny in particular elaborated the Aristotelian three-way classification by listing verbs belonging to each of the three classes, and developing diagnostics for membership within each. Kenny adopted the same three classes as Aristotle, but used his own class labels: *states*, *activities* (actions with no terminus), and *performances* (actions with terminal state). Kenny's main diagnostics are based upon semantic entailments about whether the event can be construed as having taken place when it is still in progress. For example, at any point during the unfolding of an activity, the event described by that activity has taken place, but the same is not true of a performance. The examples in (1) illustrate the distinction between an activity and a performance.

(1) a. ACTIVITY
Terry is running.
=>entails that Terry has run

b. PERFORMANCE
Terry is building a house.
=>does not entail that Terry has built a house

A crucial difference between activities and performances turns out to be one of *delimitation*. A delimited event is one that has an inherent or natural end. Delimitation is the characteristic of performances that Kenny's test is sensitive to.

Perhaps the most influential work on event classification is that of Vendler (1967). Vendler proposed a four-way classification, which, together with Dowty's (1979) set of diagnostics, made up the most widely cited classification system. Vendler proposed that all verbs can be classified as denoting states, activities, achievements, or accomplishments. Each is defined in (2) below and exemplified in (3) through (6):

(2) a. activities: events that go on for a time, but do not necessarily terminate at any given point.
b. accomplishments: events that proceed toward a logically necessary terminus.
c. achievements: events that occur at a single moment, and therefore lack continuous tenses (e.g., the progressive).
d. states: non-actions that hold for some period of time but lack continuous tenses.

(3) ACTIVITIES
a. Terry walked for an hour.
b. Terry is driving the car.

(4) ACCOMPLISHMENTS
a. Terry built five houses in two months.
b. The child is drawing a circle.

(5) ACHIEVEMENTS
a. Terry reached the summit in 15 minutes.
b. The vase broke.

(6) STATES
a. Terry knows the answer.
b. Terry resembles his brother.

Smith (1991) proposed the same four verb classes and added a fifth class called *semelfactives* (instantaneous events), as exemplified by the sentences in (7). Smith defined achievements as instantaneous culminating events, and semelfactives as instantaneous non-culminating events. The addition of semelfactives effectively divides achievements into two classes: events having no duration (such an event's beginning is the same as its end) but which do culminate, and events having no duration and no culmination. Unlike achievements (see (5) above), semelfactives (such as those in (7)) result in no change of state.

(7) SEMELFACTIVES
a. Terry knocked at the door.
b. The child coughed.

1.2. Extra-verbal factors in event classification

In their early work on event classification, Aristotle, Ryle, and Vendler all assumed that the object of classification is the verb: Because the verb determines the class membership of a predicate, it is the verb that must be classified. Classification of verbs is also found in the works of Bach (1986) and Piñón (1995). However, it has been noted again and again that characteristics of the object, adjuncts, and other materials in the clause contribute to the event type of the entire clause. Thus, Verkuyl (1972), Dowty (1979; 1991), Tenny (1987; 1994), and Ritter and Rosen (1996) all argued that

classification must be compositional, not exclusively verb-based. In Rosen (1996), I pointed out various problems with attempts to classify verbs into lexical semantic groups; much of the criticism there is relevant to event classification efforts as well. My most telling criticism consisted of verbs that seemed to belong to one semantic class as used in one sentence, but to a different semantic class as used in another. The same problem afflicts event classification efforts: Many verbs cannot be assigned rigidly to one and only one event class; their behavior is variable and context dependent.

Substantial evidence indicates that sentence material other than the verb can change the overall event type. The direct object affects the event type in at least four different ways. First, the examples in (8) through (11) taken from Ritter and Rosen (2000), show that the addition of an object can affect the event type.

(8) ADDITION OF DIRECT OBJECT

a.	Bill ran for 5 minutes/*in 5 minutes.	activity
b.	Bill ran the mile *for 5 minutes/in 5 minutes.	accomplishment

(9) COGNATE OBJECT

a.	Terry sang for an hour/*in an hour.	activity
b.	Terry sang the ballad ?for an hour/in an hour.	accomplishment

(10) X'S WAY CONSTRUCTION

a.	Terry sang for an hour/*in an hour.	activity
b.	Terry sang her way to the Met in 10 years/*for 10 years.	accomplishment

(11) FAKE REFLEXIVE

a.	Terry sang for an hour/*in an hour.	activity
b.	Terry sang herself to sleep in an hour/*for an hour.	accomplishment

Second, the examples in (12) through (14) illustrate that event class varies on the basis of the internal characteristics of the direct object.

(12) SPECIFICITY OF OBJECT

a.	Bill wrote letters for an hour/*in an hour.	activity
b.	Bill wrote the letter *for an hour/in an hour.	accomplishment

(13) COUNT/MASS OBJECT

a.	Bill drank coffee for an hour/*in an hour.	activity
b.	Bill drank a cup of coffee *for an hour/in an hour.	accomplishment

Moreover, object Cases can lead to different event interpretations of the predicate. Finnish, as illustrated in (14), marks a morphological distinction between accusative and partitive Case objects. If the object is marked accusative, then the predicate receives an accomplishment reading, as in (14a); but if it is marked partitive, then the predicate is an activity, as in (14b) (Kiparsky 1998: 2-3, 5).

(14) OBJECT CASE

a.	*Hän*	*kirjoitt-i*	*kirjee-t*	accomplishment
	he/she	write-PST.M.3SG	letter-PL.*ACC*	
	'He/she wrote the letters (...and left).'			
b.	*Hän*	*kirjoitt-i*	*kirje-i-tä*	activity
	he/she	write-PST.M.3SG	letter-PL.*PART*	
	'He/she wrote (some) letters (...and left).'			
	'He/she was writing letters (...when I came).'			
	'He/she was writing the letters (...when I came).'			

Third, verb particles and resultative predicates can change the event character of the predicate, as the examples in (15) and (16) show, taken from Ritter and Rosen (2000).

(15) VERB PARTICLE

a.	Terry thought for an hour/*in an hour.	activity
b.	Terry thought up an answer in an hour/*for an hour.	accomplishment

(16) RESULTATIVE

a.	Terry ran for an hour/*in an hour.	activity
b.	Terry ran us ragged in an hour/*for an hour.	accomplishment

Finally, the conative alternation and the antipassive alternation can also change the event classification of a verb. Both alternations demote the direct object to an oblique object; eliminating the direct object simultaneously eliminates the delimitation. Examples appear in (17) and (18). Example (18b) has an imperfective or atelic reading.

(17) CONATIVE

a.	Terry ate the apple ??for 10 minutes/in 10 minutes.	accomplishment
b.	Terry ate at the apple for 10 minutes/*in 10 minutes.	activity

(18) ANTIPASSIVE (Bittner & Hale 1996: 36)

a.	*Juuna-p*	*Anna*	*kunip-p-a-a*.	accomplishment
	Juuna-ERG$_i$	Anna-ABS$_j$	kiss-IND-(+TR)-3SG$_i$/3SG$_j$	
	'Juuna kissed Anna.'			
b.	*Juuna*	*(Anna-mik)* ...	*kunis-si-vu-q*.	activity
	Juuna-ABS$_i$	(Anna-INSTR)	kiss-*APASS*-IND-(-TR)-3SGA$_i$	
	'Juuna kisses/is kissing (Anna).'			

The various examples of the compositionality of event type necessitate two conclusions: (a) Not only the verb determines event type, and (b) systematic relations link sentence structure and event type. It is not yet entirely clear how the syntax relates

to event type, but the direct object is involved (Tenny (1994), for example, pioneered work on the relation between event type and direct object). One solution to the problem of how event type is compositional is to classify the predicate or even the whole clause, thereby finessing the issue of how event type is determined. This is essentially Dowty's (1979) tack. Although classifying the entire predicate or clause instead of the verb alone may solve many of the descriptive problems with event classification, classification still suffers from a much more serious shortcoming: Even if the resultant classes accurately describe the eventualities that language encodes, the classification approach is inherently non-explanatory, and the classes themselves are not necessarily the primitive elements involved. Thus, however useful classification schemes are in describing clause types, they are not aimed as explicating the basic elements of events at the disposal of natural language, and they do not bring us closer to understanding how and where in the grammar events are encoded. We should not and need not be satisfied with description alone.

1.3. Parameters underlying event classes

A large body of work examines the specific characteristics of predicates that place them in one event class or another. The main goal of this endeavor is to show that the classification of a verb or clause into an event type is attributable to a more basic set of underlying features: Each particular classification is dependent on more basic primitive characteristics of the event. Explanations of the parameters underlying classifications go beyond pure description by digging beneath the surface of the event classes. Investigations of parameters have thus identified a set of characteristics of events that any theory of event structure must capture. We will see that the lexical and syntactic theories of events largely try to explain the characteristics identified by this research. Individuals attempt at defining the underlying characteristics of the event focuses on different characteristics, but all search for the set of parameters that make up the Vendler classification. I will call efforts to derive the parameters underlying classification the neo-Vendlerian approach. I will briefly run through a few neo-Vendlerian proposals for the purpose of highlighting the main characteristics of these works; we will see in later sections that the event characteristics identified by the neo-Vendlerians have influenced what it is that event theorists try to explain.

Verkuyl (1993), in reviewing Vendler's classification system, argued that event classes themselves are not primitive. Instead, classification is based on deeper characteristics of the event. He identified many shortcomings in Vendler's classification diagnostics (for example, whether the diagnostics test for continuousness, an event characteristic, or for agentivity, a semantic characteristic), the variation in event type found across the different uses of many verbs (as the examples in (8) through (18) illustrated), and the non-structural, lexical nature of the punctuality of achievements. Verkuyl concluded that classification itself is not as useful as is understanding the parameters that make up the classes. He suggested that combinations of two binary features generate the four Vendler classes: *continuousness*, or whether the event has duration, and *boundedness*, or whether the event has a (natural) terminal endpoint. Activities and accomplishments take place over a period of time; states and achievements

do not. Accomplishments and achievements have a terminal bound; states and activities do not. The four classes and their relations are described in (19).

(19) VERKYUL'S (1993) PARAMETERS OF EVENT CLASSES
- a. state: -bounded, -continuous
- b. activity: -bounded, +continuous
- c. achievement: +bounded, -continuous
- d. accomplishment: +bounded, +continuous

Carlson (1981) took much the same approach of analyzing the Vendler system as binary features of predicates. She argued that three parameters define the event properties of adverbials, verbal aspect, tenses, and quantified objects, all of which are elements that affect event structures. Her three parameters were point, extended, and continuous. In fact, her parameters point and extended seem to be simply opposing values of a single feature: Point refers to momentaneous events, and extended refers to events with duration. Her continuous parameter refers to whether culmination is inherent in the event. Carlson's "continuous" is parallel to Verkuyl's "bounded" and Carlson's "point" and "extended" are parallel to Verkuyl's "continuous".

(20) CARLSON'S (1981) PARAMETERS OF EVENT CLASSES
- a. state: +continuous, -extended
- b. activity: +continuous, +extended
- c. achievement: -continuous, -extended
- d. accomplishment: -continuous, +extended

Moens (1987) redefined Vendler's classes by adding a class much like Smith's (1991) semelfactives. Moens also considered the underlying features of his several classes. He suggested that, in addition to states, there are four event types based upon two binary features: ±consequence (termination or culmination) and extended versus atomic (momentaneous or pointed) events.

(21) MOENS' (1987) PARAMETERS OF EVENT CLASSES

a.	culmination: +conseq, atomic	(recognize, win the race)
b.	culminated process: +conseq, extended	(build a house)
c.	point: -conseq, atomic	(hiccup, tap, wink)
d.	process: -conseq, extended	(run, swim, play the piano)
e.	state	(understand, love, resemble)

Moens further proposed that the event classes in (21) are made up of smaller atomic units: A "culminated process" is a process with a consequent state. The insight that events can be decomposed into sub-events becomes important in much of the work on the lexical analysis of events, e.g., in Pustejovsky (1991; 1995). Further, van Voorst (1988), Grimshaw (1990), and Tenny (1994) all claimed that the arguments of the verb are related to the sub-events. I will discuss the lexically based analyses of events in Section 3.

Finally, Hoeksema (1983) and Mourelatos (1978) both introduce the notion of the countability of an event. They liken countability to the mass/count distinction in nouns: Terminating events can be counted but nonterminating processes cannot. Hoeksema (1983), following Mourelatos' arguments regarding countability, argued for a redefinition of the four event classes on the basis of the two features ±count and ±duration, as summarized in (22). The term count refers to whether instances of an event can be counted: achievements and accomplishments have the feature +count; states and activities do not. The feature of duration refers to whether the event takes place over time: Activities and accomplishments have duration; states and achievements do not.

(22) HOEKSEMA'S (1983) PARAMETERS OF EVENT CLASSES
- a. state: -count, -duration
- b. activity: -count, +duration
- c. achievement: +count, -duration
- d. accomplishment: +count, +duration

The overall goal of the neo-Vendlerians has been to identify the features that make up the Kenny or Vendler description of event types. The most common features identified are extension over time and having a culmination or terminus:

(23) MOST COMMON PARAMETERS OF EVENT CLASSES
- a. extended: states, activities, accomplishments
- b. nonextended (momentaneous): achievements
- c. bounded (countable, definite): accomplishments, achievements
- d. unbounded: activities, states

The work of ter Meulen (1983; 1995) suggested a redefinition of the Vendler classes on very different grounds. She defined the four Vendler classes on the basis of their semantic entailments rather than on whether they have duration or whether they culminate. She defined states as meeting an "upward closure condition;" that is, one must look outside the state to see that it is a state. States have no internal structure or change. Events, on the other hand, meet "downward closure conditions" in that they are defined on the basis of their parts. Ter Meulen's event classes are summarized in (24).

(24) TER MEULEN'S (1983) EVENT CLASSES
- a. activity: homogeneous reference, all parts are equivalent to the whole
- b. accomplishment: indivisible, the parts are not equivalent to the whole
- c. achievement: instantaneous and therefore indivisible

Ter Meulen viewed the four Vendler classes as a semantic hierarchy: Achievements are a special case of accomplishments, accomplishments are a special case of activities, and activities are a special case of states.

In her later work, ter Meulen (1995) examined the event classes in terms of the dynamic discourse interpretation that each accords. (See also Hinrichs (1985) for a

discourse oriented approach to events.) Ter Meulen defined three characteristics of events, corresponding to the three event classes: Holes (activities) are homogeneous events; filters (accomplishments) are heterogeneous and no part is identical to the entire event; and plugs (achievements) have no distinction between the initial and final stage of the event. Her purposes in defining events in this fashion were to illuminate the relation between event type and other events in the discourse, and to understand the temporal relation between each event and the other events described.

There is no doubt that efforts toward event classification have increased our understanding of the event, particularly efforts to identify the features underlying event classes. However, classification has various problems. First, classifying verbs in and of itself does not shed much light on the verbs' semantic or syntactic behavior. As outlined above, the verb alone contributes only part of the information necessary to determine the semantic and syntactic outcomes. For this reason, many researchers have turned to the classification of predicates rather than of verbs. It is possible that classifying predicates rather than verbs could produce a descriptively accurate account of the semantic and syntactic outcomes. However, a descriptively accurate account would be just that—descriptive—and no more: Understanding the linguistic representation of events requires deeper analyses than mere classification schemes. The neo-Vendlerians who have investigated the features underlying event classes have indeed looked deeper than the classes themselves, and the features underlying that they have found appear more enlightening than the original classifications themselves. As we have seen, investigations of underlying features have largely converged on the existence of a terminal endpoint (delimitation) and the existence of duration. The consequent challenge to any theory of event structure is to arrive at a representation of events that can explain the effects that delimitation and duration have on the lexical, semantic and syntactic representation of events.

2. Events in logical semantics: The Davidsonian [e]

2.1. [e] in the logical semantics

Panini (B.C.E.), as cited by Parsons (1990), observed that verbs denote particular actions and nouns denote things that relate to these actions, either by doing the action or by being the object or instrument of the action. Plato ([366 B.C.E.] 1961) made the same syntactic distinction between actions and non-actions: He observed that a verb denotes an action, whereas a noun denotes the thing that performs an action. Plato further stated that a sentence is constructed of an action (verb) plus a result (presumably the object nominal).

These early works on events claim that language encodes two basic sorts of information--actions and non-actions--and that the distinction between actions and non-actions is encoded in the lexical category of words: Nouns represent things and verbs represent actions. Davidson (1967) refined the notion of "action" by proposing that action sentences include an event variable in their logical semantics. His proposal and subsequent work building on his proposal constitute the Davidsonian and neo-Davidsonian approach to the encoding of events in language. Davidson's approach looks at the relation between the event denoted by the verb and other constituents in the

sentence, such as modifiers. Davidson argued that events logically are like "things" in that they introduce a variable that can be modified and quantified over. He discussed a problem first pointed out by Kenny (1963) with determining the valence of event predicates. Event predicates can include any number of modifiers, including time, place, manner, and instrument. Just as nominal modifiers modify the noun, event modifiers modify the event. However, one would not want to posit that a verb like *butter* in (25) is simultaneously a two, three, four, five, etc., place predicate (the example is from Davidson 1967), which is a possible consequence of the logical semantics of the modification in these sentences. In fact, adjuncts freely modify, and any number of adjuncts can be added to a predicate. A system that treats the verb *butter* differently in each case would not capture the right generalizations about adjunct modification in language.

(25) a. Jones buttered the toast.
b. Jones buttered the toast slowly.
c. Jones buttered the toast slowly, in the bathroom.
d. Jones buttered the toast slowly, in the bathroom, with a knife.
e. Jones buttered the toast slowly, in the bathroom, with a knife, at midnight.

Davidson represented the logical semantics of action sentences by including an event position, as sketched out in (26). Because the event position is a variable, it can be added to the semantic representation of each modifier, allowing modification to be freely added along with an event variable. The semantic representation then captures the fact that an adjunct modifies the event without changing the valence of the basic predicate.

(26) a. (∃e) (buttered (Jones, the toast, e))
b. (∃e) (buttered (Jones, the toast, e) & (slowly, e))
c. (∃e) (buttered (Jones, the toast, e) & (slowly, e) & (in the bathroom, e))
d. etc.

An advantage of the so-called Davidsonian [e] is its ability to capture the modification of the event in the logical semantics without positing "variable polyadicity" of a given verb: Because the event is represented as a variable, the event variable can be included in the logical semantics of each modifier. Further, the event variable allows us to represent the arguments of the verb separately from the event, allowing for independence of the extension of the arguments and the extension of the event. Davidson (1967: 117-19) illustrates with the example in (27): Given the independence between event and argument reference, the statement in (27b) allows substitution of the name of the argument in (27c) with no resulting effect on the event.

(27) a. (∃e) (Flew (I, my spaceship, e) & To (the Morning Star, e))
b. the Morning Star = the Evening Star
c. (∃e) (Flew (I, my spaceship, e) & To (the Evening Star, e))

Others have pointed out many advantages of the Davidsonian [e] in representing the logical semantics of event-denoting sentences. To begin with, the event variable leads to a natural account of the tense dependency between perception verbs and their infinitival complements (Higginbotham 1983; Vlatch 1983; Parsons 1990). Parsons (1990) argued further that a Davidsonian analysis of events allows an identical analysis for events represented syntactically as nominals and events represented syntactically as verbs--both N and V can denote events. For example, one can refer to the event of the verb *to burn* or the noun *a burn*, as in the examples below: Both denote an event. (Interestingly, Parsons' comment implicitly refutes Panini's and Plato's claims that verbs and nouns are the syntactic realizations of different semantic types, actions and things respectively.) Moreover, Parsons maintained that giving variable reference to events allows explicit quantification over events the same way that quantification applies over things. Parsons (1990: 18-19) exemplified the quantificational property of the Davidsonian [e] with the example in (28).

(28) a. In every burning, oxygen is consumed.
b. Agatha burned the wood.
c. Oxygen was consumed.

The sentence in (28c) follows from (28a,b) because the quantification over the burning in (28a) is logically related to (28b) and (28c). In the logical semantics of (28c), the consuming of oxygen follows from the quantification in (28a) and the specific event in (28b):

(29) a. $(e)\ (\text{Burning}(e) \rightarrow (\exists e')\ (\text{Consuming}(e') \ \&\ \text{Obj}(e', O_2) \ \&\ \text{In}(e, e')))$
b. $(\exists e)(\text{Burning}[e] \ \&\ \text{Subj}(e, \text{Agatha}) \ \&\ \text{Obj}(e, \text{wood}))$
c. $(\exists e')(\text{Consuming}(e') \ \&\ \text{Obj}(e', O_2))$

Various uses of the Davidsonian [e] have been made in the literature, and the different treatments can be classified into the Davidsonian and neo-Davidsonian camps. The Davidsonian analysis places an event [e] argument in the main predicate of the clause, and distributes it among the modifiers of the clause in the logical representation (Davidson 1967; Bayer 1997, for example). The neo-Davidsonian treatment carries this further to distribute the [e] argument among not only the modifiers, but also the individual arguments of the predicate: There is a tendency to represent each thematic argument of the predicate along with the event argument (Krifka 1989; 1992; Lasersohn 1995; Parsons 1990, to name a few). Although the various proposals are interesting in their own right, and although they vary substantially, many of them focus on details of the logical semantics of predicates and events and thus are not of particular relevance to the present paper. I will focus on the syntactic representation of events and its effects on interpretation. Therefore, I will give the various Davidsonian and neo-Davidsonian analyses unfair short shrift, in order that I might focus on the relation between events and the syntax.

I would like to highlight one neo-Davidsonian analysis, because it combines verb classification and neo-Davidsonian event variable approaches. Parsons (1990) included

in his neo-Davidsonian logical representation an extra term corresponding to the event type of the predicate. He distinguished two different types of eventualities: eventualities that culminate, called Cul (achievements and accomplishments) and those that do not, called Hold (states and activities).

(30) a. Jones buttered the toast.
b. (∃e) (buttering (e) & agent (e, Jones) & theme (e, toast) & (∃t) (t<now & Cul (e, t))

(31) a. Mary knows Fred.
b. (∃e) (knowing (e) & exper (e, Mary) & theme (e, Fred) & Hold (e,now))

Parsons' (1990: 25) attempt to combine the (neo-)Davidsonian logical argument analysis with event classification was quite interesting. In adding a logical argument that refers to the event type (Cul versus Hold) to the logical semantics of the sentence, Parsons implied that the event type is itself a semantic entity separate from the event and separate from the event's arguments and modifiers. We will see in Sections 3 and 4 that the lexical and syntactic approaches to events have associated the arguments of the verb with the event type, albeit in very different ways; in certain respects the arguments define the event and the event type.

2.2. [e] in the syntax

For the purpose of understanding the relation between the syntax and the semantics of events, the most interesting use of the Davidsonian argument is the proposal that events are represented in the argument structure of the verb. The proposal effectively adds an argument (which must be satisfied) to the syntactic representation. I will discuss two theories, which differ in the details of which verbs have this argument, and how the argument is syntactically satisfied.

Higginbotham (1985) posited that the Davidsonian [e] appears in the argument array of all verbs, including event-denoting verbs and non-event denoting statives. Because [e] is an argument of the verb, in parallel with the verb's thematic arguments, [e], like thematic arguments, must be syntactically satisfied (as a consequence of the Theta Criterion (Chomsky 1981)). Higginbotham suggested that [e] is satisfied through argument binding to I (or T in more current phrase structure). The example in (32) shows Higginbotham's mechanism of argument satisfaction (Higginbotham 1985: 554-556). In (32b), the numbers within the brackets <> refer to the thematic arguments of the verb, presumably annotated with semantic role labels such as experiencer or theme; the *E* refers to the Davidsonian argument in the logical semantics of the sentence.

(32) a. John saw Mary.
b. *see*, +V, -N, <1,2,*E*>
c. (∃e) see(John, Mary, e)

Because <E> is an argument of the verb, it must be syntactically satisfied. Higginbotham suggested that the mechanism responsible is *theta binding*: The <E> argument is bound

by the inflection node (I), just as the referential argument of a noun is bound by the D node. Binding of <E> results in existential closure of the event.

Kratzer (1989) also suggested that the Davidsonian [e] is an argument of the verb, in Kratzer's case, syntactically satisfied by Tense. Unlike Higginbotham, however, Kratzer posited that only some verbs have [e] as an argument. She proposed that there is a syntactic distinction between stage level predicates (denoting events and temporary states) and individual level predicates (denoting relatively permanent properties), a semantic distinction that Carlson (1977) first noticed. Kratzer argued that only stage level predicates have an [e] in their argument structures. She made a strong case for the claim that the subject of stage level predicates, but not the subject of individual level predicates, is projected internal to the VP (cf Diesing 1988), and that [e] functions as the (implicit) external argument of the verb.

The Higginbotham/Kratzer uses of the Davidsonian [e] made two claims about the representation of events that substantially advanced lexical and syntactic analyses of events. First, Higginbotham and Kratzer provided a syntactic representation for the event. Davidson previously had claimed that events have the representational equivalent of things or entities in the semantics. The Higginbotham/Kratzer representations imply that events also behave like an entities in the syntax: A syntactic inflectional node must satisfy the event argument, just as thematic arguments must be satisfied by specific nodes in the syntax. Second, the Higginbotham/Kratzer representations place [e] on a par with thematic arguments: Because [e] is an element in the argument structure of the verb, it behaves like an argument, is discharged to a syntactic position like an argument, and, in Kratzer's view, has the status of an external argument with all the privileges of external arguments. The view that [e] is an argument of the verb differs considerably from neo-Davidsonian analyses, which allow thematic arguments to be arguments of the event. The Higginbotham/Kratzer analyses claim that [e] is a (thematic) argument of the verb: Although it has no semantic role label, it is one of the arguments, and it is discharged to a syntactic position.

A couple of problems do exist with the Higginbotham/Kratzer syntactic analysis of the (neo-)Davidsonian event variable. First, in general, arguments of the verb have semantic content, but it is not clear whether or in what way [e] has semantic content. Second, arguments of the verb are satisfied by XPs in argument position (subject or object); in contrast, Higginbotham and Kratzer would satisfy the event argument in an inflectional (functional) head (I or T). It is troubling that the syntactic treatment of [e] differs fundamentally from the syntactic treatment of thematic arguments. We will see in Section 4 that it is indeed possible to represent events in the syntax without violating the core assumptions of argument mapping. Third, the monolithic nature of the Davidsonian [e] is at odds with lexical and syntactic evidence regarding the nature of the event. We will also see in Sections 3 and 4 that the event is far too rich in its internal structure and its relation to the syntax is far too complex to permit an analysis that does not allow decomposition of the core event.

3. Events in the lexicon/syntax mapping

Linguistic research has found a tight relation between the lexical entry of a verb and the syntactic structure that it is used in. The omni-presence of the lexicon-syntax relation has prompted the exploration of the limits and constraints on the behavior of lexical items in the syntax, resulting in the development during the last two decades of theories of the lexical-syntactic interface. Research looking at the syntactic representation of events developed from two sources: work on argument structure, and work on event classification and the logical semantics of events. Lexical analyses of events and argument mapping analyses generally address the same questions—the relation between verb meaning (qua event interpretation and argument interpretation respectively) and the syntactic realization of arguments.

WHAT A MAPPING THEORY MUST EXPLAIN

The tendency for specific semantic (thematic) arguments to have characteristic syntactic positions has led to two major proposals regarding universal mapping relations: Perlmutter and Postal's (1984) Universal Alignment Hypothesis (UAH) and Baker's (1988) Uniformity of Theta Assignment Hypothesis (UTAH). The U(T)AH states that specific semantic arguments belong in specific syntactic positions, and that there is a one-to-one mapping between semantic argument and initial syntactic position. Universal alignment predicts identical mappings of arguments into syntax across verbs and languages.

Any theory of the relation between the lexicon and the syntax must explain many phenomena concerning argument mapping. One phenomenon is the near-universality of certain mappings across languages. The most obvious (indeed, perhaps the only universally agreed-upon) of the various mapping universals is that agents appear in subject position in all languages, at least as far as we know. No other thematic role behaves quite so predictably: Thus, theme can appear in object, subject, or indirect object position; and experiencer can appear in subject or object position. The qualification "near" in the term near-universality suggests two research agendas: (a) We must understand and explain the observed regularities in number and position of arguments across the syntactic structures of all languages, and (b) we must understand and explain why the number and position of arguments is not exactly identical in all syntactic structures across all languages.

A lexicon-to-syntax mapping theory must also explain the existence of argument alternations. Given that a semantic role can appear in different syntactic positions for the same verb, then either mapping is not universal, or accounts of argument mapping based on the lexical semantics of the verb are mistaken in their assumptions about what controls mapping. A common solution to the failure of U(T)AH to explain the evident variability of the syntactic positions of semantic roles is to posit the existence of semantically-defined classes of verbs. By hypothesis, each class of verbs defines a set of mapping relations and a set of argument alternations that derive new lexical items with new mappings (e.g., Levin, 1993; Levin & Rappaport Hovav, 1995; Pinker, 1989). The ultimate goal of semantic classification is to find a set of semantic generalizations that totally account for the number and position of arguments.

A problem with semantic classification is that, in apparent contradiction to its core U(T)AH assumption, no one-to-one correspondence exists between the semantic meaning of a verb and its syntactic behavior. Semantically similar verbs may behave differently across languages (C. Rosen 1984), a given verb within a language may have multiple syntactic realizations (C. Rosen 1984; S.T. Rosen 1996), and semantically similar verbs may allow different mappings (Rosen 1996). Simple description shows that verb behavior is variable and context dependent. This context-based variability directly contradicts hypotheses about semantically based universal alignment. More critically, a verb classification model would claim that (by assumption) two verbs are semantically similar only if they are syntactically identical. And so, whenever two verbs behave differently in the syntax, one must posit more and more detailed semantic classes. Should the syntactic data demand it, they could end up with placing every verb in a different class (this sometimes happens—see Pinker's (1989) semantic classes). Because there are no a priori semantic criteria restricting verb classification, theoretical claims based on classification cannot be disproved, because verb classification proponents need only add more and more verb classes as needed to fit the available data.

THETA ROLES DON'T DETERMINE THE MAPPING

In recent work, several researchers have suggested that the role an argument plays in the event described by the verb determines how and where the argument is mapped into the syntax (Dowty 1991; Grimshaw 1990; Tenny 1994; Ghomeshi & Massam 1994; Rosen 1996; van Voorst 1998; van Hout 1993, 1996). These researchers have concluded that semantically based verb classes and thematic roles at best partially determine the mapping. Instead, syntactic arguments identify participants in the event, and the work on event mapping has proposed a set of event roles, which determine the position of the arguments in syntax. Event role mapping theories postulate that the verb lexically determines a set of event roles, and each event role maps to a particular syntactic position.

Some examples of event roles, taken from Grimshaw (1990), Tenny (1994), and van Voorst (1988), are given in (33). Event roles describe the part of the event that the argument is linguistically involved in. For example, an *originator* (cf. van Voorst) begins, or instigates an event; a *delimiter* (cf. Tenny, van Voorst) determines the extent, or unfolding of the event; a *terminus* (Tenny) determines the endpoint of the event.

(33) a. Ned$_{<originator>}$ ate the apple$_{<delimiter>}$.
b. Fred $_{<originator>}$ pushed the cart$_{<delimiter>}$ to the gas station$_{<terminus>}$.

Crucially, event roles are independent of semantic roles. (This statement isn't quite true for Grimshaw, who argued that an event role hierarchy and a semantic role hierarchy jointly determine argument mapping.) For example, instruments and locatives generally appear in oblique position, but if an instrument is interpreted as an originator, it will map to subject position (*The key opened the door*), and if a locative delimits an event, it will map to direct object position (*The farmer loaded the truck with hay*). Tenny proposed

that the mapping of verbal arguments is constrained by the event rather than by thematic roles:

(34) ASPECTUAL INTERFACE HYPOTHESIS (AIH)
The universal principles of mapping between thematic structure and syntactic argument structure are governed by aspectual properties. Constraints on the aspectual properties associated with direct internal arguments, indirect internal arguments, and external arguments in syntactic structure constrains the kinds of event participants that can occupy these positions. Only the aspectual part of thematic structure is visible to the universal linking principles (Tenny 1994: 2).

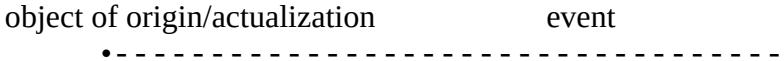
The AIH explicitly denies that semantic or thematic roles play any part in determining the mapping of arguments into the syntax. Tenny proposed a set of lexicon-to-syntax mapping principles that determine the position of internal arguments based primarily on the role that each argument plays in delimiting the event.

Van Voorst (1988) arrived at the same conclusion that the direct object plays a role in delimitation. He also suggested that origination maps to a particular position in the syntax--the subject. Van Voorst represented Event Structure as a line bounded at one end by a point that marks the origination (initiation) of the event and at the other by a point that marks the event's termination. He identified the initiation point with "the object of origin or actualization" (i.e., with the participant responsible for launching or effecting the event), and he identified the end point with "the object of termination" (i.e., the participant that determines when the event is complete). A set of Event Structure Correspondence Rules implied by the diagram in (35) maps the object of origin or actualization to the D-structure subject, and the object of termination to the D-structure object.

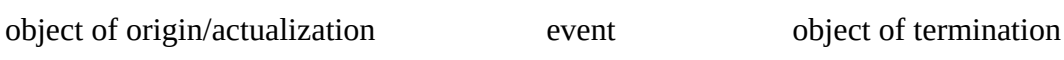
(35) object of origin/actualization event object of termination
•- -•
subject direct object

Van Voorst used event structure to represent the three (non-stative) event types in the Vendler event classification system. (Only non-stative sentences have an event structure.) As shown in (36), activities or processes have no inherent endpoint, so their event structure representation lacks an object of termination. Van Voorst assigned the structure in (36) to achievements as well, because their objects are non-delimiting. Accomplishments, on the other hand, always have an inherent endpoint, though they may or may not have a beginning point. Consequently, their event structure representation contains only an object of termination as in (38), or else contains both an object of termination and an object of origin/actualization as in (37).

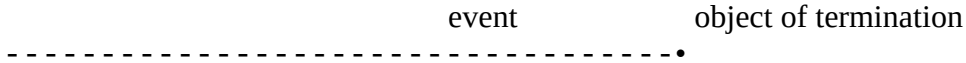
(36) ACTIVITIES



(37) TRANSITIVE ACCOMPLISHMENTS



(38) INTRANSITIVE ACCOMPLISHMENTS AND ACHIEVEMENTS



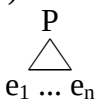
Tenny (1987, 1994) linked the terminal point of a delimited event and the direct object; van Voorst (1988) made the same point, and both he and Grimshaw (1990) further hypothesized that origination or causation is associated with the subject of the clause. We can thus (informally and non-technically) view events as potentially including two event bounds that are identified with the underlying subject and object.

The event role mapping approach generally assumes that event information appears in the lexical semantics of a verb. The works just discussed imply that the lexical semantics of the verb determines (a) the event roles of its arguments, and therefore also determines (b) the mapping of the event arguments into the syntax. However, these several works are not explicit about the lexical representation of these event roles. In contrast, Pustejovsky (1991; 1995) and Jackendoff (1990) have proposed specific representations for the event in the lexical semantics of the verb.

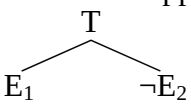
Pustejovsky (1988; 1991) made two claims about the structure of events: (a) Events have internal structure that can be decomposed into smaller parts, and (b) traditional thematic roles can be redefined in terms of the internal analysis of events. Pustejovsky identified three temporal subperiods—initial, internal, and final—which differentiate three underlying properties of event classification. He used these temporal periods to define three event types—states, processes and transitions (Pustejovsky 1991: 56):

(39) STATE (S): a single event, which is evaluated relative to no other event

(40) PROCESS (P): a sequence of events identifying the same semantic expression



(41) TRANSITION (T): an event identifying a semantic expression, which is evaluated relative to its opposition



E in the structure for a transition stands for any event type. Transitions generally decompose into a process (P) with a culminating state (S).

Pustejovsky included in the verb's lexical conceptual structure (LCS) a set of semantic operators that map onto the above-defined event structures. These operators were ACT, CAUSE and BECOME. An LCS with no event operator is a state. An LCS with the BECOME operator maps onto a transition in the event analysis, and one with the ACT operator maps into a process. The CAUSE operator appears to give agentivity; because his event structures lack the notion of origination, the CAUSE operator has no direct event representation. Thus, the two operators, ACT and BECOME, serve to distinguish the three main event types. In later work, Pustejovsky (1995) suggested that the LCS of a verb includes an event structure representation. The LCS breaks down the sub-event structure of the verb's interpretation, using three event types outlined above. Pustejovsky also included an extended event structure, a set of restrictions on the relations between the event and its component parts. These relations included notions such as overlap, partial ordering, and inclusion. So, for example, Pustejovsky (1995: 71) analyzed the event structure of a verb like *build* as in (42). The symbol $<_\alpha$ stands for the relation "exhaustive ordered part of." This particular relation indicates that the parts of the event are partially ordered. The sub-events of other verbs may be overlapped, as he argued is the case for the verb *accompany*.

(42)

$$\begin{bmatrix} \text{build} \\ \text{EVENTSTR} = \begin{bmatrix} \text{E1} = \text{process} \\ \text{E2} = \text{state} \\ \text{RESTR} = <_\alpha \end{bmatrix} \\ \ldots \end{bmatrix}$$

The event denoted by the event structure is then cross-referenced with an [e] argument in the so-called *qualia* structure. The qualia structure contains in essence the word meaning (including the constituent parts of the word), how the item fits into the larger domain, the item's purpose or function, and its origin. The crucial point is that event structure is largely specified in the lexical representation of the verb. Compositionality is represented by combining the lexical representations into larger conceptual structures.

Like Pustejovsky, Jackendoff combined LCS representations into composite conceptual structure (CS) representations. Also like Pustejovsky, he placed event information within the LCS of a verb, but Jackendoff did not differentiate event information from the thematic information as clearly as did Pustejovsky. Jackendoff's LCS representations include a code for EVENT versus STATE, but the particular event type is determined by the internal structure of the lexical representation. Jackendoff divided the LCS representation into two components, called tiers. The Thematic Tier contains thematic role information. One could view a portion of the thematic tier as being more event-like than thematic in that it includes entities like CAUSE (akin to event instigation), and includes information about goals (which might be event delimiters). The Action Tier, contains information concerning agentivity (essentially willful causers) and patientivity (affectedness). Despite the name Action Tier, it's not entirely clear that it does contain event information; instead it seems to include semantic information embellishing the event information that exists in the Thematic Tier.

The lexicon-based and argument-oriented approach to event structure espoused by Tenny and van Voorst clarifies a number of syntactic constructions, argument alternations, and their interpretations in a variety of languages. For example, the approach makes sense of the fact that a semantic theme maps to object position only if it delimits the event and otherwise maps elsewhere. In general, the approach allows thematic roles to appear anywhere in the syntax, but event roles are assigned to particular positions. In addition, event mapping recognizes that the entire predicate determines the event type and not the verb itself. By allowing all constituents of the predicate, including arguments and adjuncts, to play a role in the event and thereby to determine the event type, event mapping goes a long way toward recognizing the syntactic influence on events. However, although the event mapping approach explicitly recognizes the compositionality of events, it has not provided a systematic account of the compositionality. Given that the parameters controlling the event are assumed to be encoded in the lexicon, less compositionality and more lexical control are expected.

Ritter and Rosen (1996) argued that the lexical semantics of the verb has limited influence on the syntactic behavior of the arguments or the semantic interpretation of the clause. Whereas event mapping models claim that verb semantics tightly controls the syntax, we showed that the syntactic position of the arguments and the specific semantics of the arguments themselves plays a large role in verb interpretation: Verbs at least in part mean what the syntax allows them to mean. We further showed that, in contrast to the lexical models, (at least many) verbs have variable argument realizations, the extent of argument variability differs across verbs, and variability is correlated with just how detailed a particular verb's lexical representation is. The less detailed a given verb's semantic specification, the more variability the verb allows in its argument realization and event interpretation, and the more the syntactic context contributes to the interpretation. Ritter & Rosen made two important points: (a) Lexical semantics isn't enough to explain the forces at work in argument mapping, and (b) verbs are often used in a fashion that violates the canonical assumptions about the lexical structure of the verb.

Various lexical approaches have been successful to the extent that they have linked event characteristics to both lexical semantics and argument position. But the lexical approach stops short of implicating the syntax in a way that makes full syntactic use of the compositional nature of events. The lexical approach hasn't explained what it is about subjects and objects that enables them to encode the seemingly critical event constituents of initiation or origination and delimitation.

4. Event structure as syntax

The recent work of Borer (1994, 1996), Benua and Borer (1996), Travis (1994; 1997, 2000a), and Ritter and Rosen (1998, 2000) incorporated the findings of the argument-based studies of events showing that subjects encode initiation and objects encode delimitation. The same work extended argument-based efforts by proposing a syntactic representation of events that explains the relation between subjects and initiation and between objects and delimitation. In particular, the syntactic approach holds that the clausal functional projections determine the event structure of the sentence, and, with some variation across theories, that DPs receive both Case/agreement and event roles in Spec of these functional projections. In other words, the syntactic approach to event structure equates the functional mechanisms of Case and agreement with the interpretive mechanisms of the components of the event—nominative Case subjects are interpreted as initiators and accusative Case objects are interpreted as delimiters. In short, events are seen as being specified in the syntax.

I will discuss three different syntactic models of event structure, those of Borer (Borer 1994, 1996; Benua & Borer 1996), Travis (1994, 1997, 2000a), and Ritter and Rosen (1998, 2000). The three models differ in the exact details of the range of functional projections that encode event information as well as in the exact connections between event information and Case/agreement. But all three models encode the event properties (e.g., initiation and delimitation) within the clausal functional projections.

Borer (1994, 1996) argued that a given verb does not inherently belong to a particular lexical class (e.g., unaccusative versus unergative). She claimed instead that the verb projects into the syntax with any number of nominal arguments, unordered within the VP. The nominal arguments raise to the spec of particular functional positions, and the role each argument plays in the event is assigned by the functional heads.

As evidence that the syntax encodes the event, Borer discussed "variable behavior verbs," which behave like unaccusatives in some contexts and like unergatives in others. She used data from Dutch and Italian of the familiar auxiliary selection facts for unaccusatives and unergatives, from Italian regarding the behavior of the clitic *ne*, from Dutch regarding the impersonal passivization of a verb that is generally classified as unaccusative, and from Hebrew regarding a supposed unaccusative that actually allows a reflexive construction that normally is permissible only with external arguments. In each case, she showed that a single verb can behave either like an unaccusative or an unergative. The data, she argued, show that verbs do not determine whether their argument is external or internal; instead the position of the argument is determined in the

syntax, and therefore the syntax determines the event characteristic of the predicate. Behavioral variability, Borer argued, is unexpected under the assumptions of a lexical approach to argument mapping.

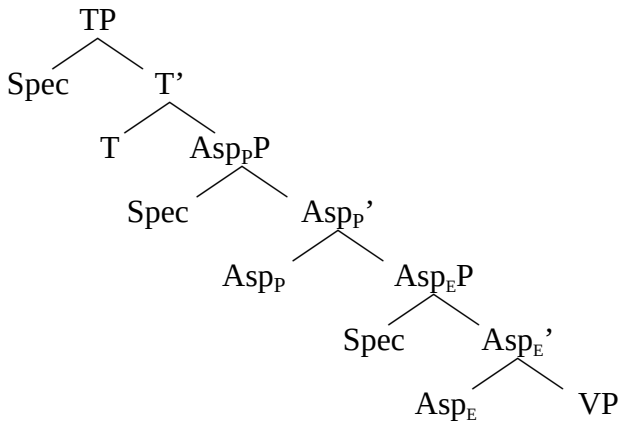
Borer explained her observation of variability by developing a syntactic account of events and argument projection, one in which the variable behavior is fully expected. In stark contrast to the lexical approach, the syntactic approach maintains that variable behavior is the norm.

A fundamental assumption of Borer's work is that the verb projects with any number of unordered nominal "arguments" (i.e., VP is not configurational), and that the arguments raise to Spec of AspP in order to receive an event role, and possibly Case. Borer argued that the syntactic position of the subject and object determines the interpretation of the roles of these arguments, not the lexical representation of the verb. So, for example, the interpretation for (43b) might be odd, but we do give it the interpretation necessitated by the syntactic positions of the two arguments, assigning event instigation to the subject and delimitation to the object.

(43) a. Bill ate the apple.
b. The apple ate Bill.

Borer (1994, 1996) and Benua and Borer (1996) posited that two event projections, Asp_P and Asp_E, dominate VP. These two projections are directly responsible for the eventive interpretation of predicates and their arguments by encoding the *aktionsart* distinction between activities and telic (delimited) events, and between initiated and non-initiated events. The model has shifted a bit in the course of its development and elaboration, but in their most recent work, Borer (1996) and Benua and Borer (1996) proposed a clausal structure like that in (44). A predicate is interpreted as an activity if Spec, Asp_P is filled, and as a result state (i.e., accomplishment or achievement) if there is an argument in Spec, Asp_E.

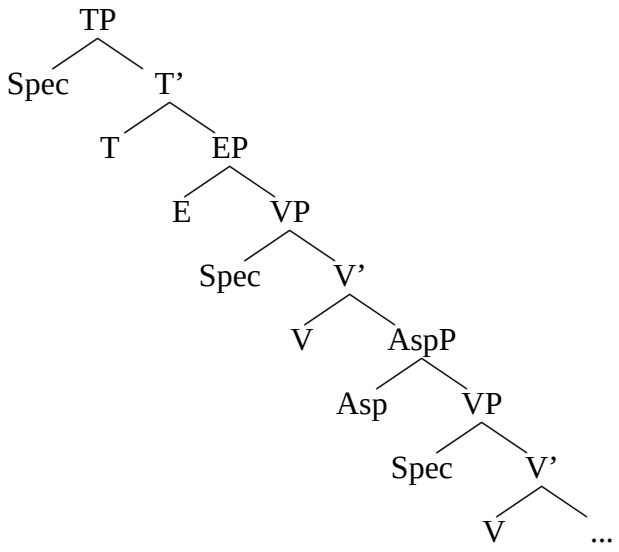
(44) BORER'S EVENT SYNTAX



A further feature of Borer's model is that both AspPs in (44) are optional, but when they are present, their Specs must be filled by an argument. If Asp_EP is projected, there will be an argument in its Spec, which is the "subject of result." This is also the position in which accusative Case is assigned or checked (though not all subjects of result states receive accusative Case). Consequently, accusative Case is only available when the predicate denotes a delimited event. Similarly, if Asp_PP is projected, its Spec will be filled by the "subject of process" argument. However, because all clauses must have a subject, and because nominative Case may be assigned independently of this event role, Benua and Borer assumed that nominative Case is assigned in Spec, TP.

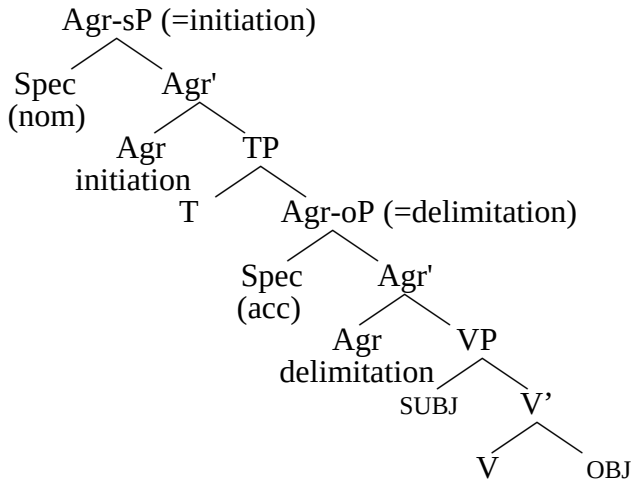
Travis (1994, 1997, 2000a) independently proposed that events are encoded in the clausal functional projections and are related to the mechanism of agreement. Working largely with Malagasy and Tagalog, she argued that two functional projections encode the event—an Event Phrase (EP) dominated by T, and an AspP sandwiched between a VP shell (containing transitivizers, causatives and other such light "verbs") and the lexical VP. The details concerning the exact position of these functional projections have changed throughout the development of Travis' work, but the basic function of these projections has remained the same. In the most recent version of her work, AspP encodes delimitation or telicity; and EP binds the Davidsonian [e] of the verb's argument array and provides event information. Travis (2000a: 163, 170) proposed the structure in (45). Her evidence for the existence and position of the functional projections AspP and EP included verb movement through Asp and object raising to (Spec, AspP) in Malagasy, and the appearance of agents in (Spec, AspP) in Chinese resultative "flip" constructions. Travis also argued that the AspP triggers agreement, a natural reflex of the spec-head relation of functional projections.

(45) TRAVIS' EVENT SYNTAX



The work of Ritter and Rosen (1998, 2000, 2001) built on Borer's and Benua and Borer's work and is consistent with Travis' overall approach. Like Benua and Borer and Travis, Ritter and Rosen suggested that the event structure notions of initiation and delimitation are encoded in the clausal functional projections. We further suggested that AgrP—the functional projections responsible for Case and agreement—assigns the event roles of initiation and delimitation. For a canonical event (one with both initiation and delimitation), the subject moves to (Spec, Agr-s) and identifies the originator of the event; the object moves to (Spec, Agr-o) and identifies the delimiter of the event. Ritter & Rosen's syntactic model appears in (46).

(46) RITTER & ROSEN'S EVENT SYNTAX



Ritter and Rosen (2000) further argued that, in representing eventhood, a given language only activates one of the FPs, either the initiating FP (Agr-s) or the delimiting FP (Agr-o). Languages vary as to whether activation of the initiating or the delimiting functor triggers an eventive interpretation of the clause: Some languages treat any clause with an initiator as eventive, whereas other languages treat any clause with a delimiter as eventive. In initiation (I-)languages, activities and accomplishments have the syntax of events because both have an initiator; in delimitation (D-)languages, accomplishments and achievements have the syntax of an event because only accomplishments and achievements have a delimiter. Ritter and Rosen showed that languages make a structural distinction between eventive and non-eventive clauses, but what constitutes an "event" varies from language to language. We presented evidence that the classification of a clause as eventive is overtly marked through the Case and agreement features of the language, as detailed below.

D-LANGUAGES
Delimitation determines eventhood: accomplishments and achievements

I. Sensitive to semantic and syntactic properties of the object including
   - •specificity or definiteness
   - •Case marking

II. Accusative Case may be restricted to delimiting objects
III. Ergative splits on the basis of perfective aspect/past tense
IV. Object agreement not specified for person features

I-LANGUAGES
Initiation determines eventhood: accomplishments and activities

I. Sensitive to semantic and syntactic properties of the subject including
   - •agentivity
   - •animacy
   - •person

II. Make a grammatical distinction between topic and subject
III. Ergative splits on the basis of properties of the subject
IV. Subject and object agreement specified for person features
V. Quirky Case subjects
VI. Animacy hierarchies

Ritter and Rosen hypothesized that a predicate in a D-language is eventive if and only if it is delimited and the delimiting FP (Agr-oP) is specified. Accordingly, Agr-oP is part of the syntactic representation of every predicate in a D-language and, in order for the clause to be syntactically eventive, a DP must raise into the specifier of Agr-o. Because Agr-o also contains the features for object agreement and accusative Case, these features are checked with those of the DP in (Spec, Agr-oP). Ritter and Rosen argued that a non-delimiting object must remain inside the VP, where it receives inherent (e.g., partitive) Case. We suggested that Agr-s in a D-language is not inherently specified with eventive content, so that initiation is only possible in the context of delimitation (Ritter & Rosen, 2000). In other words, in a D-language, an argument in (Spec, Agr-s) may be interpreted as initiating an event only if the clause is eventive, that is, only if (Spec, Agr-o) is filled.

In contrast, a predicate in an I-language is eventive if and only if it has an initiator; Agr-sP (the intiating FP) is specified for eventive content. Consequently, a clause will be interpreted as eventive if a DP appears in (Spec, Agr-sP). In an I-language, Agr-oP (the delimiting FP) is not inherently specified for eventive content, so delimitation is only available when initiation is present. On this analysis, an argument in (Spec, Agr-o) will be interpreted as delimiting an event only if the clause is eventive, that is, only if (Spec, Agr-s) is filled. Linn and Rosen (to appear) are looking at the role of the subject and animacy in event structure.

Ritter and Rosen (2000; 2001) presented cross-linguistic evidence showing that a host of characteristics of Case, agreement, verbal aspect, and object position follow from our analysis of the typology of languages and how the syntax encodes events. Regarding

D-languages, we argued that various grammatical characteristics of the object and the availability of causatives correspond to the specification of delimitation in the language. Such grammatical characteristics include the restriction of causers to delimiting predicates in English (Ritter & Rosen 1998), the restriction of accusative Case to delimiting objects in Finnish (Kiparsky 1998), and the availability of delimiting objects to undergo object shift in Chinese BA constructions (Cheng 1988). In general, languages that determine eventhood on the basis of Agr-o are sensitive to properties of the object such as definiteness, specificity, the mass/count distinction, and perfectivity. Regarding I-languages, we argued that various grammatical characteristics of the subject correspond to the specification of initiation in the language. Such grammatical characteristics include restrictions on nominative Case resulting in quirky Case subjects of non-eventive predicates in languages like Icelandic, ergative subjects in languages like Dyirbal and Inuit, VP internal subjects in Irish, and PP subjects in Japanese. Animacy restrictions on subjects, as found in some languages, may also be a reflex of initiation orientation. In general, I-Languages, which determine eventhood on the basis of Agr-s, are sensitive to properties of the subject, including person, animacy, and agentivity.

The event syntactic approach as developed by Borer, Travis, and Ritter and Rosen offers several advantages over non-syntactic analyses. First, its syntactic nature provides a natural explanation for the compositional character of events. It has been noticed repeatedly that the entire predicate, including the verb, its arguments, and adjuncts, determines the event interpretation. For example, Dowty (1979) and Verkuyl (1993) said this within an event classification framework; the Davidsonian [e] was in part developed to take into account the role that modifiers play in the event; and Tenny (1994), Pustejovsky (1995) and others have argued that theories of the lexical mapping of events must take compositionality into account. The fact that event interpretation is compositional suggests that events are encoded somewhere in the syntax.

Second, the event syntactic approach implies that the mechanisms of Case and agreement correspond to an interpretive material. The claim that the event is represented in the clausal functional projections entails the parallel claim that the mechanism of Case and agreement are not purely syntactic; instead the FPs encoding Case and agreement also contain semantic interpretation. The Borer, Travis, and Ritter & Rosen models of event syntactic structure differ a bit technically as to the functional mechanisms and structural configuration, but all three models place at least some of the functions of Case or agreement within the event projections. In Government and Binding Theory and in the early versions of the Minimalist Program, the Agreement node largely performs the Case and agreement checking functions (in conjunction with T for checking nominative Case and V for checking accusative Case). Chomsky (1995) wrote that Agr, unlike all the other functional projections, has no interpretive component to it, and therefore its existence is not justified at any interface level; for this reason, he eliminated AgrP. If Ritter and Rosen's syntactic analysis is correct, then Agr does indeed have an interpretive component, and hence it is therefore justified at LF and should be retained.

Third, the event syntactic approach provides a natural explanation for the special nature of subjects and objects in the interpretation of the event. The relevance to events

of subjects and objects has been noted within the lexical literature (cf. Grimshaw 1990; Tenny 1994; van Voorst 1988) and within the logical semantic literature (cf. Krifka 1992). A basic assumption of the syntactic approach is that the functional projections checking Case and agreement of subject and object house the features of initiation and delimitation of events. Because initiation and delimitation features are checked in the same position as Case and agreement, it is to be expected that languages will grammaticalize properties of initiation and delimitation on the subject and object and that the subject and object in part determine the properties of the event is now explained.

Fourth, the event syntactic approach organizes observations of cross-linguistic variation in how languages deal with events. Languages may differentially focus on the subject or the object because either of the two components of an event can be syntactically specified by the language, as Ritter & Rosen (2000) argued. The notion that a given language specifies either initiation or delimitation led Ritter & Rosen to a new and unified analysis of ergative Case, quirky Case, animacy hierarchies, person and other agreement systems, and accusative and partitive Case. It may also lead to an understanding of the syntax of secondary predication insofar as Ritter and Rosen (1988) have argued that secondary predication often delimits a predicate.

5. Unanswered questions and loose ends

Knowledge of the relations between the happenings of the world and the encoding of events in language has grown tremendously in recent years. Each approach to representing events that I have discussed views events from a different perspective, and each approach clarifies a different part of the overall problem of understanding the linguistic representation of events. In this final section, I outline some of the questions that remain and some directions that event structure research might explore.

Outside of the event structure literature, the term “aspect” refers to viewpoint (e.g., perfective or progressive). For the most part, event structure research has ignored viewpoint aspect. Recent work, however, has shown that perfectivity may be related to delimitation, which is, as we have seen, central to the analysis of events. For example, Kiparsky (1998) suggests that the perfective in Russian is tightly associated with delimitation. He shows that when the perfective appears on the verb, then the predicate is interpreted as delimited; when the imperfective appears on the verb, then the predicate is interpreted as non-delimited. Further, Vlatch (1981), Borer (1996), Demirdache (1997) and others have claimed that progressives are stative rather than eventive: A stative generally cannot take the progressive, presumably because the progressive expresses an event as a state. In particular, Demirdache shows that progressives yield the same interpretation as other statives and non-delimited predicates in the so-called “out of control” morphology in Salish (a kind of anti-causative). Although “out of control” morphology may allow two readings, an ability reading and an accidental reading, it is only delimited predicates that are in fact ambiguous: Non-delimited predicates allow only the ability reading. Critically, Demirdache reported that viewpoint aspect affects delimitation: When the progressive morphology appears on an otherwise delimited verb, only the ability reading is available. In effect, progressive morphology takes away the delimitation.

And so the question that needs to be asked is: What is the relation between viewpoint aspect and event structure? Demirdache and Uribe-Etxebarria (1998) proposed a set of clausal functional projections to encode viewpoint aspect. In and of itself, the fact that viewpoint aspect has the capacity to affect event structure (e.g., event/state or delimited/non-delimited distinctions) is good evidence that event structure is syntactically represented: Because viewpoint aspect is introduced in the syntax, its effect on the interpretation of the event must be realized in the syntax. If indeed event structure is represented in the clausal functional projections, then what is the (functional) structure of viewpoint aspect that causes it to interact with event structure?

Demirdache (1997) also showed that negation, generic adverbs ("always"), and modal operators ("will/might") affect the "out of control" interpretation of delimited predicates in Salish. Again, clausal functional elements interacting with event structure (delimitation) affect the interpretation of the predicate. Any theory of events must be syntactic (at least in part), and any syntactic theory of events must take into account the relation between the event and the other functional material.

A related question concerns the relation between the characteristics of the direct object and the event structure. One particular set of phenomena to be explicated is how the characteristics of the direct object tie in to the syntactic mechanisms that control event structure. The semantics literature has clearly established that characteristics of the direct object--the mass/count distinction, definiteness or specificity, bare plurals, generics, quantized noun phrases--influence delimitation and thus influence the event classification of the predicate. For example, Krifka (1989; 1992) worked out in detail the semantic relation between event classification and object reference, and Schein (1993) discussed the relation between events, parts of events, and plurality. Properties of the direct object, such as specificity, genericity, etc., are syntactically determined in the functional projections surrounding the nominal projection. The question this raises is: What is the relation between the functional properties of the object (the nominal functional projections) and the functional properties of event structure (the clausal functional projections)? Recent work by Ritter and Rosen (2001) addressed some of these questions. Work of Linn and Rosen (2001) is now turning to similar questions about the relation between the functional properties of the subject and event structure.

Turning to semantic issues in the use of thematic roles, Parsons (1990) raised the question: Are thematic roles identical across verbs? Consider subjects, for example: Although we call the subject of many verbs an agent, what the subject actually does varies considerably across verbs. Identifying event interpretation with functional projections resolves the variability issue in an interesting way. If arguments receive or check event roles in the syntactic structure, then what makes any given argument an "agent" (or, perhaps more accurately, an instigator of the action) is the same across verbs. And thus any difference between the agent of "kissing" and the agent of "killing" purely due to the different lexical semantics of the two verbs, and not due to the syntactically-determined instigation. The subjects of both verbs are agents/instigators because both receive or check the initiator role in Agr-s (that is, from whatever functional projection

encodes the initiating role). So, for purposes of the syntax and the interpretation of the overall event, the two subjects are the same: They both initiate. For purposes of the specific meaning of the sentence, the two subjects are clearly different. In other words, the interpretation comes from at least two sources—the syntax of the sentence and the lexical semantics of the verb.

In view of the lexical semantics work of Jackendoff, Pustejovsky, and Levin and Rappaport Hovav, we must ask about the relation between the lexical representation (LCS) of a verb and the syntactic structure of an event. Even if (as I have argued) the event is largely encoded in the syntax, the event syntax is not entirely disconnected from the lexical semantics of the verb. The lexical semantics can constrain the event structures compatible with a given verb, and thereby constrain the syntax. For example, Tenny (1994) pointed out that in the locative alternation, either the theme or the location can be the direct object, and whichever is the object delimits the action. It is well known that there are similar locational verbs that do not allow this alternation, as the examples in (47) and (48) show.

(47) a. Terry poured water into the bucket.
b. *Terry poured the bucket with water.

(48) a. *Terry filled water into the bucket.
b. Terry filled the bucket with water.

Within Borer's general approach, the syntax allows all of the sentences in (47) and (48), and one interprets as best as possible. For example, while (47b) is ungrammatical, it is still interpreted--the bucket is inundated with water. But the verb's LCS somehow determines the naturalness of the different constructions, and so *pour* is specified as not allowing the location to delimit the action. The LCS of a verb can constrain the syntactic structure, the event type, and the number and interpretation of the arguments. How and in what ways?

Another set of questions that this area must face is how syntactic studies of event structure will incorporate some of the advances made within the field of event classification. In particular, the features of initiation and delimitation do not quite correspond to Vendler's classification system: Are syntactic models weakened by their failure to encode the Vendler classes? What is the syntactic relevance of Vendler's four-way classification, and of the features that may underlie his classification? Is incorporating the features into syntactic models crucial for understanding the syntax and interpretation of events?

Turning to the field of logical semantics, what is the relation between the logical semantics of events and their syntactic representation? In particular, Davidson and his followers proposed that eventive sentences behave semantically as if there is an entity in their semantic representation that can be modified, quantified over, etc. Is there something in the syntax of events (perhaps a functional head of some sort) that translates into the Davidsonian [e]? Would the precise functional head differ across languages,

perhaps in a manner consistent with the cross-linguistic variation pointed out by Ritter and Rosen?

In this paper, I have reviewed three approaches to the problem of how events are represented. The three approaches differ with respect to what they try to represent. Semantic theories of event structure represent the event itself: The [e] included in the logical semantics of the predicate treats the event as a primitive semantic entity. Other approaches claim that events are composite and therefore try to decompose them, either by identifying sub-events (Pustejovsky; Grimshaw) or sub-properties of events (neo-Vendlerian classification approaches). Still other approaches associate the event with lexical or syntactic units, such as arguments (Tenny, van Voorst, Grimshaw) or functional projections (Borer, Travis, Ritter & Rosen).

Where, then, are events (possibly including sub-events and the properties of events) encoded? If the event can be quantified, and if quantification is calculated in the logical semantics, then some form of event representation must be encoded in the semantics. If the meaning of the verb constrains event types, then some form of event representation must be encoded within the lexicon of the verb. If the syntactic functional features are sensitive to the event, then some form of event representation must be encoded in the syntax. And so it is possible that events are represented in all three components of the grammar. The relations among the separate representations in the three components remain to be discovered.

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