DAVID R. DOWTY

THE EFFECTS OF ASPECTUAL CLASS ON THE TEMPORAL STRUCTURE OF DISCOURSE: SEMANTICS OR PRAGMATICS?

1. INTRODUCTION

The temporal relationship between the events and states that are described in successive sentences in a narrative discourse is often indicated explicitly through definite time adverbials, as in (1), temporal subordinate clauses, or certain tense combinations (e.g. a past perfect sentence within a narrative in the simple past).

(1)   John arrived at 8 PM. He left again at 10.

But in cases where such indicators are absent, it has been observed by Jespersen, and in more detail in a series of recent articles by Helen Dry (1978, ms.), that the aspectual classes of the predicates in the discourse, i.e. their *Aktionsarten*, seem to determine these temporal relationships. (By *aspectual class* I refer to the taxonomy of predicates originating with Aristotle and known in the Anglo-Saxon tradition through the work of Ryle, Kenny and Vendler; I will refer to these classes by Vendler's names *States*, *Activities*, *Accomplishments* and *Achievements*, and I assume that the reader is acquainted with the syntactic and semantic tests usually employed to distinguish these categories (cf. Vendler, 1967; Dowty, 1979).)

If a sentence in a narrative contains an accomplishment or achievement predicate but no definite time adverb, that sentence is understood to describe an event occurring later than the time of the previous sentence's event (or in the literary analyst's terms, narrative time "moves forward" in the second sentence). For example, (2) indicates this phenomenon with an accomplishment, *walk over to him*,

(2)   John entered the president's office. The president walked over to him.

and (3) illustrates it with an achievement, *wake up*:

(3)   John entered the president's office. The president woke up.

If on the other hand the second sentence of the sequence has a stative predicate, as in the second sentence in (4), or an activity predicate as in the second one in (5), the state or process it describes is most usually

understood to overlap with that of the previous sentence: narrative time
does not "move" in the second sentence.

(4)   John entered the president's office. The president sat behind a
        huge desk.

(5)   John entered the president's office. The clock on the wall
        ticked loudly.

This lack of temporal advancement is, in fact, almost inescapable when
the second sentence is in a progressive tense, no matter whether the verb
is an activity as in (6), or an accomplishment or achievement, as in (7).

(6)   John entered the president's office. The president was looking
        out the window.

(7)   John entered the president's office. The president was writing
        a letter.

Some lexical stative verbs (e.g. *stand*, *sit*, *realize*), however, seem to be
systematically ambiguous between a "stative" and an "inceptive" inter-
pretation; in the latter interpretation these are achievement predicates,
and time accordingly "moves" in this interpretation (cf. (8)):

(8)   John entered the president's office. The president realized why
        he had come.

Other stative predicates can be given an inceptive interpretation with the
aid of an adverbial like *suddenly* or *in a moment*, and here also time
moves:

(9)   John sat in his chair going over the day's perplexing events
        again in his mind. Suddenly, he was asleep.

Activity sentences likewise lend themselves to inceptive interpretations
in non-progressive tenses. Progressives, on the other hand, resist the
inceptive interpretation in almost all cases.

2. The Analysis of Kamp and Hinrichs

Hans Kamp (1979, 1982) has recently proposed a theory of the inter-
pretation of narrative discourse that proceeds in two steps: fiirst, dis-
course rules map a sequence of sentences comprising a discourse into a
discourse representation structure. Secondly, the discourse representation
is given a truth-conditional interpretation relative to a model (whereas
the individual sentences are not truth-conditionally interpreted directly).

One task of the discourse-representation construction is the specification of the temporal relationships between adjacent sentences. Kamp proposes that for French, at least, these relationships in discourse structure are a function of the tenses of the sentence. If the sentence is in the passé simple, its event follows and does not overlap with the event of the previous sentence. But if this sentence is in the imparfait, its event overlaps temporally with that of the previous sentence.

Hinrichs (1981) has applied Kamp's ideas to the analysis of English discourses. In accord with the observations I have cited above about the role of aspectual class, Hinrichs subcategorizes sentences syntactically by their aspectual class – statives, activities, etc. – in order that these classes can be referred to by the discourse representation construction rules.

Note however one problem that will arise if this method is adopted. It has been observed (Verkuyl, 1972; Dowty 1972, 1979 and elsewhere) that the aspectual properties of English sentences are not determined simply by their lexical main verbs (as Kenny and Vendler seem to have assumed). Rather, a large variety of syntactic constituents of the sentence play a role in this determination. For example, a prepositional phrase or NP expressing extent can convert an activity into an accomplishment:

(10)(a) John walked. (*activity*)
  (b) John walked to the station. (*accomplishment*)
  (c) John walked a mile. (*accomplishment*)

The presence of an indefinite plural NP or mass NP can render a sentence that would otherwise be an accomplishment into an activity:

(11)(a) John noticed the rare seashell on the beach. (*achievement*)
  (b) John noticed rare seashells on the beach. (*activity*)
  (c) Tourists noticed the rare seashell/rare seashells on the beach. (*activity*)

Since adverbials like *for an hour* are only compatible with states and activities, while adverbials like *in an hour* are only compatible with accomplishments and achievements, the choice between these two kinds of adverbial can in effect disambiguate a verb that is lexically ambiguous between activity and accomplishment interpretations. So as Fillmore (1971) observed, (12a) has the accomplishment interpretation of *read a book* (i.e. read the whole book), (12b) on the other hand has only the activity interpretation (i.e. read from the book):

(12)(a) John read a book in two hours.
  (b) John read a book for two hours.

One could still try to treat aspectual class as a syntactic property of sentences in spite of these complications; in fact Verkuyl (1972) employs this syntactic approach. To carry out this method, Verkuyl finds it necessary to subcategorize a large variety of syntactic categories for aspectual class – not only verbs, but their complements, verb phrase nodes, NP nodes, and sentence nodes; in addition, elaborate cooccurrence restrictions among these subcategories are needed as well. But, as I have argued elsewhere (Dowty 1972, 1979), this syntactic method misses the point: it is surely the *semantic* properties of verbs, of the prepositional phrase in (10b), of the definite versus indefinite plural NPs in (11), and of the adverbials in (12), etc., that are responsible for the ultimate aspectual properties of the sentences in which they appear, and a syntactically based classification of the aspectual interaction of all of these kinds of constituents would simply recapitulate work that has to be done in the lexical and compositional semantics anyway.

If I am correct in supposing that the aspectual character of full sentences is determinable only in the semantics (and I will indicate in a moment how I think this should be carried out), then this situation poses a dilemma for Kamp's and Hinrichs' approach to the temporal relationships in discourse as I understand it. For if the compositional model-theoretic interpretation of the sentences in a discourse is determined only after a discourse representation has been constructed (as Kamp proposes), and if it is only in the model-theoretic interpretation that the aspectual class of a sentence is fully apparent (as I am arguing), then how can aspectual class have an effect on how the temporal relationships between sentences are represented in the discourse representation? A second problem I see for the application of Kamp's method to English is that in certain cases, the intended aspectual class of a sentence is determined in part by the hearer's real world knowledge; i.e. this knowledge is needed to disambiguate sentences that are potentially ambiguous in aspectual class. These cases will be discussed later on. But in these cases as well, the decision how to order the states and events described by successive sentences in a discourse will depend on the prior decision as to just what aspectual classes the individual sentences fall into. If so, then here again it seems that the temporal relationships among sentences in a discourse depends on the prior determination of the semantics of the individual sentences, contrary to Kamp's proposal as I understand it.

But rather than attempt to argue that Kamp's proposal about discourse representation cannot be amended to account for these apparent problems, I will simply present here an alternative account of the temporal semantics of discourse, one in which discourse semantics depends on

sentence semantics and pragmatic principles, and try to show that it gives a simple and natural account of discourse ordering, one that makes use of certain principles that are independently motivated.

In particular, my claim is that the temporal relationships between sentences of a discourse are determined by three things: (1) the semantic analysis of aspectual class using the interval semantics that was proposed by Barry Taylor (1977) and extended in Dowty (1979), (2) a single principle for the interpretation of successive sentences in a discourse, a principle which in itself does not make reference to the aspectual classes of the sentences involved, and (3) a large dose of Gricean conversational implicature and "common sense" reasoning based on the hearer's knowledge of real world information.

I should add that I will draw heavily on data and observations made in several papers by Helen Dry (1978, 1983), whose analysis rests in part on ideas of Carlota Smith (1979, 1983). Both Dry and Smith speak of aspectual distinctions in terms of "sentences which make reference to the natural beginning points and endpoints of a situation" versus sentences which do not make reference to such points. I should point out that what I say in this paper need not be construed as disagreeing with Dry's and Smith's claims. Rather, my contribution will lie in making precise just what these so-called "natural endpoints of a situation" are in model-theoretic terms (i.e. in terms of moments and intervals of familiar tense-logical models), and also making precise just how the compositional semantics of sentences and discourse is determined, both of which remain unformalized in Dry's and Smith's work.

3. TAYLOR/DOWTY SEMANTICS FOR ASPECTUAL CLASSES

The semantics of aspectual classes used by Taylor and by myself rests on an essential innovation in tense logic first put forward by Bennett and Partee (1973). This is the idea that the recursive semantic clauses are to be stated in terms of the (primitive) notion of truth of a sentence with respect to an interval of time (rather than with respect to a moment of time, as in earlier treatments). In particular, the truth of a sentence with respect to a given interval I is independent of the truth of that same sentence with respect to subintervals of I, or moments within I, or with respect to superintervals of I. Thus to cite an example illustrating the utility of this idea, if it is true that John ran a mile in five minutes, say between 1:00 PM and 1:05 PM, we want to allow it to be false that he ran a mile in any subinterval of this time, say between 1:00 PM and 1:03 PM. Conversely, if a sentence is true of two consecutive intervals, it may yet

be false of the interval which is the union of these two intervals. So if John ran a mile between 1:00 and 1:05 PM and then, without pausing, ran a mile again between 1:05 PM and 1:10 PM, it need not follow that the sentence "John ran a mile" is true of the interval from 1:00 PM to 1:10 PM. However, sentences with different predicates will obey exactly the conditions which fail with respect to predicates like "run a mile", and it is just in conditions like these that predicates of one aspectual class differ from those of another in the Dowty/Taylor semantics. The defining criteria of three aspectual classes of predicates are given in (13):[1]

> (13)(a)　A sentence φ is stative iff it follows from the truth of φ at an interval I that φ is true at all subintervals of I. (e.g. if John was asleep from 1:00 until 2:00 PM, then he was asleep at all subintervals of this interval: *be asleep* is a stative).
>
> (b)　A sentence φ is an activity (or *energeia*) iff it follows from the truth of φ at an interval I that φ is true of all subintervals of I down to a certain limit in size (e.g. if John walked from 1:00 until 2:00 PM, then most subintervals of this time are times at which John walked; *walk* is an activity.)
>
> (c)　A sentence φ is an accomplishment/achievement (or *kinesis*) iff it follows from the truth of φ at an interval I that φ is false at all subintervals of I. (E.g. if John built a house in exactly the interval from September 1 until June 1, then it is false that he built a house in any subinterval of this interval: *build a house* is an accomplishment/achievement.)

Note that these criteria make no distinction between two of Vendler's classes, accomplishments versus achievements. This is deliberate. It is often suggested that accomplishments differ from achievements in that achievements are "punctual" in some sense, whereas accomplishments have duration: dying, an achievement, happens all at once, while building a house, an accomplishment, takes time. However, many events usually classed as achievements do in fact have some duration. A physicist may object that reaching the finish line, no matter how defined, has duration, and a physician may likewise view dying as a process with multiple stages happening in sequence.[2] It has also been observed that the test of occurring in the progressive, supposedly a test for distinguishing achievements from accomplishments, also gives inexact results, as it is often possible to put an achievement sentence in the progressive tense (*John was dying when the doctor arrived*). Rather, I think the distinction as Vendler and others must have intuitively understood it is something like the following: achievements are those kinesis predicates which are

not only typically of shorter duration than accomplishments, but also those for which we do not normally understand as entailing a sequence of sub-events, given our usual every-day criteria for identifying the events named by the predicate. Dying, or reaching the finish line, take place, according to every-day criteria, when one state – being alive or being not yet at the finish line – is recognized as being replaced by another: being dead, or being at the finish line, respectively. Recognizing an accomplishment, such as building a house or running a mile, can normally and usually involve recognizing distinct sub-events which may be necessary but not individually sufficient for the accomplishment itself – building the foundation for a house, raising the walls, adding the roof, for example. Thus achievements are "punctual" only in a sense akin to that in which events in a narrative are punctual in Kamp's theories: they are not interrupted by other events in the narrative. (This sense of punctual is a bit stronger than Kamp's actually, for an accomplishment may also be punctual in his sense simply in that it is not interrupted or overlapped by other events mentioned in the narrative in which it occurs: yet because of our knowledge of how events such as house-building normally transpire, we may infer the existence of temporally included subevents for accomplishments, whether mentioned in the narrative or not. But we do not do so, I suggest, in the case of achievements.)

The criteria in (13) actually give us tests for stative, activity or accomplishment/achievement *sentences*, not predicates. But the criteria for the predicates themselves are straightforwardly derivable from these: if a predicate when combined with enough definite NPs to form an atomic sentence (but without the addition of indefinite plurals, progressives, or aspectual adverbs) meets a certain one of these tests, then the lexical predicate itself is to be classed accordingly. This brings up the point of just what aspectual classes should be classifications of: are these classes of verbs, or verb phrases, or sentences (or possibly events or situations)? This is a question which has generated much confusion in the past. The claim which is thoroughly implicit in the treatments in Dowty (1979) (but which, unfortunately, may not have been made explicit enough), is that we must classify not only lexical predicates but also verb phrases and sentences by these tests. The aspectual class of a verb is of course a property of its lexical meaning (and must be described by meaning postulates or similar means). The aspectual class a phrase or sentence belongs to will thus be determined in a mechanical and completely explicit way by the lexical aspectual class of its main verb and the compositional semantic rules that have applied in combining the NPs adverbials, tenses and other constituents involved in the whole sentence.

This resulting class will often not be the same as that of the lexical verb. To cite a case which will be of importance later on, consider the progressive tense. The semantics for the progressive proposed by Taylor and myself is approximately (14):

(14)   [PROG φ](i.e. the progressive form of φ) is true at I iff there is an interval I' properly containing I such that φ is true at I'.

(I have argued elsewhere (Dowty, 1979) that (14) is not quite adequate for the English progressive; rather the progressive should be given a kind of modal interpretation involving some but not all possible histories containing I. However, this difference is irrelevant for topics I will discuss in this paper, and I ignore it here for simplicity.)

It now follows as a theorem from (13) and (14) that any sentence with a progressive tense, no matter what the aspectual class of its lexical verb, is a stative sentence. To see this, suppose that a sentence of the form PROG φ is true of interval I_1. Hence φ is true of some superinterval I' of I_1. Now consider some arbitrarily chosen subinterval of I_1. This subinterval of I_1 will also necessarily be a subinterval of I', hence PROG φ will be true of this subinterval as well. Because this conclusion holds of any subinterval of I_1 whatsoever, PROG φ has the criterial property of statives, property (13a). (It has been independently suggested that progressives ought to be considered statives, but as far as I know, no analysis has been given in which this is a consequence of the definitions of the progressive and stativity.)

It can similarly be shown that the negation of any atomic sentence will be a stative sentence, and given an appropriate semantics for modals, any atomic sentence plus a modal will be stative.

Thus to summarize this discussion, let us consider the question what aspectual class is to be found in example (15).

(15)   John was walking to the station.

The answer is, three classes: The lexical verb *walk* is an activity. The verb phrase *walk to the station* is an accomplishment, given the semantics for directional adverbials like *to the station* proposed in Dowty (1979), and the sentence as a whole is a stative because of its progressive tense.

It will of course be the aspectual class of the sentence as a whole (rather than any of its subconstituents) which is relevant to the temporal effect on discourse interpretation.

While this analysis of aspect seems to serve us fairly well, taking the notion of the truth of a sentence with respect to an interval of time as primitive (or, in possible world semantics, truth with respect to an index

consisting of a possible world and an interval of time), it has been proposed by Kamp (1979) that we should instead take events as primitive, with orderings of precedence and overlap defined upon these, and then derive the definitions of interval and moment from events. It has also been proposed in situation semantics that we eschew the notion of possible world in favor of situations and situation types (Barwise and Perry, 1983; Cooper, 1982). I am not at all unsympathetic to either of these two proposals, but I would merely point out here that if either or both of these proposals were adopted, it would still be possible, as far as I can tell, to reconstruct the definitions of aspectual classes in (13) in these new frameworks; indeed, I conjecture it will be necessary to do so to properly capture the semantics of verbs, aspectual adverbs and the progressive tense. For example, if we took events as primitives, then we should require that any "event" satisfying a stative sentence must have temporally located within it another located situation type satisfying this same sentence, and so on. I will also assume, without discussion, that the principles for discourse interpretation I will present shortly will also carry over to these new frameworks.

4. THE TEMPORAL DISCOURSE INTERPRETATION PRINCIPLE (TDIP)

I am now ready to introduce the primary principle for interpreting successive sentences in a discourse temporally, the *temporal discourse interpretation principle* (TDIP), (16):

(16)   Given a sequence of sentences $S_1, S_2, \ldots, S_n$ to be interpreted as a narrative discourse, the reference time of each sentence S_i (for i such that $1 < i \leq n$) is interpreted to be:
(a) a time consistent with the definite time adverbials in S_i, if there are any;
(b) otherwise, a time which immediately follows the reference time of the previous sentence S_{i-1}.

Several features of (16) require comment. The term "reference time" here is an allusion to Reichenbach (1947), i.e. in a simple past tense sentence, this is the time at which the event or state mentioned by the sentence occurred (or obtains, respectively), not the time at which the sentence is heard or read by the hearer, which I will rather refer to as the speech time. The semantic theory for the interpretation of tense I have in mind here (though it is not the only one consistent with my approach to discourse time reference) is one I have proposed in various forms in

earlier papers (Dowty, 1982, ms.): a theory in which both reference time and speech time are contextual parameters of the utterance. Treating reference time as a contextual parameter enables one to account for examples like Partee's example "I didn't turn off the stove" (Partee, 1973) and similar examples. (See also Nerbonne's paper in this volume for a more elaborate development of this idea.) Specifically, I have in mind that the recursive clauses for sentences are stated relative to a pair of times $\langle i, j \rangle$ in which the first time i is a reference time, the second time j is the speech time. The semantic clauses for the tenses past, present and future require that a certain relation obtains between reference and speech time – that the former is earlier than, the same as, or later than the latter, respectively. The semantic clauses for the perfect, progressive, and for aspectual adverbials, on the other hand, do not mention the speech time j but relate to the reference time i to another reference time i' which bears some specified relation to i. For example, we have already seen in (14) how the progressive asserts that the reference time i is properly contained within the interval i' at which the atomic non-progressive sentence is true. Definite time adverbials locate the reference time i at a particular time or date. For those who have not seen this two-dimensional approach to the semantics of tense before and find it puzzling, there is no need to go into greater detail for our present purposes: I believe the intuitive, quasi-Reichenbachian notion of "reference time" is all that is required to understand how the TDIP will work.

Secondly, the clause (16a) is necessary for the TDIP to be compatible with successive sentences in which the second has a definite adverbial such as one mentioning a clock time or calendar date. (17) is such an example, and the TDIP instructs us in this case to choose a reference time that can be satisfied at by the adverbial "at two PM".

(17)   John arrived at 10 AM. He departed again at 2 PM.

(16a) is probably to be subsumed under a more general principle for interpreting indexical expressions, namely "choose values for indexical expressions that allow the sentence to be true wherever possible" (cf. the parallel case of the value of the indexical *I* in *I am John Smith*).

5. THE TDIP AND ACCOMPLISHMENTS/ACHIEVEMENTS

Consider now how clause (16b) will come into play with successive accomplishment/achievement sentences having no time adverbial, such as (18), the same as an earlier example.

(18)   John entered the president's office. The president walked over
        to him.

The TDIP in this case tells us to put the reference time of the second
sentence, the time of the president's walking over to John, immediately
after that of the first sentence. (As I will explain in a moment, the
non-overlap between the two is correctly predicted.) The phrase "im-
mediately after" in (16b) is of course vague, but deliberately so. The
reason is that the closeness of the reference time of S_i to that of S_{i-1} at
any point in a discourse is only determined by the hearer's understanding
of the nature of events being described in the narrative, the overall
degree of detail in which events are being described, and common
knowledge about the usual temporal relationships among events. In (18),
the elapsed time between the two reference times is naturally taken to be
only a few seconds or minutes. But in the narrative in (19), the times
elapsing between the first and second, and between the second and third
will be taken to be a matter of days, weeks, or perhaps even longer.

(19)   John moved to Boston in July. He took a job in a steel mill.
        His boss became a close friend of his.

The point is that in both cases the reference times "immediately" follow
one another in the sense that each successive sentence presents the very
next event that transpires that is important enough to merit the speaker's
describing it to the hearer, given the purpose of the narration. In Kamp's
terms (Kamp, 1979), the successive events are "punctual" in the sense
that no event of crucial importance to the narrative overlaps with the two
successive events or intervenes temporally between them.

I should also add at this point that the TDIP will be compatible with
the way past perfect sentences are interpreted when they are interspersed
in a narrative in the simple past. A past perfect following a simple past
superficially appears to be in violation of the TDIP, in that the event
described in the past perfect is understood to have taken place before,
not after, the event of the previous sentence. (20) illustrates this:

(20)   John hurried to Mary's house after work. But Mary had
        already left for dinner.

But this situation will be in accord with the TDIP if we give the past
perfect a semantics that places the event of its clause at a time i' before
the reference time i. Thus if the reference time of the first sentence in
(20) is i_1, the reference time for the second sentence will be a later time
i_2; but the past perfect specifies that Mary's leaving takes place at a time
i' earlier than i_2 (and therefore possibly earlier than i_1 as well).

(21)   ├─┤──────├─┤├─┤─→
    i' i_1 i_2

To be sure, nothing in the semantics of the past perfect or in the TDIP will exclude the possibility that i' here is simultaneous with i_1, but I believe this possibility is ruled out by Gricean principles: Since the language has independent and unambiguous means for expressing simultaneity of events (for example *when*-clauses, or the locution *at the same time as*), the past perfect is conversationally implicated to exclude this possibility. This kind of semantics for the past perfect itself can be independently motivated on various grounds – for example, handling the semantics of sentences such as "Mary had left when John arrived" – but I will not take the time to discuss this motivation here.

In connection with the TDIP, not finally that this principle makes no mention of differences in aspectual class, and will therefore treat statives just the same as accomplishments and achievements in locating their reference times. But it is a central thesis of this paper that the inferences we draw in a narrative about which events or states overlap with others in the narrative is not really a consequence of the times sentences are *asserted* to be true, but rather also in part a consequence of the times at which we *assume* that states or events actually obtain or transpire in the real world, intervals of time which may in some cases be greater than the intervals of time for which they are simply asserted.

6. THE TDIP AND STATIVES

Before considering statives, let us look at accomplishments/achievements once more. The defining criterion (13c) for accomplishments/achievements states that if an accomplishment/achievement sentence is true at an interval I, then it is false at all subintervals of I. It also turns out that this criterion entails that if such a sentence is true at I, then it is false at all superintervals of I as well. To see this, let it be given that an accomplishment φ is true at I. Suppose that φ were also true of some superinterval of I, I'. But this would in turn violate the condition that if an accomplishment φ is true of any interval – in particular I' – then it must be false for all subintervals of I', and therefore false of I itself, which contradicts the assumption. Given this result, we can now see why the TDIP requires that if two accomplishment/achievement sentences occur successively in a discourse, they are not only asserted to be true at successive but non-overlapping intervals, there cannot even be overlapping intervals at which the two are true which are *not* explicitly asserted.[3]

The case of statives and activities is significantly different in this

respect. If a stative sentence is asserted to be true at an interval I, then the criterion (13a) does nothing to exclude the possibility that it is actually true for larger intervals that properly include I. This is as it should be, for (22) is a perfectly normal assertion.

(22)   Yes, John was asleep between 1:00 PM and 2:00 PM; in fact, he fell asleep at noon and did not wake up until 3:00.

By contrast, (23) is anomalous, as *build a house* is an accomplishment.

(23)   Yes, Mary built that house between July 1 and December 1: in fact, she began building it in June and did not finish it until January.

Indeed, I propose that for many stative predicates in many discourse contexts, when the stative is asserted to obtain at a certain point in a discourse, the *normal* assumption the hearer makes is that the stative began to obtain in advance of this point, perhaps well in advance of it. So in the discourse (24),

(24)   Mary entered the president's office. There was a bound copy of the president's budget on his desk.

I argue that the TDIP actually tells us that the time of the budget's being on the president's desk was immediately after Mary entered the room, but that we are expected to assume in addition that this was not the first moment that it was there: it was no doubt there before Mary's entry. Similarly, if two or more stative sentences follow an accomplishment as in (25),

(25)   Mary entered the president's office. A copy of the budget was on the president's desk. The president's financial advisor stood beside it. The president sat regarding both admiringly. The advisor spoke.

we not only assume that the second and third states began to obtain before Mary's entry, but that all three states continued beyond the asserted time and into the time of the accomplishment that ends the passage, *The advisor spoke*. Again, all these possibilities are consistent with the TDIP claim that the states are asserted to obtain in sequence.

Of course, we do not perceive that time "moves" in this narrative in the three middle sentences, but I do not find this disturbing. We have already seen in earlier examples like (19) and (20) that the duration which the hearer assigns to successive reference times in a discourse, and to the intervals between these reference times, depends on assumptions

about the normal real-world duration and spacing of events of a given type. In the case of statives, the minimum duration can be arbitrarily small, so there would be no reason not to assign very brief and closely-spaced reference times to stative sentences in a context like (25), given that we are assuming the actual times for which these states obtained were much longer than these reference times.

In fact, if there is any sense in which we assign a non-trivial duration to such stative reference times, I suggest that it is the following. In reading a narrative such as (25), we are invited to interpret such "scene-describing" statives as if they were the perceptual observations that a hypothetical human observer would make in the situation described, either the narrator or the protagonist from whose point of view the narrative is constructed. We as readers vicariously re-live these perceptual events. Thus we may take the duration of these stative reference times to be the time it would take a human observer to perceive these facts about the scene, and I believe the writer may even suggest that the order in which pragmatically overlapping statives are recorded in the discourse is the order in which the hypothetical observer notices them.

Now as I have mentioned earlier, there are also occurrences of statives in a discourse where the state is *not* interpreted to overlap with the previously described event; in this case, the stative sentence does "move" narrative time forward. Consider (26), a repetition of an earlier example.

(26)   John went over the day's perplexing events once more in his mind. Suddenly, he was fast asleep.

The thing to notice about the definition of statives in (13a) is that while this *allows* a state to begin earlier than its asserted reference time, it does not *require* it to be so. An adverb like *suddenly* will cancel the pragmatic inference that the state obtained earlier, for obvious reasons. This combination of the assertion of the state at the reference time with the inference that it did not obtain before this reference time constitutes a change of state, i.e. an inceptive interpretation for the stative. This inceptive interpretation is an event happening at a particular time, and thus we infer that narrative time "moves" here. But note that it is not at all necessary to regard the stative in this second sentence in (26) as lexically ambiguous between stative and inceptive interpretations. The inceptive reading arises purely from the ordinary stative reading of *be asleep* plus the semantics of *suddenly* and the resulting implicature that the state did not obtain earlier. (Certain stative predicates, such as *sit*, *stand*, and *lie*, admit the inceptive interpretation much more frequently

and readily than other statives, and perhaps we should regard them as truly ambiguous between stative and inceptive readings. But this is not an issue which need be resolved here.)

An adverb like *suddenly* is not always necessary to produce the inceptive interpretation of a stative in a discourse. Sometimes the entailments of the stative sentence together with the entailments of the previous sentence lead us to conclude that the state has newly come about. So in (27), an example cited by Dry,

> (27)   Away in front, the engine whistled. Trees, hills and road, slid sideways and were gone (from *A Wrinkle in Time*, by Madeleine L'Engle, cited by Dry 1978).

the state "were gone" in the last conjunct is inconsistent with the previous conjunct "trees, hills and road slid sideways", for in order for the narrator to perceive these objects sliding sideways, they must have been in view and therefore not yet "gone" in the intended sense of "out of view". Hence a kind of inceptive interpretation arises for the last conjunct. In (28) and (29), also examples cited by Dry from the same text, it is natural to infer a causal relation between the event in the first sentence and the coming about of the state mentioned in the second. Hence the state is a new one in the second sentence, and time accordingly "moves forward" in the second sentence:

> (28)   This time she was pushed out of the frightening fifth dimension with a sudden immediate jerk. There she was, herself again, standing with Calvin beside her. (cited by Dry)

> (29)   Then she was enfolded in the great wings of Mrs. Whatsit, and she felt comfort and strength. (cited by Dry)

Now since I have attached a good deal of significance to the principle that statives are often assumed to obtain before and after their asserted reference time except when there are pragmatic reasons to infer the contrary, I think it is important to ask whether there is independent motivation for such a principle. Indeed, there is. In discussing the analysis of change of state predicates in artificial intelligence processing of discourse, Drew McDermott and others have pointed out that a processor must make this kind of assumption even for sentences widely separated in a discourse. Suppose a discourse, like that in (30), includes at an early stage the sentence *the book is on the table*.

> (30)   ... The book was on the table at t_0 ... Mary removed the book from the table at t_n.

The later sentence *Mary removed the book from the table* should be interpreted as having its presupposition satisfied, i.e. the presupposition of *remove* to the effect that the book must have been on the table at the time the act of removing it began. This will be the case no matter how many sentences intervene in the discourse represented by the second ellipsis, as long as no change in the location of the book has been mentioned. If on the other hand we alter the discourse to the form in (31),

(31)   ?... The book was on the table at t_0 ... Mary put the book on the table at t_n.

still assuming that the position of the book is not mentioned in the intervening discourse, and interpreting the NP *the book* to refer to the same object in both cases, then the discourse is abnormal (and requires unusual assumptions about either the narrator of the discourse or forces which might affect the position of the book), because the presupposition of *put on the table* is that the object is not on the table at the beginning of the putting. It is apparently a conversational assumption in discourses that inanimate objects like books, which do not move under their own power, shall be assumed by the hearer to remain in the positions or other states ascribed to them, unless and until the narrator asserts otherwise. This kind of extremely common-sensical reasoning is one that seems trivial to us and hardly worth mentioning – until of course we attempt to program a computer to understand a discourse!

This principle of "inertia" in the interpretation of statives in discourse applies to many kinds of statives but of course not to all of them. For obvious reasons, a stative sentence like (32)

(32)   The runner is at the finish line.

is not likely to generate any implicatures that the state extends earlier or later than the reference time in the context of a discourse, and in fact there must be a graded hierarchy of the likelihood that various statives will have this kind of implicature, depending on the nature of the state, the agent, and our knowledge of which states are long-lasting and which decay or reappear rapidly. Clearly, an enormous amount of real-world knowledge and expectation must be built into any system which mimics the understanding that humans bring to the temporal interpretations of statives in discourse, so no simple non-pragmatic theory of discourse interpretation is going to handle them very effectively.

7. THE TDIP AND ACTIVITIES

The definition for activities in (13b) is like that for statives in that it permits but does not require that an activity asserted to take place at interval I could perfectly well have begun before I or continued beyond I. So just as with statives, the question of overlap with surrounding sentences is determined by expectations as to which activities are likely to continue for a long time and which are not, as well as whether the surrounding discourse itself gives reason to believe that the asserted time of activity is the first or last interval for which it actually took place. At the one extreme are examples like (33), an example mentioned earlier, in which the clock's ticking is the kind of activity likely to have gone on before and after the asserted time and in which the discourse gives no indications to the contrary.

(33)   John entered the president's office. The clock ticked loudly.

By contrast, the activity *Look out the window* in (34), an example of Dry's, is understood to begin at its asserted reference time, hence not overlap with the previous sentence, because one infers a causal relation between the event of the previous sentence and the activity.

(34)   John asked where the children were. Mary looked anxiously out the window. Their coats lay on the lawn, but they were not in sight. (Dry)

But even in this case, the activity of looking overlaps with the following sentence, because this last sentence reports states perceived by Mary as a consequence of the activity of looking and simultaneous with the looking.

8. THE TDIP AND PROGRESSIVES

Next I turn to the interpretation of progressive sentences in a discourse. I have already mentioned that progressives, like statives, allow the events they describe to overlap with those of the surrounding discourse, as for example in the middle sentence in (35).

(35)   John entered the president's office. The president was writing a letter. The president's advisor signaled to John to take a chair.

But the explanation for this is somewhat different from the case of statives. The semantic clause (14) for the progressive tense asserts that the reference time of a progressive sentence falls within a larger interval

over which the verb's action extends, and this larger interval may overlap
with events described by the surrounding discourse, even though the
reference time of the progressive sentence is disjoint from preceeding
and following ones. The normal interpretation of a case like (35), I would
argue, is that diagrammed in (35'), where I_2 is the reference time

(35')
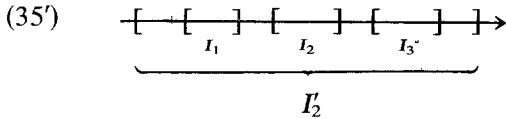
of the middle sentence but I_2' is the interval over which the letter was
written. Unlike the stative case, the larger, overlapping interval is here
explicitly asserted, not just pragmatically inferred.

As I also pointed out earlier, progressives differ from statives in that
the possibility of an inceptive interpretation is extremely remote with
progressives, and thus the overlapping interpretation with surrounding
discourse is highly consistent with progressives. To see an explanation for
these facts, we must examine the interaction of the progressive with the
TDIP in more detail. Note first that (14) does not really rule out the
possibility that the reference time I might be an initial subinterval of the
larger interval I' for which the atomic sentence is true. If this were
allowed, an inceptive interpretation for a progressive ought to be pos-
sible. In fact, progressives are not normally used this way. Upon hearing
(36), for example, one does not think of the possibility that 2 PM might
be

(36)   John was writing a letter at 2 PM.

the first moment, or the last moment, of letter writing, but rather that it is
somewhere in the middle of the event. We could if desired account for
this fact directly by modifying the semantic clause for the progressive to
stipulate that the reference time I is neither an initial nor a final
subinterval of the atomic clause interval. But it is also possible that this
added condition is simply a conversational implicature – one that arises
for this reason: if the speaker knows that the reference time he would
indicate with a progressive sentence is in fact the initial or final interval
of the activity, there exist more explicit means in the language for
indicating this, such as saying "John began to write a letter at 2 PM" or
"John finished writing a letter at 2 PM", etc. By the Maxim of Quantity,
the speaker should use the more explicit expression in this case. We can
try to test the status of this added condition in a familiar way: Suppose
that I bet you $5 that John will be writing a letter at 2 PM. At 1:59, he

still has not started to write, but at precisely 2 PM he begins the letter. Have I won my bet? If so, this is an indication that the added condition is conversational. Now the status of this added condition may remain unclear, but it is not really necessary to resolve the issue here. Either way, there is clearly a preference for not using the progressive to indicate the initial subinterval of the verb's event.

But another possibility to worry about arises when we remember that the interpretation of "immediately after" in the TDIP might leave a gap between the reference time of the sentence preceding the progressive and the reference time of the progressive itself: Suppose S_2 is a progressive and I_2 its reference time:

$$
\begin{array}{ccc}
S_1 & & S_2 \\
\vdash\!\!\dashv & & \vdash\!\!\dashv \\
I_1 & & I_2 \\
& & I'
\end{array}
$$
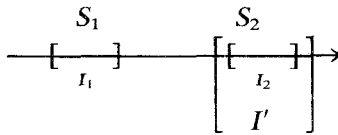
Even though this reference time is prohibited from being an initial subinterval of the time for the atomic clause of the progressive, I', I' might fail to overlap with the reference time of the preceding sentence, as in this diagram. The reason why this possibility might be excluded is a bit indirect, but would go something like this: As already mentioned, the intent of the phrase "immediately after" in the TDIP is that the reference time of the sentence S_i is to be the very next event or state (or narrator's perception of a state) of significance to the narrative. But the assumption that the time of the atomic sentence's truth, I', begins between I_1 and I_2 would violate the "immediately after" condition, since a potentially relevant event, the beginning of the activity or event denoted by the verb of the progressive sentence, would take place within this gap.

The possibility that this reasoning or something like it might be correct receives additional support, I believe, from the nature of the rare and exceptional examples in which this diagrammed temporal interpretation does arise. As far as I am aware, these exceptional examples are all similar to (37) and (38).

(37)   In the darkness, John felt his way up the stairway of the dilapidated old house. Halfway up, there was a loud cracking noise under his feet, and suddenly he was falling through space.

(38)   The president began the interview in a coldly official manner, much as Mary had expected. But the next thing she knew, the president was offering her the ambassador post.

These cases indicate a very particular psychological effect on the pro-
tagonist of the narrative: an event begins to happen, but it is only after it
is already in progress that the protagonist realizes what is going on. This
is made especially clear by the phrase *the next thing she knew* in (38), a
phrase which seems to support this quasi-inceptive interpretation of the
progressive better than any other. If as I suggested earlier the succession
of reference times in a narrative can be exploited by the author to
indicate the succession of perceptions of events and states by the person
from whose point of view the narrative is constructed, then this quasi-
inceptive interpretation of the progressive does not really violate the
condition that the new reference time is the next significant event in the
narrative. Rather, it indicates that the *perception* of this event already in
progress is the next salient event in the consciousness of the protagonist.

By contrast, it seems very hard to get a felicitous inceptive reading of a
progressive where this psychological effect cannot be inferred. Suppose
we take the narrative in (39),

(39)   John dropped the letter from the bridge and watched it hit the
         swiftly flowing water. The water carried the letter downstream
         and out of sight.

and change the second sentence to a progressive;

(40)   ?John dropped the letter from the bridge and watched it hit the
         swiftly flowing water. (Suddenly/the next thing he knew), the
         water was carrying the letter downstream and out of sight.

Even with the insertion of *suddenly* or *the next thing he knew* into the
second sentence, the narrative is rather strange. At best, we have to try
to infer an unexplained momentary lapse of consciousness on John's part
(or on the narrator's part); the "surprise effect" cannot be attributed to
the letter since it is inanimate.

This section can be summarized as establishing that although progres-
sives are like statives in certain respects according to this analysis (e.g.
they both typically allow overlap with the previous sentence), it does
seem to be consistent with this analysis that they are quite different in the
way they allow an inceptive reading in the narrative.

9. SOME REMAINING MODIFICATIONS TO THE TDIP

Before concluding, I turn to some further modifications that need to be
made in this method of handling temporal discourse interpretation and
some further possible applications of it.

First, I have not discussed how sentences expressing iterative, or habitual, aspect are temporally ordered in a discourse. Dry (1983) has considered these, and has observed that iterative sentences behave like statives in that they are usually understood to overlap with the events of surrounding sentences in a discourse. Though I do not have at this point an explicit formal analysis of iterative aspect to propose (but cf. Vlach, ms.), it seems fairly obvious that any such analysis should give iteratives the subinterval property of statives, i.e. (13a). For example, if it is true at interval I that John smokes a pipe, in the iterative or habitual sense (i.e. John is a pipe smoker), then it surely should follow that "John smokes a pipe" is true in this same iterative sense at any subinterval of I (though of course he need not be actually smoking a pipe in the non-iterative, activity sense of "smoke a pipe" at any of these subintervals).

Secondly, the reader may have noticed that I have sometimes included examples of discourse ordering effects not just between independent main clauses of sentences, but also between conjuncts connected by *and*. Indeed, it seems that exactly the same sort of ordering principles apply whether we are dealing with successive main clauses or successive conjuncts with *and*, no matter what the syntactic category of these conjuncts, as long as they contain a verb. I am assuming that the semantics for natural language *and* is like that suggested by Cresswell (1977), approximately that in (41):

(41) $[\varphi \text{ AND } \psi]$ is true at i iff there are subintervals I' and I'' of I such that (a) φ is true at I', (b) ψ is true at I'', and (c) there is no subinterval of I that contains both I' and I''.

In other words, $[\varphi \text{ AND } \psi]$ is true of the smallest interval that contains times at which φ and ψ are true, but the semantics for AND itself does not specify what the relation is between these two times: φ and ψ might be true at the same time, at partially overlapping times, or at disjoint times. There seem to be two ways in which we could collapse the ordering of conjuncts with that of independent sentences. We could modify the definition of "reference time of a sentence" so that sentences with conjuncts connected by *and* have as many reference times as there are conjuncts. Or else we could leave the notion of "reference time of a sentence" as it is and try to generalize the TDIP so that it orders not only reference times proper but potentially any two times referred to in a sentence which are not explicitly ordered via time adverbials. One reason for preferring the latter is Hinrichs' (1981) observation that within passages of discourse entirely in the past perfect, the events mentioned are often ordered in accord with their aspectual classes in the same way

that events in simple past clauses are. Since we want to be able to distinguish the true "reference time" of a past perfect from the time that its verb is true (or as Reichenbach would say, its "event time"), this is motivation for keeping the notion of "reference time" as it is. Under either method, many details remain to be worked out.

Thirdly, there are still a few exceptional examples of sentences with accomplishments/achievements which do not obey the TDIP as it stands. One of these, a case noted by Dry (1983) is where the second sentence in a discourse describes what is interpreted as the very same event as that described by the first sentence, but under a more detailed description, for example (42).

> (42)   John knelt at the edge of the stream and washed his face and
>   hands. He washed slowly, feeling the welcome sensation of the
>   icy water on his parched skin.

Since the event is the same, the reference time is also understood to be the same in the two sentences, even though both contain accomplishments.

Another, perhaps related exception arises when the discourse clearly implies that although events mentioned are distinct, they happen simultaneously. Consider the second and following sentences in (43).

> (43)   At the signal, everyone went to work at once. Mary searched
>   the room for any of the items on the list that might be there.
>   John went next door to do the same in Bill's apartment. Susan
>   organized the rest of the players to canvass the block.

Kamp (ms.) has observed yet another kind of exceptional case: one in which a certain sentence is followed by a sequence of sentences each describing a "subevent" of the event mentioned in the first sentence, e.g. "Pedro dined at Madame Gilbert's. First there was an hors d'oeuvre. Then the fish. After that the butler brought a glazed chicken. The repast ended with a flaming dessert . . ."

It seems, therefore, that the TDIP must be modified to allow that if the discourse itself conveys some implication as to how events are to be specifically ordered, this should take priority over the third part of the rule that orders reference times successively. In other words, this third part is the "default case" to be followed when neither time adverbials nor entailments and implicatures of the discourse itself give clues to the ordering of events. (At this point, in fact, one is entitled to ask whether the TDIP is to be regarded as an independent principle of discourse interpretation per se, or merely as a description of the typical outcome of

the interaction of various conversational principles and the speakers'/ hearers' knowledge of typical events and typical goals of narratives, any one clause of which may be overridden in various ways in exceptional cases. But this is not a question which can be profitably addressed here.)

A further application of this method of discourse interpretation is in adverbial subordinate clauses, such as those introduced by *when, while, before,* and *after*: Heinämäkki (1974), Smith (1978), Stump (1981) and especially Dry (1983) have called attention to the fact that the aspectual classes of verbs in these clauses, and also the aspectual classes of the verbs in the main clauses which these adverbials modify, have an effect on just what temporal relationship is conveyed by these connectives.

10. CONCLUSION

I believe that the main points of this paper are as follows. First, I have proposed that it is not really necessary for discourse construal rules of English to make reference to the aspectual class of lexical verbs directly nor to the progressive/non-progressive distinction. This is because semantic properties needed to explain these different effects on discourse are exactly those we would need to ascribe to the various aspectual classes independently in order to do lexical semantics and sentence-level compositional semantics. This "explanation" of discourse ordering of course has relied to a considerable degree upon pragmatics, but the pragmatic principles appealed to also seem to be those we would have to invoke anyway, such as the principle that a stative mentioned in a discourse should often be assumed to remain in effect long after it is explicitly mentioned and should likewise often be assumed to be in effect *before* it is explicitly mentioned.

A key thesis in this explanation therefore has been the assumption that we do not understand the perceived temporal ordering of discourse simply by virtue of the times that the discourse *asserts* events to occur or states to obtain, but rather also in terms of the additional larger intervals where we sometimes *assume* them to occur and obtain.

I conclude, therefore, that Kamp's conception of a discourse representation does not really seem to be motivated by the need to specify overlap versus non-overlap of successively described events in a discourse in English. Of course, there may be other sufficient motivation for the theory of discourse representations, such as pronominal reference, the conception of discourse representation as a psychological or computational representation of discourse meaning, or perhaps temporal discourse phenomena in French (though even here, I think one should

first try to see whether the method I have proposed for English could be extended to French as well: the overlapping character of the French imparfait might fall out automatically, for example, if this tense were given a semantics akin to that of the progressive in English).

In fact, the considerations brought forth in this paper constitute obstacles for the theory of temporal discourse representations. If the aspectual class of sentences is determined by its compositional semantic interpretation and not its syntactic form,[4] then, given that aspectual class affects discourse ordering, discourse ordering must depend upon interpretation of individual sentences, not conversely. And since pragmatic inferences play a role in determining the ordering of events conveyed by a discourse, then, given that these inferences cannot be drawn without the hearer's having grasped the meanings of sentences to some extent, construction of implicature as well as literal semantic interpretation is needed for discourse ordering.

NOTES

[1] These criteria are adapted, with some changes, from Taylor (1977, pp. 206–209, 215) and Dowty (1979). In particular, Taylor gives more complicated versions of (13b) and (13c), so he should not be held responsible for any inadequacies of my formulations here, which are however adequate for purposes of this paper.

[2] See also Kamp (1979a) for a sophisticated formulation of the notion of becoming, according to which it does not transpire at a moment.

[3] This is not quite literally true. Since I have mentioned that there can in fact be a gap in time between the two "successive" reference time intervals in view of the TDIP, it is actually possible that the accomplishment mentioned by the second sentence was true another time at an interval lying partly in this gap which did not overlap with the reference time for the second sentence but which did overlap with that of the first sentence. The criterion for accomplishments/achievements, after all, does not exclude the possibility that a sentence of this class is true for two non-overlapping intervals. However, I believe we can ignore this possibility because this other, earlier occurrence of the accomplishment/achievement would be an event independent of the actually asserted event and also one that did not count among the events or states directly related to what the narrative describes.

[4] In connection with (1), Kamp has suggested (personal communication) that construction of discourse representation structures should not be strictly 'top down' (in the sense that what is to be done with a sentence in constructing a representation depends not only on its top node but also on properties of various other syntactic nodes within it) and that semantics, likewise, should not be strictly compositional in the received sense. However, it seems to me that the issues raised in this paper pertain not to the question of compositionality per se, but rather whether only syntactic information, or also semantic

information, is the input to discourse construction rules, no matter whether the information is derived compositionally (in either case) or not.

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Department of Linguistics
Ohio State University
Columbus, Ohio 43210, U.S.A.