Stefan Engelberg

Event Structure and the Meaning of Verbs[1]

1. During the last years a lot of research has been done on argument structure and the syntax of verbs. Some of these approaches have pointed out that a good deal of the syntactic behaviour of verbs can be explained by their aspectual properties. These properties, which manifest themselves e.g. in the modifiability of verbs by temporal adverbials, depend on the kind of events the verb can refer to. A consequence for lexical semantics should be: argument structure as part of the meaning representation of verbs has to be integrated in a lexical event description.

Several approaches to event reference and to event complexity have influenced the ideas about event structure presented in the paper at hand. The assumption that verbs refer to events and therefore have a referential event argument in their semantic representation goes back to Davidson (1967). The question that arose in the ensuing discussion was: How do thematic roles or semantic relations fit in these representations? In the so-called "Neo-Davidsonian Systems of Thematic Roles" (cf. Dowty 1989) verbs are always one-place and thematic roles - understood as being relations between events and event participants - introduce the verb's thematic arguments (1b). In contrast, functional approaches following Chierchia (1984) assume an additional referential argument for events and represent thematic roles as functions from sets of events to sets of event participants (1c). I.e., according to (1b) *Jenny* in (1a) is standing in an agent relation to the event, and according to (1c) she is picked out by an agent function as the (only) agent of the fixing event. The differences between the two approaches will be discussed later.

(1)　(a)　*Jenny fixed the bike*
　　(b)　$\forall e[\text{fix}(e) \Rightarrow [\exists x[\text{Agent}(y,e)] \,\&\, \exists y[\text{Theme}(x,e)]]]$
　　(c)　$\forall x \forall y \forall e[\text{fix}(x,y,e) \Rightarrow [[\text{Agent}(e) = y] \,\&\, [\text{Patient}(e) = x]]]$

While these approaches conceive of events as temporally unstructured entities, Pustejovsky (1991) suggests that events are complex in the sense that they consist of subevents. Verbs and phrases containing verbs belong to either of three different types: they can be states, processes or transitions. Transitions are complex in that they consist of a process and a following state. Each subevent is connected to a lexical decomposition:[2]

(2)　(a)　*the door is closed*　　$\text{STATE}[\text{closed(the-door)}]$
　　(b)　*Mary ran*　　　　　　$\text{PROCESS}[\text{run(Mary)}]$
　　(c)　*John closed the door*

　　　$\text{TRANSITION}[[\text{PROCESS}(\text{act(John,the-door)} \,\&\, \neg\text{closed(the-door)})][\text{STATE}(\text{closed(the-door)})]]$

Grimshaw (1990) observes that event participants are not always involved in all of the verb's subevents. While the agent in (1a) is engaged in the process of fixing the bike she is not involved in the resulting state of the event, namely the bike being fixed. Grimshaw assumes that in addition to an argument structure that is hierarchically ordered according to a thematic hierarchy, every verb is provided with an event structure based on an aspectual hierarchy.[3] That is to say, an argument is aspectually more prominent if it is involved in the first subevent than if it is involved in the second subevent or both subevents (3b):

(3) (a) *to fix*, Argument Structure: (x   (y))   <<   (Agent(Theme))
     (b) *to fix*, Event Structure   1   2

Based on these approaches I want to pursue the following three ideas in this paper:

(i)   Verbs refer to events that are internally structured in the sense that they consist of several subevents.
(ii)   These subevents have to be lexically specified and belong to different types.
(iii) The event participants corresponding to the thematic arguments of the verb stand in semantically specified relationships to one or more of the verb's subevents.

2. Empirical evidence for these assumptions is provided by different phenomena. As far as the primitive event types go, it has been argued in Engelberg (1994a) that in addition to durational events (DUR = processes in Pustejovskys terminology) and states (STE), punctual events (PCT) also have to be distinguished. This idea is supported by the behaviour of verbs with respect to the constructions in (4); table (5) shows the acceptability of one- and two-place verbs of different event types when they appear with or in these constructions.[4]

(4) (a) *lang*-PP: *er tanzte zehn Minuten lang*; 'he was dancing for ten minutes'
     (b) *in*-PP: *er baute eine Hundehütte in zwei Tagen*; 'he built a kennel in two days'
     (c) progr. (*am*+inf.): *sie war am Tanzen*; 'she was (at the) dancing'
     (d) partitive (*an*-PP): *sie baute an einer Hundehütte*; 'she was building (at) a kennel'

(5)

			lang-PP	*in*-PP[5]	progr.	part.
(a)	DUR	*qualen*(x,y) 'to tease'	OK	*	-	*
		tanzen(x) 'to dance'	OK	*	OK	-
(b)	DUR+STA	*bauen*(x,y) 'to build'	*	OK	-	OK
		gelieren(x) 'to gel'	*	OK	OK	-
(c)	PCT	*kneifen*(x,y) 'to pinch'	OK[iter]	*	-	*
		klopfen(x) 'to knock'	OK[iter]	*	OK[iter]	
(d)	PCT+STA	*sprengen*(x,y) 'to blow up'	*	*	-	*
		platzen(x) 'to burst'	*	*	*	-

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[3] The event structure in Grimshaw's theory is mainly used to explain linking regularities.

[4] "Ok[iter]" indicates that the construction is acceptable with an iterative interpretation; "-" means that the phenomenon is not relevant for this type of verb for independent reasons.

[5] Referring to the span of time the event takes up and not to the span of time between a contextually determined point of time and the onset of the denoted event.

One property of verbs referring to a durational event plus a resulting state is that they allow an *in*-PP. But, as the examples in (6) show there are some verbs of this type which sound odd when combined with this adverbial:[6]

(6) (a) *sie brannte das Haus nieder* ($^{??}$*in sechs Stunden* / $^{??}$*sechs Stunden lang*)
       'she burned down the house (in six hours / for six hours)'
    (b) *sie versenkte das U-Boot* ($^{??}$*in sechs Stunden* / $^{??}$*sechs Stunden lang*)
       'she sank the submarine (in six hours / for six hours)'

These verbs refer to events which consist of an initial punctual event followed by a process and a resulting state. In (6a) this corresponds firstly to an event of somebody setting fire to the house, secondly to a process of the house burning down, and thirdly to the state of the house being burnt down. But it is not the mere fact of an additional punctual event that influences the aspectual behaviour of verbs, as the acceptability of a *für*-PP with some verbs shows:

(7) (a) *sie brannten das Haus nieder* ($^{??}$*in sechs Stunden* / $^{??}$*für sechs Stunden*)
       'they burned down the house (in six hours / for six hours)'[7]
    (b) *sie reparierte den Wagen* (*in drei Stunden* / $^{??}$*für drei Stunden*)
       'she fixed the car (in three hours / for three hours)'
    (c) *die Arbeiter besetzten die ganze Fabrik* (*in dreißig Minuten* / *für dreißig Minuten*)
       'the workers occupied the whole factory (in thirty minutes / for thirty minutes)'

In the reading of the *für*-PP taken into consideration here, the PP refers to the duration of a resulting state.[8] Since all three sentences in (7) imply such a resulting state, but only (7c) is acceptable, there must be an additional semantic property that licenses this construction. While *reparieren* 'to fix' only implies that the agent controls the process of fixing, the meaning of a verb like *besetzen* 'to occupy' includes that the agent in (7c) not only controls the process of occupying the factory but also the resulting state; i.e., the factory will remain occupied as long as the occupiers decide to stay there. Only if the resulting state is controlled by the agent is a *für*-PP acceptable. Looking back to the examples with *niederbrennen* 'to burn down' we can now see that event control is responsible for the admissibility of the *in*-PP, too. We don't understand the process of the house burning down in (6a) as being controlled by the agent, and that exactly is a requirement for being modified by the *in*-PP. The semantic differences between the three verbs in (7) are summarized below:

(8) (a) *besetzen*(x,y) ⇒ DUR + STA & y controls DUR and STA
    (b) *reparieren*(x,y) ⇒ DUR + STA & y controls DUR
    (c) *niederbrennen*(x,y) ⇒ PCT + DUR + STA & y controls PCT

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6 I owe these examples to Kaufmann (1993). Notice that the corresponding non-causative sentences *the house burnt down* and *the ship sank* are fully acceptable with *in*-PPs.

7 The difference between *fünf Minuten lang* and *für fünf Minuten* reveals an ambiguity in the English *for*-PP; it has a process-related reading and a reading referring to the duration of the resulting state of the process.

8 There are other readings, though: in the sense of 'she fixed the car to use it for three hours' sentence (8b) is less unacceptable with the *für*-PP.

These differences have syntactic consequences, too. In fact, the same properties restricting the distribution of the *für*-PP can account for the fact that only some verbs including a resulting state allow an agent-PP in the stative passive construction with *bleiben*. Only if the resulting state is controlled by the agent as in (9a,b) is such a PP possible:[9]

> (9) (a) *die Fabrik blieb von den Arbeitern besetzt*; 'the factory remained occupied by the workers'
>
> (b) *die Straße blieb von der Polizei gesperrt*; 'the street remained blocked/closed by the police'
>
> (c) *sie blieben (*vom Standesbeamten) verheiratet*; 'they remained married (by the registrar)'
>
> (d) *der Tänzer blieb (*vom Gradobier) angezogen*; 'the dancer remained dressed (by the dresser)'

3. An event structure that is able to capture the semantic distinctions that proved to be relevant for the aspectual and syntactic behaviour of verbs can be defined as follows: An event structure is a representation of the verb's meaning that integrates the thematic arguments of the verb into a description of the events that the verb can refer to. The main characteristics of an event structure are: a) verbs refer to complex situations that consist of subevents; b) these subevents are of different types (punctual events, durational events, states); c) the event participants corresponding to the thematic arguments of the verb are involved in different subevents; d) semantic functions relate participants and subevents. The event structure of the verb *niederbrennen* 'to burn down' can be represented as a meaning postulate like in (10b), where "<" indicates temporal precedence:

> (10) (a) $\lambda x \lambda y \lambda e^1 \lambda e^2 \lambda e^3 [\text{niederbrennen}(x,y,e^1,e^2,e^3)]$
>
> (b) $\forall x \forall y \forall e^1 \forall e^2 \forall e^3 [\text{niederbrennen}(x,y,e^1,e^2,e^3)] \Rightarrow$
>
> $[[e^1 < e^2 \,\&\, e^2 < e^3]$ & $[\text{PCT}(e^1) \,\&\, \text{DUR}(e^2) \,\&\, \text{STA}(e^3)]$ &
>
> $[\text{ACT}(e^1) = y]$ & $[\text{CONTROL}(e^1) = y]$ & $[\text{AFFECTED}(e^1) = x]$
>
> $[\text{CHANGE}(e^2) = x]$ & $[\text{THEME}(e^3) = x]]$

This kind of representation is motivated by the following considerations: i) The representation of semantic relationships between subevents and event participants as functions instead of simple relations has several desirable consequences. Firstly, each of the functions relates only one participant to a subevent, that is to say it is for example excluded that two participants control the same subevent. Secondly, one participant can hold the same role in different subevents; e.g. the agent in *bauen* 'to build' only controls the process while the agent of *besetzen* 'to occupy' controls the process and the resulting state. Finally, a participant can stand in different relations to different subevents like the object of *niederbrennen*. ii) Verbs with optional complements have to be lexically marked whether the omitted but implicitly understood argument is existentially or contextually bound (cf. Jacobs 1993). This requires the presence of thematic arguments in the argument structure, which is not the case in neo-davidsonian approaches. iii) Subevents are integrated into the argument structure because they can be referred to and can be modified by temporal-aspectual adverbials. Precisely: the temporal-aspectual adverbials *in*-PP, *für*-PP, *lang*-PP, *um*-PP always modify one subevent and only one subevent. There is, for example, no adverbial that expresses the duration of a process plus the duration of the resulting state.

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[9] More syntactic phenomena are discussed in Engelberg (1994b).

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