

Primitives of Events and the Semantic Representation

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Abstract

The event structure (aktionsart) is a widely discussed issue for the representation of verbal semantics in languages. However, there is still problems for the classification of verbs into state, activity, accomplishment, achievement and semelfactive. It is also not clear where are the differences of them embedded in terms of lexical, semantic or syntactic levels. In this paper, we will give a discussion on the primitives of events from an ontological point of view. We suggest that event types should be discussed in the usage level of language. Based on the Generative Lexicon theory, we provide a semantic representation of verbs which can give a better explanation how the semantics of verbs and the composition with their complements can determine the event type they denote.

1 Introduction

According to Vendler (1967), events can be divided into four classes: state, activity, accomplishment and achievement. Smith (1991) proposed a fifth class called semelfactive (instantaneous events), such as knock, kick. Some diagnostics are used to distinguish them. For example, states and achievements cannot appear in progressive aspect, while accomplishment and activities do. The so-called imperfective paradox is used to discriminate activity and accomplishment. For example, *he is running* entails that *he has run*, but *he is building a house* doesn't entail *he has built a house*. In addition, activities doesn't allow *in* time adverbial, while achievement does. For example, **he run in five minutes* is unacceptable, while *he built a house in one month* is acceptable.

Regardless of how many categories there are, it has been observed that the event type of verbs

are affected by their complements, as discussed in (Dowty, 1991; Verkuyl, 1993; Tenny, 1994; Ritter and Rosen, 2000). For example, (1a) and (2a) denote activities, while (1b), (2b) and (2c) denote accomplishments. It seems that the discussion of event types has been mixed from the lexical level to the usage level of language. If a verb that has been classified as accomplishment can also express activities, then what is the purpose to do verb classification?

- (1) a. He is eating sandwiches.
b. He is eating a sandwich.
- a. He is running.
- (2) b. He is running to school.
c. He is running 1000 meters.

Degree achievement verbs, such as cool, strengthen as discussed in (Jackendoff, 1996; Hay et al., 1999) failed to be classified into the four categories as they take both *in* and *for* time adverbials as shown in (3). Some other verbs, such as eat, clean and water as discussed in (Harley, 1999) also have this problem as shown in (4) to (6). According to Hay (Hay et al., 1999), there is a telicity implicature for these verbs. Such implicature could be cancelled when taking *for* time adverbial. We agree with this explanation. However, we still need to know how pragmatic factors can give different interpretations.

- (3) a. He cooled the soup in one minute.
b. He cooled the soup for one minute.
- (4) a. He ate in one minute.
b. He ate for one minute.
- (5) a. He watered the flower in one minute.
b. He watered the flower for one minute.
- (6) a. He cleaned the house in one hour.
b. He cleaned the house for one hour.

Another problem of most of the previous discussion is that their analyses are language dependent and thus will not expose the insight of what events are from an ontological point of view. The imperfective paradox actually utilizes the meaning carried by the perfective aspect. However, it doesn't apply in Chinese. In Chinese, the perfective aspect is ambiguous in that it can denote both the start of a process, either an activity or an accomplishment, and the finishing of it. For example, *ta pao le* (he has run) means either he has finished running or he has started running. So we cannot say that *ta zai pao* (he is running) entails *ta pao le* (he has run). Similarly, *ta chi le na ge han bao* (he has eaten that sandwich) means either he ate the entire sandwich or he took some bites on it.

Even for English, the imperfective paradox test is also problematic. If we take *knit* for example, *he is knitting* entails *he has knitted*, and *he is knitting a sweater* doesn't entail *he has knitted a sweater*. It seems that *knit* qualifies both activity and accomplishment. Should we treat *knit* as polysemy? Actually, the difference of *knit* and *build* is that *knitting* itself can denote an action, while *building* always requires an object. According to the Generative Lexicon theory (Pustejovsky, 1995). The argument of verb *knit* has a default value, while *build* doesn't. So, the argument of *build* must be realized explicitly.

The evidence suggests that event type is affected by many factors, and to do event classification in the lexical level is difficult and not enough. On the other hand, it is more important to discuss which elements or parts of the meaning of verbs allow them to behave differently from each other, and is there any rules to follow in order to predict the behavior of verbs based on their semantic representation. In this paper, we will discuss the primitives of events from an ontological point of view. Within the GL framework, we will give a semantic representation for verbs which can predict the behavior when combined with different complements.

In Section 2, we will discuss different event types from an ontological point of view. In Section 3, we will present the primitives of events and show how these primitives can be combined together to produce different event types. In Section 4, we will discuss factors that affect event types and give the semantic representation for verbs, based on which we can make better pre-

diction on what kind of events they can denote. Section 5 is the conclusion.

2 Ontological Event Types

Although the classification of verbs in terms of event types is difficult, the definitions of the Vendler's terms, namely state, activity, accomplishment and achievement, are quite clear. From now on, we will use his terms from ontological point of view which is independent on a specific language. The term *event* will be used to denote any kind of the four types. The term *process* will be used to denote activity and the first part of accomplishment without the final state as is used in GL theory (Pustejovsky, 1995).

Events are located in time axis. When talking about events, we always bear a reference time in mind, which is by default the speaking time. When we stand at different positions to a certain event in time axis, we will have to use different ways to describe it. On the other hand, we can describe an event from different perspectives, which will form different aspects. For example, we can describe the start point, end point and the instant state of any point between them. We can also describe the duration of an event, the duration from the start point to a middle point etc. This is how we understand and describe events with our language from an ontological point of view. We would like to claim that the perspectives to describe events are universal across languages, although may be realized in different ways. Let's discuss some examples in English as follows.

- (7) He became angry just now.
- (8) He started running at 9:00am.
- (9) He will start building a house tomorrow.
- (10) He stopped being angry when he got the money.
- (11) He will stop running in an hour.
- (12) He stopped building the house.
- (13) He was angry just now.
- (14) He was running from 9 to 10.
- (15) He is building a house now.
- (16) He has been angry for hours.
- (17) He had been running for hours when you came.
- (18) He has been building the house since last year.
- (19) He was angry yesterday.
- (20) He ran yesterday.
- (21) He built the house last year.

In the above sentences, (7) to (9) describe the start of an event (state, activity or accomplishment), which is called inchoative for states and inceptive for activities and accomplishments. (10) to (12) describe the end of an event, which is called terminative or completive. (13) to (15) describe an instant state of the whole events. Note that, although (14) takes a durative time complement, it actually means that at each point in the interval it is true that he is running; (16) to (18) describe the duration from the start point to a reference time which is in the middle of the whole event duration. (19) to (21) describe three whole events. In other words, (19) is a bounded state; (20) is a bounded activity; (21) is a real accomplishment which implies that the final goal has been accomplished.

2.1 Activity and accomplishment

(14) and (15) both express an ongoing process. The difference is that there is a goal/target encoded in (15). However, syntactically, they behave the same. For example, they take time point or durative complements and don't take *for* and *in* time adverbials. In terms of truth condition, (14) and (15) are also similar. Although (15) include a goal which is carried by the object, the truth condition doesn't include the achievement of the goal. Otherwise, the truth value of (15) will be dependent on future which is not true considering that (15) can also be true even if he gave up building the house in future. In this sense, we argue that (14) and (15) denote the same kind of event from the ontological point of view.

2.2 Achievement and accomplishment

Achievements and accomplishments are different. Achievements are instantaneous, such as *arrive*, *die*, *kill*, *break* (inchoative), while accomplishments take a time duration. Some causative verbs behave similar to achievement verbs, such as *kill* and *break* (causative), e.g. they don't appear in progressive. However, they are different in that achievements are logically instantaneous. They describe pure changes of state, while causative verbs entail an action (Engelberg, 2001). Causative verbs, such as *kill* and *break*, can be treated as a special kind of accomplishment, where the process part is perceived as instantaneous (ter, 1995; Verkuyl, 1993). It is possible that some accomplishment verbs can denote instantaneous events. For example, *he ate a bug accidentally* doesn't entail a noticeable process, as it is incompatible

with progressive: **he is eating a bug accidentally*.

Based on headedness theory by Pustejovsky (1995), *arrive* and *die* are right headed verbs with the left process shadowed. We suggest that the process are not encoded at all. For example, *he died* doesn't mean *he was killed*. The latter one certainly entails a cause which is not expressed explicitly. For the former one, it is similar to say that *he became dead*, which doesn't obviously entail a cause. We should not exclude the possibility that some verbs can denote pure change of state. An evidence for this claim can be observed from Chinese compound *sha si* (kill to death), composed by *sha* (kill) and *si* (dead/die/death). This shows that *sha* (kill) is an activity verb, which do have a goal to make something die. So, it is also possible to say *sha bu si* (kill not to death) meaning that one can try to kill someone but he may not die in the end.

The headedness theory is aimed to explain the causative/inchoative alternation phenomena. However, it is not intuitive in terms of human's perception of linguistic knowledge. We still need to test whether people notice the headedness when using different verbs. Although the principle of GL theory is to treat logical polysemy as unique while different meaning could be generated by some devices. We should not exclude the possibility that some verbs only describe a pure change of state in some context without any process encoded. We will discuss this issue further in the next section.

2.3 Activity and semelfactive

Semelfactives such as *knock*, *kick*, *vibrate* are actually a special kind of activity which is perceived as instantaneous and implies no change of state. Instantaneous verb should not appear in progressive aspect. However, this is not exactly true. For example, *he is kicking the tree*. In this case, it actually describes an activity with iterative sub events. Then, what is the difference between *kick* and *run*? Actually, *kick* is the lexicalization of one action, while *run* is the lexicalization of the whole iterative activity. For example, *he knocked the door twice* describes two individual knocks. But *he ran twice* only means that he performed two independent running activities, rather than two steps.

3 Primitives of Events

Generalizing the different event types we discussed above, we found two primitives: state and change of state. For state, the definition here is different from that of previous literatures. States can be further divided into two different types: static state and dynamic state. A static state is a property of an object with a specific value at a certain time. Dynamic state refers to the state of being in a process, such as (14) and (15). Borer (1996) also argued that the progressive expresses an event as a state. Actually, some phrases can also express such dynamic state, such as *he is at work*.

3.1 State

The homogeneity can differentiate the dynamic state from the static state. For dynamic state, there are always a series of sub events which can be described with different predicates. Dynamic state can be iterative (e.g. vibrating) or non-iterative (e.g. building a house). Formally, the static state and dynamic state can be represented as in (1) and (2).

$$static(e) \models \lambda_P [P(e) \wedge \forall_{e' \prec e} [P(e')]] \quad (1)$$

$$dynamic(e) \models \lambda_P [P(e) \wedge \exists_{e' \prec e} \exists_{P'} [P' \neq P \wedge P'(e')]] \quad (2)$$

3.2 Change of state

Change of state is then defined a change from one state to another as in (3). We can get four different kinds of changes of state: static-static, static-dynamic, dynamic-static, dynamic-dynamic. The static-static change refers to inchoative, such as *die* (alive to dead), *break* (unbroken to broken), *recognize* (unrecognize to recognize), *become red* (non-red to red). Static-dynamic change refers to inceptive, such as *start running*. The dynamic-dynamic change in real world is relatively rarely lexicalized. However, there do exist such kind of events. For example, *he continued to read the book after washing clothes*. The dynamic-static change refers to terminative or completive, it usually describes an ending of an dynamic state, such as *finish*, *end* etc.

$$change(e) \models \lambda e_1 \lambda e_2 [state(e_1) \wedge state(e_2) \wedge holds(e_1, t < time(e)) \wedge holds(e_2, t > time(e))] \quad (3)$$

3.3 Complex events and lexicalization

Based on the two primitives, we claim that some words in language describe pure states, and some describe changes of state. There are also words that can describe complex events that are made up of more than one primitive. For example, an accomplishment is made up of a bounded dynamic state and a final static state. The phrase *start up* describes a special kind of accomplishment that is made up of a bounded dynamic state and a final dynamic state. For example, *the machine started up and is working now*.

Theoretically, for a event that is made up of three states $state_{e_0}$, $state_{e_1}$ and $state_{e_2}$, there will be eight cases. If we also consider whether $state_{e_0}$ and $state_{e_2}$ are the same, then there will be another four cases. All the twelve cases are shown in Table 1. Some of the combination may not correspond to any words or some examples of real events. Theoretically, any combination is possible to be lexicalized if the combination denotes a whole meaningful event. In addition, the sub states in the combination may overlap. However, this is not the focus of this work and it is a different perspective to discuss event structure. The extended event structure in GL can deal with this problem very well.

3.4 The *in* and *for* time adverbials

The semantics of *in* and *for* time adverbials can be represented as (22) to (25). The difference of *in* and *at* is that, *in* describes the duration from a potential standing point to a future change of state, while *at* doesn't include the standing point information. Similarly, the difference of *for* and *at* for a state is that, *for* described the duration of the state, while *at* only describe a certain time point at which the state holds, but the duration information is not included.

For accomplishments and achievements, the *in* time adverbial actually modifies the duration from a reference time to the culminations of the events. For accomplishments, it is also possible to describe the dynamic state part. So, (24) and (25) also apply to the dynamic process of an accom-

combination	exemplar words	example sentences
$s_0-s_1-s_2$	/	he fainted to death
$s_0-s_1-s_0$	faint	he fainted for a while
$s_0-s_1-d_0$	/	he got nervous before the examination/
$s_0-d_0-s_1$	build	he built a house
$s_0-d_0-s_0$	run	he ran for a while
$s_0-d_0-d_1$	/	the engine started up
$d_0-s_0-s_1$	/	he sat down after running
$d_0-s_0-d_1$	/	
$d_0-s_0-d_0$	pause	the match paused for a while
$d_0-d_1-s_0$	/	the car slowed down until stopped
$d_0-d_1-d_2$	/	the car slowed down
$d_0-d_1-d_0$	insert	they inserted an advertisement during the TV program.

Table 1: Complex events with three states. s is for static state, d is for dynamic state

plishment. For example, the perfective progressive in English actually works in this way, e.g. *he has been building a house for one month*.

In summary, the *in* time adverbial is related to change and focus on time duration from a reference time to it; the *for* time adverbial is related to state either static or dynamic. For a bounded durative state, there are two potential changes of state, start and end. So, we can predict that the *in* time adverbial can refer to both the start and the end. For example, *the class will start in ten minutes* and *the class will end in ten minutes* are both acceptable.

- (22) [Change] will happen *in* [time duration].
- (23) [Change] happens *at* [time point].
- (24) [State] lasts *for* [time duration].
- (25) [State] is true *at* [time point].

4 Semantic Representation of Events

As mentioned above, static state and dynamic state can be discriminated based on the homogeneity. Activity and semelfactive can be differentiated from Accomplishment and achievement based on whether they have a final change of state or not. Activity is different from semelfactive that it has a longer time duration. Accomplishment and achievement are different in that accomplishment include a dynamic state while accomplishment only describes a change of state and is thus logically instantaneous.

So, duration and change of state are two important factors to differentiate different event types. Duration information is actually embedded in the start time and end time of an event, which should be an external factor that is based on the time sys-

tem. We can define functions such as *start_fn* to get the start time of an event. So, for semantic representation, we should only focus on the second factor. How change of state is expressed has been widely discussed in literatures, namely semantically or syntactically (e.g. resultatives). In this section, we will give a discussion on how meaning of verbs based on the two primitives and their arguments can affect the event types.

4.1 Semelfactive and activity

The semantic representation of *kick* is shown in (4). The semelfactive *kick* is the lexicalization of the predicate *kick_act*. However, *run_act* as shown in (6) is not lexicalized as *run*, which is the lexicalization of a series of *run_acts*, such as stepping as shown in (7). The progressive aspect of semelfactive verb *kick* denotes an activity with iterative sub events of *kick_acts* as in (5). Here, we introduce an operator *while(x)[y]*, which means that event y repeats until x becomes false. x actually encodes the conditions that control the process. The kicking event is controlled by the intention of the agent meaning that the agent performing the kicking act again and again until he doesn't want to. In this case, it is of the same event type as *running*.

$$\begin{aligned}
kick_act \models & \lambda e \lambda x \lambda y \exists z [animal(x) \wedge phy_obj(y) \\
& \wedge foot(z) \wedge part_of(z, x) \\
& \wedge touch(e, x, y, z)]
\end{aligned}
\tag{4}$$

he is kicking the door.

$$\models \exists e \exists x \exists y \exists w [human(x) \wedge door(y) \wedge proposition(w) \wedge while(w) [\exists e' \prec e [kick_act(e', x, y)]]] \quad (5)$$

$$run_act \models \lambda e \lambda x \lambda y \lambda z [animal(x) \wedge location(y) \wedge location(z) \wedge run_step(e, x, y, z)] \quad (6)$$

$$run \models \lambda e \lambda x \exists w [animal(x) \wedge proposition(w) \wedge while(w) [\exists e' \exists y \exists z [location(y) \wedge location(z) \wedge run_act(e', x, y, z)]]] \quad (7)$$

He is running.

$$\models \exists e \exists x \exists w [human(x) \wedge proposition(w) \wedge \lambda w [run(e, x)](w)] \quad (8)$$

The *run_act* is not elementary. The movements of arms and legs both could be treated as *runActs*. However, by this definition, we can represent a non-iterative activity as an iterative one. For example, the process of building a house could also be represented as an iterative activity with a definition of *build_act*. However, this abstract concept could be implemented with more details when needed.

We should also note that we only describe the main part of the semantic representation to show how event primitives work. The difference of run and walk is not described in (7). But it is possible to add this information to it. For example, there must be some moment that both of the feet are over the ground for running, while no such moment should exist for walking. The difference of progressive and perfective is not described neither. As we have discussed, progressive only describe an instant state, which is a slice of the whole event. This means that the reference time is actually after the start of the process while before its end. In other words, the speaker noticed the happening of some instantaneous actions, e.g. *kick_act*, *run_act* etc.

4.2 Activity and accomplishment

Similar to *kick_act* and *run_act*, we can define *eat_act* as (9). Based on the *while(x)[y]* predicate, the final change of state of accomplishments actually gives another constraint in *x*. So, for event denoted by (11), the final disappearance of the sandwich ends the eating process. Basically, the verb

eat denotes a human action which has a shadowed argument, e.g. food. When taking an explicit object, the default value of the shadowed argument is substituted with the new value through a λ conversion. This rule also applies to other activities verbs with such argument, such as knit.

$$eat_act \models \lambda e \lambda x \lambda y [animal(x) \wedge phy_obj(y) \wedge holds(existing(y), t < time(e)) \wedge holds(!existing(y), t > time(e))] \quad (9)$$

$$eat \models \lambda e \lambda x \exists y [human(x) \wedge phy_obj(y) \wedge while(existing(y)) [\exists e' \exists y' [eat_act(e', x, y')]]] \quad (10)$$

He is eating a sandwich.

$$\models \exists e \exists x \exists y [human(x) \wedge sandwich(y) \wedge \lambda y [eat(e, x)](y)] \quad (11)$$

Similarly, we can give the semantic representation for *build_act* and *build*. The difference is that the condition for performing *build_act* is the existing rather than disappearance of the object. In addition, the object must be explicitly assigned.

Now, let's discuss the examples (1) and (2) repeated below. First, the resultatives (2b) and (2c) are explicit conditions that control the running process. This is how an activity verb can denote an accomplishment. (12) and (13) show how the external argument can cooperate with activity verb *run* and form an accomplishment. The qualia unification operation in GL can also explain (2b). However, it has a problem to explain (2c). On the contrary, the generic NP *sandwiches* in (1a) doesn't provide a quantity limitation that could control the eating action. In this way, an accomplishment verb can also denote activities.

- (1) a. He is eating sandwiches.
b. He is eating a sandwich.

- a. He is running.
(2) b. He is running to school.
c. He is running 1000 meters.

He is running to school.

$$\models \exists e \exists x \exists y [human(x) \wedge school(y) \wedge \lambda w [run(e, x)](!at(x, y))] \quad (12)$$

He is running 1000 meters.

$$\models \exists e \exists x \exists w [human(x) \wedge distance(w) \wedge \lambda w [run(e, x)](w < 1000m)] \quad (13)$$

Finally, we come back to the examples from (3) to (6) repeated below. We agree with Hay (1999) that the telicity interpretation is given by pragmatic factors. We suggest that factor is actually encoded in the telic role of the verbs. For example, the telic role of *cool* is to make something cool; the telic role of *eat* is to be not hungry; the telic role of *water* is to make something not dry; the telic role of *clean* is to make some place clean. The telic role is different from the formal role in that the purpose or function is not necessary to qualify the predict. Even though the purpose is not completely achieved for some reason, the process doesn't change meaning that it can be described with the same predicate. According to the Cooperative Principle (Grice, 1991), if the sentence *he watered the flower* is uttered, it should imply that the listener doesn't have to do it any more. Since, the implicatures could be cancelled, examples (26) to (29) are all acceptable.

- (3) a. He cooled the soup in one minute.
b. He cooled the soup for one minute.
- (4) a. He ate in one minute.
b. He ate for one minute.
- (5) a. He watered the flower in one minute.
b. He watered the flower for one minute.
- (6) a. He cleaned the house in one hour.
b. He cleaned the house for one hour.
- (26) He cooled the soup, but it is still hot.
- (27) He ate but still hungry.
- (28) He watered the flower, but it is still dry
- (29) He cleaned the house, but it is still dirty.

4.3 Achievement and accomplishment

Achievements as we suggested only denote changes of state. The verb *arrive* could be represented as (14). Such verbs can appear in progressive as in (30) and (32). In our opinion, this should

be a syntactic issue, i.e. expressing a near future event with progressive. So, the sentence (31) expresses the same meaning as (30).

$$arrive \models \lambda e \lambda x \exists y [human(x) \wedge location(y) \wedge holds(!at(x, y), t < time(e)) \wedge holds(at(x, y), t > time(e))] \quad (14)$$

(30) He is arriving.

(31) He will arrive soon.

There are two cases for collectives either in subject or object position. The first is that the verb requires collective subject or object, such as crowd, disperse etc. The second is that all the individuals in the collective are doing the same kind of event, such as (32). However, (32) is ambiguous, the first meaning is similar to (30), which express a forerunning stage. The second meaning is that every guest arrives one after another, which denotes an iterative event composed by a series of achievements. The meaning of (32) can be represented as (15).

(32) The guests are arriving.

$$\models \exists e \exists X \exists y [guest_set(X) \wedge location(y) \wedge while(\exists x \in X [!at(x, y)]) [\exists e' \prec e [arrive(e', x)]]] \quad (15)$$

4.4 Causative and accomplishment

Causative verbs such as kill and break are usually treated as instantaneous. For example, (33) also has similar interpretation to (30). However, they are different from pure change of state verbs. So, in progressive, they will have different interpretations. For example, the progressive in (33) can also refer to the action part, which for some reason takes a noticeable time duration. This interpretation is shown in (16). However, for the pure change of state verb arrive, there is no *arrive_act* defined.

(33) He is killing a dog.

$$\models \exists e \exists x \exists y [human(x) \wedge dog(y) \wedge while(alive(y)) [\exists e' \prec e [kill_act(e', x, y)]]] \quad (16)$$

Such causative verbs, when taking massive object, also have different interpretations. For example, (34) could have a similar interpretation as (33) or can be interpreted as (17) which is similar to (32).

(34) He is killing the bugs.

$$\models \exists e \exists X \exists y [bug_set(X) \wedge human(y) \wedge while(\exists x \in X [alive(x)]) [\exists e' \prec e [kill(e', y, x)]]] \quad (17)$$

5 Conclusion

In this paper, we discussed different event types from an ontological point of view. We have shown that the concept of event type should not exist in lexical level. Then, we presented two primitives based on which all different kinds of events could be composed. We also discussed factors that could affect the types of events and how one type of event could be changed into another. Finally, we give semantic representation for different kinds of verbs and exemplar events. It is shown that our representation can give a better prediction on event types verbs can denote.

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References

- Hagit Borer, 1996. *Morphological Interfaces*, chapter Passive without theta grids. Stanford: Center for the Study of Language and Information.
- David Dowty. 1991. Thematic proto-roles and argument selection. *Language*, 67(3):547–619.
- Stefan Engelberg. 2001. The semantics of the progressive. In *Proceedings of the 2001 Conference of the Australian Linguistic Society*, pages 1–8.
- H.P. Grice. 1991. Logic and conversation. *Pragmatics: A Reader, New York*, pages 305–315.
- Heidi Harley. 1999. Denominal verbs and aktionsart. *MIT Working Papers in Linguistics*, 35:73–85.
- Jennifer Hay, Christopher Kennedy, and Beth Levin. 1999. Scalar structure underlies telicity in "degree achievements". In Tanya Matthews and Devon Strolovitch, editors, *Proceedings of Semantics and Linguistic Theory IX*, pages 127–144. Ithaca, NY: Cornell University.
- Ray Jackendoff. 1996. The proper treatment of measuring out, telicity, and perhaps even quantification in english. *Natural Language and Linguistic Theory*, 1(4):305–354.
- James Pustejovsky. 1995. *The Generative Lexicon*. Cambridge: The MIT Press.
- Elizabeth Ritter and Sara Thomas Rosen, 2000. *Events as Grammatical Objects*, chapter Event structure and ergativity, pages 187–238. Stanford: Center for the Study of Language and Information.
- Carlotta Smith. 1991. *The Parameter of Aspect*. Dordrecht: Kluwer Academic Publishers.
- Carol Tenny. 1994. *Aspectual Roles and the Syntax-Semantics Interface*. Dordrecht: Kluwer Academic Publishers.
- Meulen Alice G.B. ter. 1995. *Representing Time in Natural Language: The Dynamic Interpretation of Tense and Aspect*. Cambridge, MA: MIT Press.
- Zeno Vendler. 1967. *NY: Linguistics in Philosophy Ithaca*. Cornell University Press.
- Henk Verkuyl. 1993. *A theory of Aspectuality*. Cambridge: Cambridge University Press.