

## TIME AND EVENT MEASURE\*

Richard Larson  
Stony Brook University

In linguistic semantics durative adverbs like *for two hours* have typically been analyzed within the framework of **internal semantics**. Under that theory, sentences are evaluated with respect to time intervals, and temporal measure adverbs quantify over the parts of those intervals (see Dowty 1979, Taylor 1977, Hinrichs 1985, Moltmann 1991, Vlach 1993, among others). Example (1) contains typical sample analyses for the sentence *John slept for two hours*.

(1) John slept for two hours.

- a.  $\exists t[\text{PAST}(t) \ \& \ \mathbf{two\text{-}hours}(t) \ \& \ \forall t' [t' \subseteq t \rightarrow \text{AT}(t', \text{sleep}(j))]]$  (Dowty 1979)  
 b.  $\exists t[\mathbf{two\text{-}hours}(t) \ \& \ \forall t' [t' \text{ Pt} \rightarrow \exists e[\text{sleep}(e, j) \ \& \ \text{AT}(e, t') \ \& \ \text{PAST}(t)]]]$   
 (Moltmann 1991)

The first analysis, due to Dowty (1979) says that *John slept for two hours* is true iff there is some time interval  $t$  that is past with respect to the moment of evaluation, that is two hours long, and is such that each subinterval contains sleeping by John. The second analysis, by Moltmann (1991, 1997), is similar, but introduces events located at time intervals. (1b) says that the sentence is true iff there is a two-hour interval of time  $t$  such that at every part of  $t$ , there is a past event of sleeping by John. A crucial feature of both accounts is that the “stuff” measured by durative phrases is **time**. At each portion of the “time-stuff” there is sleeping by John.

In this paper, I suggest an alternative to the usual interval-based account. Specifically, following ideas by Cartwright (1975) on the semantics of nominal measure phrases, I propose that durative adverbs do not measure time, but rather event-stuff in the general sense of Davidson (1967). I begin with two simple questions that arise for the interval account. I then go on to introduce Cartwright’s analysis, and its extension to the temporal case. I close noting that if the proposed account is correct, it suggests an extension of Davidsonian event semantics to a wider range of constructions than is generally recognized.

## 1.0 Two Questions for the Standard Account

### 1.1 Reification

Various authors have observed that durative temporal adverbs in the verbal system are analogous to temporal measure phrases in the nominal system (Krifka 1989; Moltmann 1997). Thus *sleep for two hours* is comparable to *(get) two hours of sleep* (2a). In their surface grammar, phrases like *two hours of sleep* are similar to measure nominals with mass nouns like *two feet of rope* (3a). Both cases also have count noun counterparts, as shown in the (b) cases:

- |                            |                           |
|----------------------------|---------------------------|
| (2) a. two hours of sleep  | (3) a. two feet of rope   |
| b. a two-hour (long) sleep | b. a two-foot (long) rope |

The analogy between (2a) and (3a) raises a simple and direct question. To the best of my knowledge, no semantic analysis of mass noun measure analyzes (4a) along the lines of (4b), where length is reified as some stuff that is asserted to be measured. That is, we **don't** analyze *two feet* as measuring some “length stuff” such that “at” each part of that stuff there is rope, etc.:

- (4) a. A two-foot rope appeared.  
 b.  $\exists l[\mathbf{two-feet}(l) \ \& \ \forall l'[l' \ Pl \rightarrow \exists e\exists x[\text{rope}(x) \ \& \ \text{appear}(e,x) \ \& \ AT(x, l')]]$

Rather, *two-foot* is taken to measure the stuff given by the common noun—rope in this case. The same holds for other measure nominals like *two spoonfuls of sugar*, or *two pounds of sugar*. We don't take ourselves to be measuring abstract volume entities or abstract mass entities, with which real entities like sugar are associated. Rather we are measuring out sugar, with spoonfuls and pounds providing the units and the scale.

This raises a simple question: if we don't assume abstracts stuffs with examples like (3a), why should we do so with examples like (2a)? Why do we not take ourselves to be measuring just what we see—sleeping activity in the latter case?

### 1.2 Temporal Anaphora

In a discussion of temporal and event anaphora, Glasbey (1993) notes that the presence of an overt temporal adverb like *in July* is needed to support co-temporal anaphoric reference by *then* (5a, b). Thus, whereas (5a) can be understood as asserting that Daniel and Gareth climbed mountains in the same month, (5b), which lacks an explicit temporal antecedent, cannot easily be understood this way.

- (5) a. Daniel climbed Ben Nevis **in July**  
 Gareth climbed Snowdon then (= Glasbey's (1a,b))

- b. Daniel climbed Ben Nevis  
 #Gareth climbed Snowdon then (= Glasbey's (2a,b))

Glasbey further observes that not all temporal adverbials will support temporal anaphora with *then*. Specifically, inclusive *in*-adverbials and durative *for*-adverbials will not do so (6).

- (6) Daniel climbed Ben Nevis (**in four hours/for four hours**)  
 #Gareth climbed Snowdon **then** (= Glasbey's (3a,b))

Geis (1970) notes very similar facts. Once again, despite the presence of an explicit adverbial, temporal anaphora with *then* is not possible with various duratives (7):

- (7) a. #John studied **for four hours** and George studied **then** too.  
 b. #John studied **until Bill arrived** and George studied **then** too.  
 c. #John has lived here **since his father died** and George has lived here **then** too. (7b,c) = Geis's (60), (61))

These points raise another simple question for the standard analysis: if durative adverbs invoke a time interval (the one over which they quantify), why do they not license temporal anaphora? Why is the relevant interval not made available as a "discourse entity" for later anaphoric reference?

### 1.3 On Homogeneity

To my knowledge, only one argument has been offered in support of the standard analysis. Moltmann (1991) argues that only if durative adverbials quantify over time intervals can we correctly deduce their co-occurrence with predicates that are "homogeneous" in the sense defined in (8) below (where  $\Pi$  is the part-of relation):

- (8) a. P is **homogeneous** iff P is cumulative and divisive.  
 b. P is **cumulative** iff  $\forall xy[P(x) \ \& \ P(y) \ \rightarrow P(x \oplus y)]$   
 c. P is **divisive** iff  $\forall xy[P(x) \ \& \ y\Pi x \ \rightarrow P(y)]$

The crucial part of the argument concerns achievement verbs and goes like this: achievement verbs like *die* resist durative adverbs, at least in their nonrepetitive sense of 'V for the first time' (9):

- (9) #For two years, John died for the first time (= Moltmann's (12a))

However, the event structure of *die* trivially satisfies homogeneity. Since any two events of John dying for the first time are necessarily identical, their sum is an

event dying for the first time. Hence cumulativity is trivially satisfied. Furthermore, since *die* denotes an event that happens at an instant, that event need not have proper subparts. Accordingly, divisivity is also trivially satisfied. Since *die for the first time* is cumulative and divisive and thus homogeneous, we would expect it to accept durative adverbials. But this prediction is not correct.

Moltmann asserts that her own analysis in (10), which quantifies over times, avoids the problem.

$$(10) \exists t[\text{two-years}(t) \ \& \ \forall t'[t' \ Pt \rightarrow \exists e[\text{dying}(e,j) \ \& \ AT(e,t')]]]$$

In Moltmann's words, according to (10), "for every relevant part of the interval there must be an event *e* at *t*. Thus there must be as many events as there are relevant subintervals, that is, parts of the interval in the sense of *P*" (p. 638). The point seems to be that since there must be relevant subintervals of the interval, divisivity cannot be trivially satisfied. There must be **relevant** subintervals, and for each such subinterval there must be an event of dying for the first time. Since this is impossible, the predicate is not homogeneous, and therefore correctly predicted to resist duratives.

Two points may be made in response. First, a crucial assumption in Moltmann's argument is that achievement predicates possess no relevant event part-structure, but **do** possess relevant temporal part structure. It is unclear why this should be so, however. Achievements typically describe actions occurring "in a moment", which seems tantamount to saying that their time interval of occurrence has **no** relevant subparts—that it is a singleton or a point. If so, then divisivity with achievements will follow trivially in Moltmann's analysis too, yielding the same wrong result.

A second point concerns the fact that homogeneity is not uniformly **deduced** in Moltmann (1997) but rather stipulated in certain cases. Consider mass quantifiers like *little* in *little water*, and the corresponding German adverbial *wenig* 'little' in (11a):

- (11) a. *Maria schlief wenig.* 'Maria slept little'  
 b. *#Maria starb wenig.* 'Maria died little'

In *little water*, *little* is assumed by Moltmann to apply directly to a homogeneous domain of quantities of water. Likewise *wenig* in (11b) is assumed to apply directly to a homogeneous domain of events of sleeping. Now notice that (11b) is odd in German just as its English gloss is odd on its literal interpretation: *wenig* needs a homogeneous predicate, but the achievement verb *sterben* 'die' is not homogeneous. Since *wenig* applies directly to a domain of events and not time intervals, no **deduction** of its homogeneity requirement is forthcoming for (11b). That is we must simply assume *sterben* to be non-homogeneous. But if *sterben* must be assumed to be non-homogeneous in (11b), we may invoke this assumption with (9) too.

More generally, we can put the point as a question: why not analogize measure adverbials directly to durative adverbs like *wenig*, simply requiring them to apply to a homogeneous event domain? No deduction of homogeneity will be forthcoming, of course, but then none is available for *little* or *wenig* in any case. Under this alternative suggestion, the argument for appeal to time intervals with measure phrases simply disappears.

## 2.0 The Semantics of Measure Phrases (Cartwright 1970, 1975)

Departing from the standard analysis, I propose an account of measure phrases that makes no essential appeal to time points or time intervals, but rather analyzes them as more directly analogous to nominal measure expressions. The crucial element of this account is the semantics for mass terms and measure proposed by Helen Cartwright (1970, 1975). Summarizing briefly, Cartwright takes both count nouns and mass nouns to divide their reference. But whereas count nouns divide their reference over familiar, spatio-temporally coherent objects, mass nouns divide their reference over what she calls “quantities”, entities that need not be physically coherent. We count the **objects** that a count noun applies to and obtain their **number**. We sum the **quantities** that a mass noun applies to and obtain their **amount**.

Cartwright (1975) analyzes nominal measure phrases as counting the quantity of their associated mass noun and yielding an amount. An example like (12a), is analyzed as in (12b), where “ $p_{\text{spoonfuls}}$ ” is an extensive measure function that applies to the maximal quantity of sugar bought by Mary; it partitions this quantity by spoonfuls and yields a number expressing the amount of sugar:

- (12) a. Mary bought **two spoonfuls of sugar**.  
 b.  $p_{\text{spoonfuls}}[\text{the } x: \text{sugar}(x) \ \& \ \text{buy}(\text{Mary}, x)] = 2$   
 ‘Measured in spoonfuls, the amount of sugar bought by M is 2’

My proposal is that we extend Cartwright’s account, using the event semantics of Davidson (1967) (cf. also Krifka 1989). Many authors have remarked on the analogies between mass nouns on the one hand, and non-telic verbs on the other (Bach 1986, Jackendoff 1991, Mourelatos 1981, Taylor 1977, Vlach 1993). Following Cartwright, I suggest that we understand such verbal predicates as referring to **quantities of events**, and that we understand measure phrase adverbials as counting the quantity of event-stuff in their associated verb and yielding an amount.

To illustrate, consider first the nominal measure phrase in (13a). Under the Cartwright + Davidson proposal, this would be analyzed as in (13b). Here “ $p_{\text{hours}}$ ” is an extensive measure function that applies to the maximal quantity of walking-activity observed by Mary. The function partitions this quantity by hours and yields a number expressing the amount of walking, here 2:

- (13) a. Mary observed **two hours of walking**.  
 b.  $p_{\text{hours}}[\text{the } e: \text{walking}(e) \ \& \ \text{observe}(\text{Mary}, e)] = 2$   
 ‘Measured in hours, the amount of walking observed by M is 2’

This idea can now be directly generalized to measure phrase adverbials. *Two hours of* corresponds to measure adverbial *for two hours* (14a). The latter can once again be analyzed via temporal measure functions on event-quantities (14b):

- (14) a. Mary walked **for two hours**.  
 b.  $p_{\text{hours}}[\text{the } e: \text{walking}(e) \ \& \ \text{Agent}(\text{Mary}, e)] = 2$   
 ‘Measured in hours, the amount of walking by M is 2’

This analysis directly addresses the two questions raised above for the standard analysis. First, it does not divorce the semantics of temporal measure from that of other kinds of measure by reifying the measure-space. The analyses in (13b) and (14b) do not invoke time points—no more than the analysis in (12b) invokes an abstract space of spoonful points or volume points.

Second, the analysis makes no reference to times or temporal intervals, only to temporal measure functions. Durative adverbs therefore do not invoke such discourse entities in any direct way. Under the proposals by Glasbey (1993), where *then* requires an explicit temporal antecedent making reference to a time or time interval, there will be no expectation that duratives should support temporal anaphora.

Third and finally, under the account proposed here, the treatment of durative adverbials resembles the analysis of mass event quantifiers like *wenig* in Moltmann (1997). That is, they are applied directly to events (more precisely, to maximal quantities of events). Accordingly, the analysis of the homogeneity restriction adopted for the latter carries over to duratives as well.

## 2.1 Extensions and Comparisons

The view proposed here has a number of attractive consequences, which I will sketch here briefly, and also appears to compare favorably to an alternative measure-function approach that has been proposed in the literature.

*2.1.1 Other Measure Adverbs.* Mass nouns typically allow their amounts to be measured along a number of different dimensions. So we get *two spoonfuls of sugar* but also *two pounds of sugar*; we get *two cubic yards of concrete*, *two tons of concrete*, and *two miles of concrete*, etc. In a similar way with event measure, we get not only measurement by time but also measurement by distance (15). And beyond time and measure there are also more exotic forms of duratives, such as that in (16), where, for simplicity, *this amplifier* is interpreted by the constant *a*:

- (15) a. Mary walked **for two miles**.  
 b.  $p_{\text{miles}}[\text{the } e: \text{walking}(e) \ \& \ \text{Agent}(\text{Mary}, e)] = 2$   
 ‘Measured in miles, the amount of walking by M is 2’
- (16) a. (This amplifier is accurate up to 10,000Hz)  
 It is unstable **for (the next) 5,000 Hz**.  
 (It fails entirely at 16,000Hz)  
 b.  $p_{\text{Hz}}[\text{the } e: \text{being-unstable}(e) \ \& \ \text{Theme}(a, e)] = 5,000$   
 ‘Measured in Hz, the amount of unstable signal state is 5,000’

The analysis advanced here generalizes directly to other measures. In Cartwright’s system, *Mary walked for two miles* invokes the same kind of event-stuff as *Mary walked for two hours*, just as *two spoonfuls of sugar* measures the same stuff as *two pounds of sugar*. The difference is simply in the measure function used. Similarly for (16a,b), where we use a technical measure to assess the amount of a state of instability.

*2.1.2 N-times Measure Phrases.* The measure function analysis can also be extended to frequency adverbs of the form *n-times*, where *n* is a numeral (e.g., *seven times*). Adverbs of this form typically occur with predicates that are telic by the usual tests (17a,b). But such phrases can also occur with predicates that test out as atelic (18a–c):

- (17) a. Mary built a house **seven times/in an hour/\*for an hour**.  
 b. Mary walked to the store **seven times/in an hour/\*for an hour**.
- (18) a. Mary skipped rope **seven times/\*in an hour/for an hour**.  
 b. Mary played chess **seven times/\*in an hour/for an hour**.  
 c. Mary walked in the park **seven times/\*in an hour/for an hour**.

In the latter cases, the *n-times* phrase appears to be functioning, not as a specifier of **how many** things were done, but rather **how much** of a given thing was done: how much rope-skipping was done, how much chess-playing was done. And so.

*N-times* measure phrases can be brought within the analysis suggested here by appeal to the intuitive semantic connection that exists between (19a) and (19b):

- (19) a. Mary skipped rope **seven times**.  
 b. Mary took **seven turns of skipping rope**.  
 c.  $p_{\alpha}[\text{the } e: \text{rope-skipping}(e) \ \& \ \text{Agent}(\text{Mary}, e)] = 7$   
 ‘Counted in units  $\alpha$  (given by context), the number of rope-jumpings by M is 7’

Intuitively, both (19a,b) require Mary to engage in seven occasions of rope-skipping, where what counts as an occasion or turn of rope-skipping is determined by context. Consider, for example, the familiar situation of children jumping rope and reciting a schoolyard rhyme: the turn of jump-rope continues

to the point where a jump is missed during recitation of the rhyme. The context dependence seen with these adverbials appears analogous to what we see with nominal expressions like *Mary added seven dashes of pepper*, or *Mary suffered seven bouts of illness*, where what counts as a ‘dash’ or a ‘bout’ is likewise vague and contextually determined. We can formalize this proposal as in (19c), where the units of measure are determined by context. On this proposal, the occurrence of the word *times* does **not** signal an appeal to times or time intervals. Rather it is the suppletive adverbial counterpart of *turn* (cf. \**Mary jumped rope seven turns* and \**Mary took seven times of jumping rope*).<sup>1</sup>

2.1.3 *From-to* Phrases. Another extension involves *from-to* phrases. Measuring linear quantities (like distance) involves *from-to* arguments:

- (20) a. This boat measures seventeen feet **from its bow to its stern**.  
 b. This boat is seventeen feet long, measured **from its bow to its stern**.

Notice now that temporal *from-to* arguments appearing after an expression of amount don’t refer to time points directly. Instead they refer to events.<sup>2</sup>

- (21) a. The competition lasted two hours **from opening ceremonies to the final gun**.  
 b. \*The competition lasted two hours **from 2:00 pm to 4:00 pm**.  
 (22) a. The musical is two hours long, measured **from overture to final curtain**.  
 b. \*The musical is two hours long, measured **from 2:00 pm to 4:00 pm**.

This result is natural for us: one spatially measures an object from one part of it to another—the *from-to* arguments refer to the same kind of entity as that being measured. Likewise, one temporally measures an event from one part of it to another—the *from-to* arguments refer to the same kind of entity as that being measured.

## 2.2 “Adding Measures” (Krifka (1989))

The time-measure and event-measure analyses are not equivalent and make interestingly divergent predictions in certain cases involving addition of quantities and their measure. An important property of predicates that denote quantities is that they are **cumulative** in the sense shown in (23a). And an important requirement on functions that measure quantities is that they be **additive** in the sense shown in (23b). So consider P to be the predicate *water*. *Water* is cumulative: if x and y are quantities of water, then sum  $x \oplus y$  formed by pouring them together is also water. Furthermore, we want any measure function m for water to be additive. For example, if we add a quantity x measuring 2 gallons to a quantity y measuring 3 gallons, we certainly want the sum  $x \oplus y$  to measure out at 5 gallons:

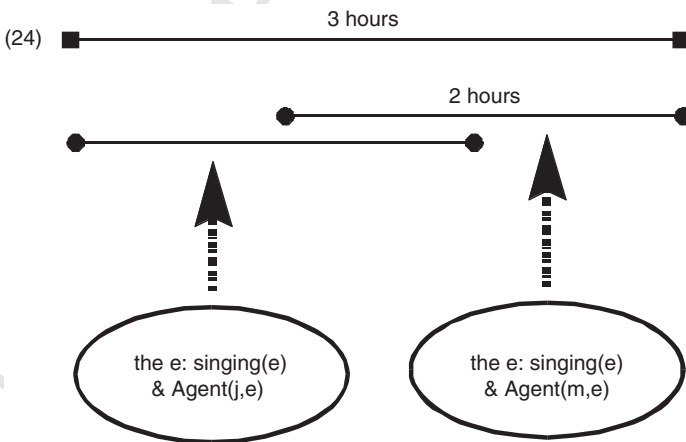


- (23) a. **P is cumulative** iff  $\forall xy[P(x) \& P(y) \rightarrow P(x \oplus y)]$   
 b. **m is additive** iff  $m(x) + m(y) = m(x \oplus y)$   
 c. If quantities  $x$  and  $y$  overlap,  $x \oplus y$  is  $x \oplus y'$  (where  $y'$  is  $y$  minus the overlap)

Notice that to get our measuring to turn out right, the entities measured must be non-overlapping, otherwise their overlap will end up be counted twice. Whenever we have a pair of overlapping quantities  $x$ ,  $y$ , and are interested in measuring their sum, we must appeal to a derived pair  $x$ ,  $y'$ , where  $y'$  is  $y$  with the overlap subtracted out (23c).

Now in a version of the standard analysis, Krifka (1989) proposes that durative adverbs express additive measure functions; but instead of measuring event-quantities directly, Krifka proposes that they measure the “temporal traces” of events: the time intervals over which the events occur. This point has an interesting consequence in the case of distinct events that happen to temporally overlap. Consider the case of two separate singing events. John sings from 2:00 pm to 4:00 pm and Mary sings from 3:00 pm to 5:00 pm. How much singing (measured in hours) has occurred in this scenario?

Since the temporal traces of the events overlap, Krifka’s account requires us to subtract the common portion. This means that we must consider the total amount of singing by John and Mary, considered collectively, to be 3 hours, as shown in diagram (24). Despite Krifka’s assertion to the contrary, however, this simply does not reflect what native speakers judge to be the case. My experience is that speakers uniformly judge the total amount of singing in the case described to be 4 hours, and not 3. In order to get sort of judgment Krifka endorses one must ask something very specific (and quite derivative) about the time-span, like “What is total time-span that these events occupy or take up?” Etc.



Hence appeal to temporal traces seems to yield a wrong result.<sup>3</sup>

The results are different if we measure events directly. Overlap between events is a complex issue, but one widely held view is that thematic roles like Agent must be unique in a given event (see Carlson 1982, for discussion). This means that if we have two events of singing with separate agents (John and Mary) they must be distinct, non-overlapping events. Since there is no overlap, we can take the sum of their temporal measures without subtraction. Hence we get the correct result where  $m(e_1) + m(e_2) = m(e_1 \oplus e_2) = 4$  hours.

Direct measurement of events not only predicts the adding of measures correctly in this case, but it also seems to predict when overlap will be relevant. Suppose there is kissing by Mary from 2:00 pm to 4:00 pm, and kissing of John from 3:00 pm to 5:00 pm. How many total hours kissing has there been? Native speakers judge this case to be one in which there may well be only three total hours of kissing. Intuitively, since the relevant thematic roles (agent and theme) are complementary, we recognize that part of the first quantity of kissing by Mary might have been kissing of John. And part of the second quantity of kissing of John might have been kissing by Mary. That is, the two events may well overlap, in which case we must indeed subtract the overlap to calculate the sum correctly. Thus direct appeal to events appears to get the right result, and for the right reasons.

### 3.0 Conclusion

In this paper I have suggested an analysis of temporal measure phrases that makes no reference to time points or intervals, but rather to Davidsonian events. Time is not itself measured; rather time provides the dimension according to which event stuff is measured. This analysis has certain broader implications, of which I will mention two.

First, if correct, this account has the consequence of implying the presence of event parameters wherever temporal measure phrases occur. This conclusion may seem straightforward for cases like (25a,b), involving verbs (*sleep*) or their nominal derivatives (*sleeping*)—constructions where events are typically postulated in any case. Consider, however, less obvious contexts like (26a,b), where a measure phrase occurs within a directional prepositional phrase (PP).<sup>4</sup>

- (25) a. John slept for 12 hours  
       b. 12 hours of sleep(ing) is a lot!
- (26) a. The restaurant is  $\left\{ \begin{array}{l} \text{[PP 12 miles down the road]} \\ \text{[PP 12 minutes down the road]} \end{array} \right.$   
       b.

In both of the latter, we measure distance down the road, but whereas (26a) invokes spatial units, (26b) uses time. Under the present analysis, this compels us to postulate a hidden event parameter inside the directional PP, despite its plainly non-verbal character. But in fact this seems exactly the right conclusion

to draw. It seems difficult to conceive of (26b) being analyzed without reference to some sort of traveling event, and indeed we can even make this event explicit using an adjunct phrase as in (27)

- (27) a. The restaurant is  $\left\{ \begin{array}{l} \text{[pp 12 miles down the road]} \\ \text{[pp 12 minutes down the road]} \end{array} \right\}$  **travelling by car**  
 b.

From this perspective, then, temporal (and perhaps also spatial) measure phrases become a diagnostic for concealed event structure.

The second implication I wish to observe is the “deflationary” character of the current account. Reference to abstract entities like times, worlds, degrees, etc. is commonplace in modern formal semantic theory. Under the present proposal, however, at least one domain where times and time intervals have frequently been invoked has been shown not to require them. It is an interesting question as to how far such a proposal might be pushed with respect to other aspects of temporal semantics, such as tense. The appeal to measure here has a direct echo to operationalism in physics where talk about abstract time and space is replaced by talk about temporal and spatial measurements. Whether such an ambitious general program can be carried through in linguistic semantics is an open, but interesting question.

## Notes

\* A shorter version of this paper was presented at the 1999 Linguistic Society of America annual meetings, Los Angeles, CA. I am grateful to audience members for questions and comments.

1. This view derives interesting apparent support from languages like Italian, which renders ‘seven times’ as *sette volte*—literally seven turns (of something). Similar facts apparently hold in Korean. I am grateful to Peter Ludlow and Sungeun Cho for these observations.
2. Examples (17b) and (18b) must be read without “comma intonation”, which allows for an irrelevant “afterthought” reading.
3. A similar, and equally wrong result will occur with spatial measure phrases. If John and Mary travel by the same road and John drives for 100 miles and Mary drives for 100 miles, then if there is overlap on their routes it will follow by Krifka’s analysis that they collectively traveled less than two hundred miles total. But this result is not intuitively correct.
4. (26a) is due to Jackendoff (1977).

## References

- Bach, E. (1986) “The Algebra of Events,” *Linguistics and Philosophy* 9: 5–16.  
 Carlson, G. (1982) “Thematic Roles and Their Role in Semantic Interpretation,” *Linguistics* 22: 259–279.  
 Cartwright, H. (1970) “Quantities,” *Philosophical Review* 79: 25–42.

- Cartwright, H. (1975) "Amounts and Measures of Amounts," in J. Pelletier (ed.) *Mass Terms: Some Philosophical Problems*. (pp. 179–198) Dordrecht: D. Reidel.
- Davidson, D. (1967) "The Logical Form of Action Sentences," in N. Rescher (ed.) *The Logic of Decision and Action*. (pp. 81–120) Pittsburgh: University of Pittsburgh Press.
- Dowty, D. (1979) *Word Meaning and Montague Grammar*. Dordrecht: D. Reidel.
- Geis, M. (1970) "Time Prepositions as Underlying Verbs," in M. Campbell et al. (eds.) *Papers from the Sixth Regional Meeting: Chicago Linguistics Society*. Chicago Linguistics Society, University of Chicago, Chicago, Illinois.
- Glasbey, S. (1993) "Distinguishing Between Events and Times: Some Evidence from the Semantics of *Then*," *Natural Language Semantics* 1: 285–312.
- Jackendoff, R. (1977) *X-bar Syntax. A Study in Phrase Structure*. Cambridge: MIT Press.
- Jackendoff, R. (1991) "Parts and Boundaries." *Cognition* 41: 9–45.
- Krifka, M. (1989) "Nominal Reference and Temporal Constitution," in R. Bartsh et al. (eds.) *Semantics and Contextual Expression*. (pp. 75–115) Dordrecht: Foris.
- Moltmann, F. (1991) "Measure Adverbs," *Linguistics and Philosophy* 14: 629–660.
- Moltmann, F. (1997) *Parts and Wholes in Semantics*. New York: Oxford University Press.
- Mourelatos, A. (1981) "Events, Processes and, States" in P. Tedeschi and A. Zaenen (eds.) *Syntax and Semantics Vol. 15: Tense and Aspect*. (pp.191–211) New York: Academic Press.
- Taylor, B. (1977) "Tense and Continuity," *Linguistics and Philosophy* 1: 199–220.
- Vlach, F. (1993) "Temporal Adverbials, Tenses, and the Perfect," *Linguistics and Philosophy* 19: 231–283.