DEIXIS IN NARRATIVE
A Cognitive Science Perspective

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CHAPTER

7

TIME IN NARRATIVES

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INTRODUCTION

Narratives are a type of discourse used to describe sequences of events. Standard examples of narratives are novels, short stories, biographies, and histories. Narratives can be contrasted with other discourse types, such as lyric poetry and expository prose, in which the temporal element is not so central. Because of the nature of narratives, one of the most important tasks for understanding them is determining the temporal relations that exist among the events described in the narrative. These events and their temporal relations constitute what is called the *story* of the narrative.

In this chapter, we concentrate on the study of issues involved in understanding the temporal structure of narratives. These issues are of two major types. The first type has to do with representational questions; here we address the problem of how to represent a story. The second type has to do with processing questions; here we address the problem of how a reader extracts the story from a narrative. Central to our approach is a representation of the present moment within the story, called the *narrative now-point*. Much of the analysis of how different event-types, tenses, aspects, and time adverbials function within a narrative concerns their interaction with, and effect on, this now-point.

THE ONTOLOGY AND BASIC REPRESENTATIONS

In this and the next few sections, we describe our basic representational approach and its underlying ontology. The representations described are implemented as semantic networks in the SNePS Semantic Network Processing System (Shapiro,

1979). A more complete account of our implementation of the representations and processes described in this article can be found in Almeida (1987).

Following Davidson (1967), we make a distinction in our representations between *propositions* and *events*. Propositions are the bearers of truth values; that is, a proposition is the sort of thing that may be true or false. Propositions can be the objects of verbs such as *know* and *believe*. Events, on the other hand, are spatio-temporal entities much like ordinary physical objects. They can be the objects of perceptual verbs such as *see* and *hear*, and they can be the subjects of verbs like *last* and *occur*. Events are often referred to with what Chomsky calls *derived nominals* (Chomsky, 1970), e.g., *explosion, eruption.*

The relationship between the proposition and the event it describes is essentially that of Davidson (1967). For example, Davidson gave as the representation for the sentence *Shem kicked Shaun*: (∃x)(Kicked (Shem,Shaun,x)), where, x is an event "such that x is a kicking of Shaun by Shem" (p. 118). As Davidson puts it, "The basic idea is that verbs of action—verbs that say 'what someone did'—should be construed as containing a place, for singular terms or variables, that they do not appear to. For example, we would normally suppose that 'Shem kicked Shaun' consists in two names and a two-place predicate. I suggest, though, that we think of 'kicked' as a *three-place* predicate" (p. 118). This third argument is the event.

Finally, we view predicates as corresponding to core verb phrases rather than simply to verbs. Thus, in the (tenseless) proposition *Mary play the piano*, the predicate is *play the piano* with argument *Mary*. This analysis is opposed to one in which *play* is considered the predicate with arguments *Mary* and *the piano*. According to Schachter (1976), gerundive nominals without an initial possessive are class names, naming types of activities, types of conditions, and so on. Thus, *going to the beach* is a type of activity, and *being sick* is a type of condition or state. It is these types of activities, and types of conditions, that are taken as predicates in our system. The class of predicates can be divided into two major subclasses: stative predicates, called *properties*, and nonstative predicates, called *acts*. These predicate classes are discussed in more detail in a later section.

The basic case frame for the representation of a nonstative proposition and the event it describes is shown in Fig. 7.1. In this figure, node 1 represents the proposition, node 2 represents the argument of the predicate, which is called the

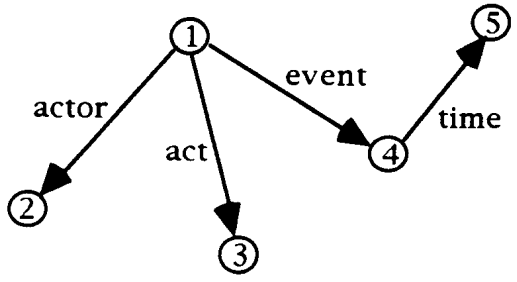


FIG. 7.1. Basic case frame for nonstative propositions.

actor, node 3 represents the predicate (in this case, an act), node 4 represents the event described by the proposition, and node 5 represents the interval of time occupied by the event. This case frame is intended to be neutral between agentive and nonagentive events. In the current representation, an event is a structured individual that (so far) consists only of a time property. This is not to suggest that this representation of events is complete. There are other components to this concept, such as a location.

The case frame for stative propositions is similar to that for nonstative propositions, except that the argument of the predicate is called an *object* and the predicate itself is called a *property*. We differ from Davidson in associating events with stative propositions as well as with nonstative propositions. As partial justification for this move, we suggest that in sentences such as *John saw a cat on the porch*, what John sees is not simply some object, but a configuration of objects—that is, a state. If such states can be seen, then they are events in our sense of the term. In addition, this move makes the overall representation and interpretation of time more uniform.

THE TEMPORAL LOGIC

The ontology of time used in this project is that developed by Allen (1981, 1984); that is, a purely interval-based approach to the representation of time. Largely because of technical differences between the way that arc labels in Allen's network system work and the way that arcs in SNePS work, we take a different approach to the representation of temporal relations. Instead of defining the basic relations as mutually exclusive, as Allen did, and then disjoining them to produce ambiguous relations, we define the basic temporal relations as ambiguous in the first place, and then, when necessary, use negation for disambiguation. We use the following temporal relations: (a) The *before/after* case frame means that the interval pointed at by the *before* arc is temporally before the interval pointed at by the *after* arc. This relation is ambiguous between Allen's *before* and *meets* relations; that is, we allow the possibility that the distance between the two intervals is zero. Notice that this case frame also represents the related inverse relation. This is true of our other relations as well. (b) The *before/after/duration* case frame means that the interval pointed at by *before* is temporally before the interval pointed at by *after* by the amount of time pointed at by *duration*. When the duration is zero, this relation is equivalent to Allen's *meets* relation. (c) The *subinterval/supinterval* case frame means that the first interval is a subinterval of the second interval. This relation is ambiguous between Allen's *during*, *starts*, *finishes*, and *equal* relations; that is, the first interval need not be a proper subinterval of the second. (d) The *initial-subinterval/supinterval* case frame is ambiguous between Allen's *starts* and *equal* relations. Again, the first interval need not be a proper subinterval of the second. (e) The *final-subinterval/supinterval* case frame is ambiguous between Allen's *finishes* and *equal* relations. (f) The *equiv/equiv* case frame is the same as Allen's *equal* relation.

PREDICATE TYPES AND EVENT TYPES

In *Verbs and Time* (Vendler, 1957), Vendler developed a classification scheme for verbs based on what he called their *time schemata*. The notions that make up these time schemata are such things as whether or not a verb can occur in the progressive, whether or not the truth of a sentence using the progressive of some verb implies the truth of the same sentence using the simple form of that verb, co-occurrence restrictions of verbs with various time adverbials, and so on. Actually, although Vendler used the word *verb* exclusively, it seems clear that he really meant verb phrases or predicates in our sense, because many of his examples were not single verbs at all, but entire verb phrases.

The four classes of predicates that Vendler posited are called *activities, accomplishments, achievements*, and *states*. This classification scheme and related schemes were discussed and elaborated upon by many other researchers in various fields, among them Bennett and Partee (1972), Comrie (1976), Dowty (1977, 1979), Mourelatos (1981), Verkuyl (1972), and Vlach (1981). Within AI, these concepts or related ones have been used by Allen (1984), Almeida and Shapiro (1983), McDermott (1982), Steedman (1977), and Webber (1978).

Among the people who discussed these classes, there is wide disagreement about exactly what sorts of things are being classified: verbs, predicates (verb phrases), propositions, or events. As stated earlier, it is clear from his examples that Vendler thought of these classes as a classification of verb phrases or predicates, and we believe that at the most basic level this is correct. However, it is also true that propositions are constructed from these predicates, and the classification, or a related scheme, can be usefully applied to these, as well. In the same way, if we posit events as objects in our representations, it is useful to extend the classes to cover these also. In this section, we give our current formulation of Vendler's original four classes. We also show how we represent these predicates, along with the events and propositions based on them.

Typical examples of activities are: *running, playing the piano, looking for an umbrella, pushing a cart, humming, sleeping*, and *remaining*. The essential properties of activities are: (a) when they involve change (which most do), it is of an indefinite extent; (b) they can occur in both the progressive and the nonprogressive (simple) forms; and (c) in the cases where some definite goal or definite change is implied by these predicates, the actual achievement of that goal or change is not expressible by either form of these predicates. As an example of the third property, the sentence *John was looking for his umbrella* implies the goal of finding the umbrella, but the actual finding of the umbrella is not expressible by either the progressive form or the simple (nonprogressive) form of the predicate *looking for the umbrella.*

Instances of activities are represented as in Fig. 7.2. In this figure, node 1 represents the tenseless proposition *John play the piano.* Node 2 represents the

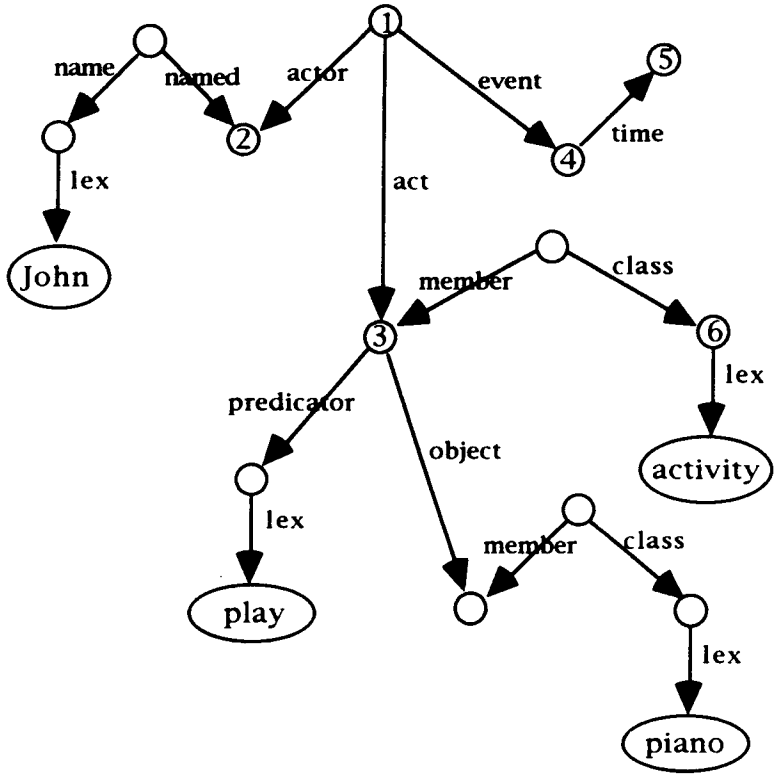


FIG. 7.2. Representation of "John play the piano" (simple or progressive).

person whose name is *John.* (The assertion that this person's name is John is represented by the *name/named* case frame.) Node 3 represents the concept of *playing the piano*, which is the act of proposition 1 and a member of the class of activities, represented by node 6. Notice that the act is a structured individual consisting of a predicator, *play*, and an object, *the piano.* Node 4 represents the event of John playing the piano, and node 5 represents the interval of time occupied by this event. In SNePS, a node with a *lex* arc coming from it represents a concept that can be expressed by the word pointed at by the arc.

Activity events have the *subinterval property* (Bennett & Partee, 1972). This means that any segment (or interval) of an activity event is an event of the same type (at least down to a certain grain size). So, for instance, any segment of a running-event is also a running-event. A consequence of the subinterval property is that, for activity V, if *John V-ed*, then at some time *John was V-ing*, and if *John was V-ing*, then at some time *John V-ed.* Of course the discourse functions of the simple and the progressive forms are quite different. At any rate, the representation in Fig. 7.2 is neutral between the simple and the progressive form.

Typical examples of accomplishments are *walking to the store, running a mile, playing a sonata, building a house*, and *writing a letter.* The essential properties of accomplishments are: (a) they involve a definite change of some

sort; (b) in most contexts, the simple form of the predicate expresses the complete process, from beginning to end, that leads to that definite change; and (c) the progressive form (and the simple form in some contexts) refers to a portion of the complete process, in other words, a subact of the complete act.

Because accomplishments involve definite change, and because the progressive only refers to some portion of the complete process leading to that definite change, an accomplishment sentence *A was V-ing* does not necessarily imply that at some time *A V-ed.* In other words, accomplishments do not have the subinterval property. For example, *John was walking to the store* merely says that John was engaged in some process and says nothing about whether he completed it or not. Therefore, it does not imply that *John walked to the store.* Dowty referred to this property of progressive accomplishments as the *imperfective paradox* (Dowty, 1977). On the other hand, *John was walking to the store* does imply that *John walked to the store for some period of time.* In this context, with an adverbial of duration, the simple form also refers to only a portion of the complete accomplishment.

The imperfective paradox introduces a complication into the representation of accomplishments: How do we represent an occurrence of an incomplete accomplishment without implying the occurrence of the complete accomplishment? Within AI, McDermott (1982) and Allen (1984) both presented ways of handling this property of progressive accomplishments. We also offered a solution to the imperfective paradox (Almeida & Shapiro, 1983), but it was based on an overall representational approach that we no longer use. Our current approach to the representation of incomplete accomplishments is shown in Fig. 7.3. The proposition represented by node 1 could be expressed (assuming the event took place in the past) as *John was walking to the store* or as *John walked to the store (for some period of time).* Node 2 represents the complete process of walking to the store. Node 4 represents the assertion that the act represented by node 3 is a subact of the act represented by node 2. That is, node 3 represents some portion of the complete accomplishment represented by node 2. The complete act of *walking to the store* is represented as a structured individual consisting of a predicator, *walk,* and a goal (indicated by the *to* arc), *the store.*

The representation of an accomplishment that is understood as being complete is similar to the incomplete case, except in this case the act is the complete process. It is important to emphasize that *acts,* in our sense of the term, are neither propositions nor events, but something akin to procedures. The performance of an act, like the execution of a procedure, generates an event. An incomplete accomplishment event is thus represented by us as a partial performance of some act, the complete performance of which would lead to some definite change as described above.

Typical examples of states are *being sick, being on the table, knowing the answer, believing that Mary walked to the store,* and *resembling Bill.* The standard

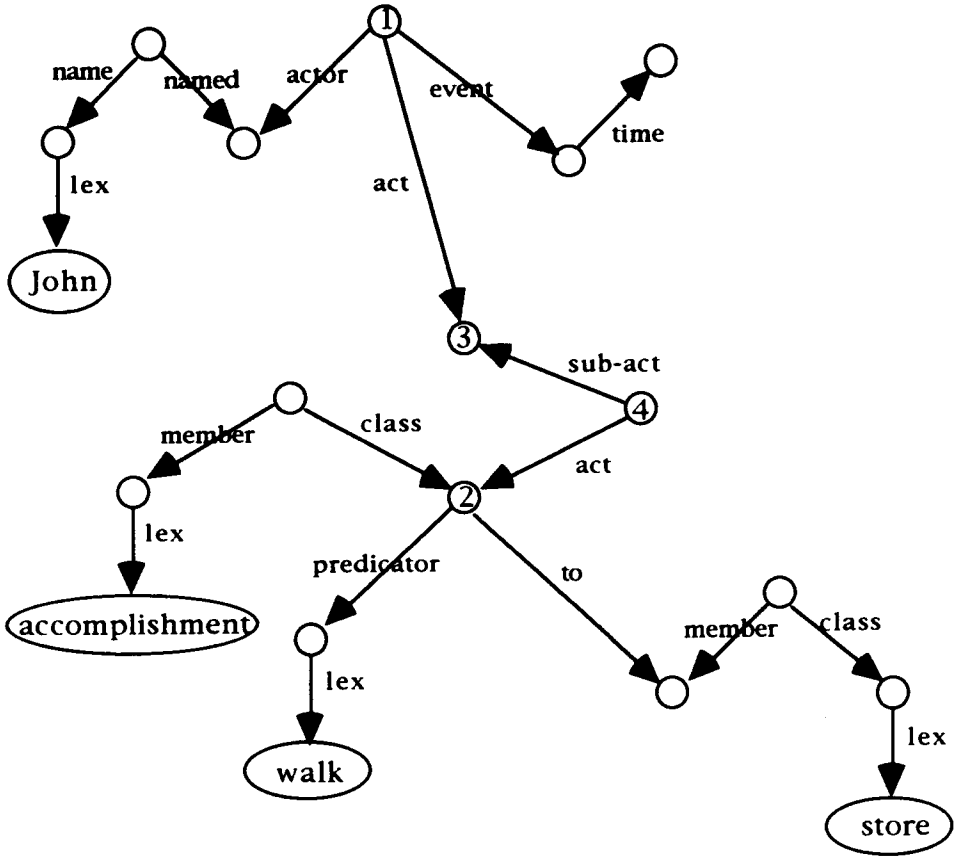


FIG. 7.3. Representation of "John walk to the store" (incomplete).

features of states are that they are not dynamic (they do not involve change), and they cannot occur in the progressive. Intuitively, any part of a state-event is an event of the same type; therefore, like activity-events, state-events have the subinterval property.

Typical examples of achievements are *losing an umbrella, dying, noticing the picture, falling asleep, arriving at the station, realizing something, returning to the house*, and *winning the race.* The principal properties of achievements are: (a) like accomplishments, achievements involve a definite change of some sort; (b) also like accomplishments, the progressive form of these predicates refers to some arbitrary portion of the complete process; and (c) unlike accomplishments, the simple form of these predicates refers not to the complete process but only to the final portion of it.

Examples of achievements that consist of clear and potentially lengthy processes are *dying* and *returning to the house.* Such predicates easily take the progressive form, and in such cases the progressive refers to a portion of the complete process. Again, because of the definiteness of the change involved, and because the progressive form refers to only a portion of the complete process, an achieve-

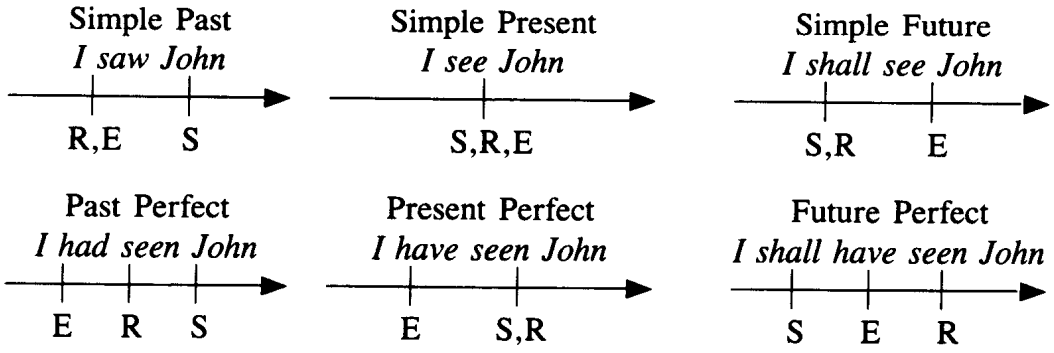
ment *A was V-ing* does not imply that at some time *A V-ed*, the same as with accomplishments. Some achievements are relatively point-like in nature and consequently do not tend to occur in the progressive. Examples of such predicates are *losing an umbrella, finding the treasure*, and *spotting a plane*.

We distinguish between complete and incomplete achievements in the same way we do for accomplishments. Complete achievements have as their act the entire process, whereas incomplete achievements have as their act only a portion of the complete process. So far, the representations for both achievements and accomplishments are basically the same. The way in which they differ—property (c), is discussed later.

TENSE AND ASPECT

The linguistic notions of *tense* and *aspect* play a central role in the analysis of narratives. Tense is used to relate the time of the event referred to in a sentence to the time of the utterance of that sentence. In his well-known analysis of tense, Reichenbach (1947) introduced the important concept of temporal reference points. He distinguished three such points: *Speech Time* (ST), the time at which the utterance is made; *Event Time* (ET), the interval of time occupied by the event; and *Reference Time* (RT), a time point which is determined by the tense of the sentence. A past tense sentence has a Reference Time in the past, *before* the Speech Time.

Reichenbach's analyses of the six basic and perfect tenses in terms of his reference points is shown in the following diagram, in which the arrow shows the direction of time from the past to the future. Times separated by commas are understood as being simultaneous.



According to Comrie (1976), aspects are "different ways of viewing the internal temporal constituency of a situation" (p. 3). Comrie distinguished two principal aspects. The *perfective aspect* occurs when a situation is referred to without reference to its internal temporal constituency; that is, the situation is

seen as a whole. The *imperfective aspect* occurs when explicit reference is made to the internal temporal constituency of a situation; that is, the situation is viewed from within. Thus, the perfective/imperfective distinction has to do with the way events are described. For example, in the sentence *John was reading when I entered*, the second clause, *I entered*, has perfective aspect, whereas the first clause, *John was reading*, has imperfective aspect, because it makes explicit reference to an internal portion of John's reading.

In English, the relation between the progressive and the nonprogressive (simple) form of verbs, providing we restrict ourselves to nonstative verbs and exclude habitual meaning, is one of imperfectivity versus perfectivity. That is, events described using the progessive are viewed imperfectively, whereas in most cases, events described using the simple form of the verb are being viewed perfectively. Statives are already typically viewed imperfectively, so most stative verbs do not take the progressive without a change of sense.

In our survey of the different types of events and their representations, we showed that each event instance has an associated interval of time, indicated by the *time* arc. This interval, the *Event Time*, is to be understood as the complete period of time occupied by the entire event from beginning to end. However, this interval does not function well in the role of Reichenbach's Event Time. Instead, we introduce a new interval of time, called the *Attachment Time* (AT), that is related to an event's Event Time as described below, and that functions as the interval directly related to the Reference Time and to the intervals referred to by time adverbials.

The ways in which Attachment Times are related to Event Times of various types of events is shown in Figs. 7.4–7.7. In these figures, and in most of the subsequent figures, event representations are compressed into the event node, represented by a triangle labelled by its associated tenseless proposition. This is just a convention to prevent the figures from being cluttered by irrelevant material.

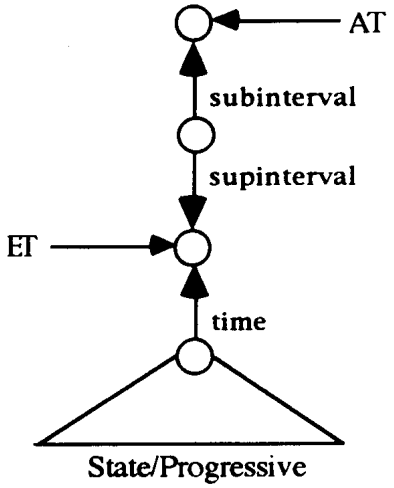


FIG. 7.4. The attachment time of states/progressives.

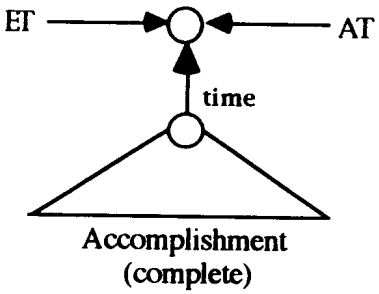


FIG. 7.5. The attachment time of simple (complete) accomplishments.

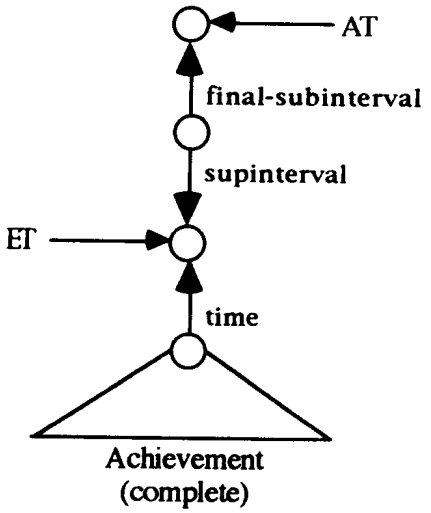


FIG. 7.6. The attachment time of simple (complete) achievements.

The AT of a state or a progressive is related to its ET as shown in Fig. 7.4. In these cases, the AT is a subinterval of the ET. For example, with *John was sick yesterday*, all we know is that John was sick during some part of yesterday. In itself, this sentence does not tell us when John started to be sick, and it does not tell us if and when John has ceased to be sick. Therefore, we can only place a subinterval of John's illness as definitely during yesterday, and this subinterval is the Attachment Time. By having the AT be only a subinterval of the ET, this representation does not bound the extent of the event. The same is true of a progressive sentence such as *John was running yesterday.*

The AT of a simple (complete) accomplishment is related to its ET as shown in Fig. 7.5. For example, we understand *John painted a picture yesterday* as saying that John both started and completed the painting of the picture sometime during yesterday. Therefore, the event is completely contained within yesterday. We capture this property of complete accomplishments by making their ET and AT identical.

The AT of a simple (complete) achievement is related to its ET as shown in Fig. 7.6. For example, with *John died yesterday*, we understand that John reached the end of the process of dying sometime during yesterday, but we do not know when this process began. In other words, John may have been dying for several

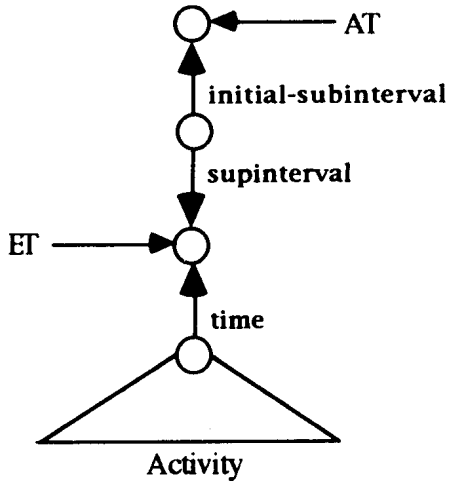


FIG. 7.7. The attachment time of simple activities and simple (incomplete) accomplishments.

days previous to yesterday. Therefore, it is, in general, only some final-subinterval of an achievement event that is bounded by such adverbials. In this way, we capture the third of the properties of achievements. Thus, we represent the difference between accomplishments and achievements as a difference in the ways that their ATs are related to their ETs.

The AT of a simple activity or of a simple (but incomplete) accomplishment is related to its ET as shown in Fig. 7.7. We usually understand a simple activity sentence as referring to the initial segment of the event. For example, *John ran at three o'clock* means that John started running at three o'clock, but says nothing about when he stopped running. Actually, in the most general case, the AT of such events is just an arbitrary, though nonzero, subinterval of the ET. In the next section, we provide additional motivation for the ways in which the ATs and the ETs of the different event types are related.

Now that we have indicated the various possible relationships between Attachment Times and the Event Times, we can show how we represent some of the tenses. Rather than trying to represent all tenses, however, we discuss only the past tenses, because these are the ones we need in our discussion of narrative. For a more complete discussion of tense, see Hornstein (1977) and Harper and Charniak (1986). As was mentioned earlier, tense is used to indicate the relation between the Speech Time and the Reference Time. Therefore, the past tense (both the simple and the progressive forms) is understood as placing the RT in the past with respect to the ST and the AT equal to the RT. Our representation

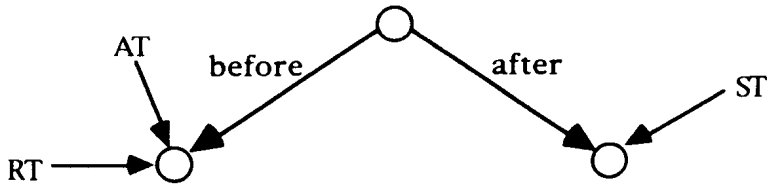


FIG. 7.8. Representation of the past tense.

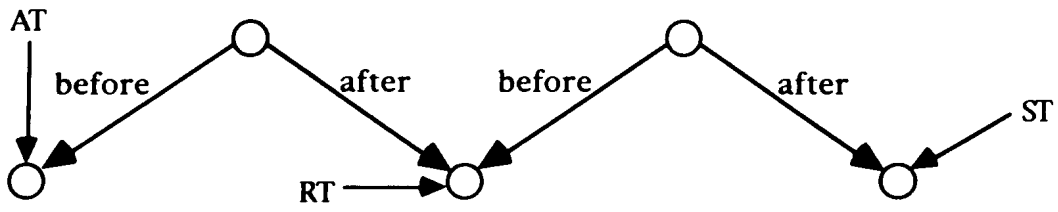


FIG. 7.9. Representation of the past perfect tense.

for the past tense is shown in Fig. 7.8. The other tense we are interested in is the past perfect. Our representation for the past perfect is shown in Fig. 7.9.

NARRATIVES AND NARRATIVE-LINES

The type of approach we use to understand the temporal structure of narratives was introduced by Hinrichs (1986). This approach makes use of a special Reference Time that interacts with the events of the story to produce the temporal structure of the story. Partee (1984) also used this approach. In the Introduction, we defined a narrative as a type of discourse used to describe sequences of events. In general, an extended narrative can be seen as consisting of one or more simpler units—narrative-lines. In the remainder of this chapter, we describe our approach to understanding the temporal structure of individual narrative-lines. Ways in which several narrative-lines can be put together to produce a large-scale narrative were discussed in Almeida (1987).

We define a *narrative-line* to be a stretch of narrative that is "controlled by," or is within the scope of, a single Reference Time. This Reference Time can be understood as representing the present moment of the story, and so we refer to this Reference Time as the *narrative now-point* (Almeida & Shapiro, 1983). It is this sense of a present moment within a narrative-line that allows the combination of the adverb *now* with a past tense sentence to be grammatical in a narrative context. Outside of a narrative context, this combination is not considered grammatical.

The narrative now-point functions within a narrative more or less the way that the actual present (the "real" now) functions in the real world. That is, everything that comes before the now-point is in the past in the world of the story, and everything that comes after the now-point is in the future from the perspective of that moment in the story. Thus, as the story progresses in time, the now-point is moved forward in time, and events that were at one point in the story future become part of the story past.

THE BASIC RULES OF NARRATION

In this section, we present the rules for extracting the story from a basic narrative-line. A *basic narrative-line* is a narrative-line with no temporal adverbials and which follows certain other simplifying restrictions. These basic narrative-lines will constitute a base case for narratives, and other types of narratives will be viewed as extensions to, or elaborations of, this base case.

The basic rules of narration are the rules which hold by default (under ordinary circumstances) in the absence of time adverbials. The only factors taken into consideration by these rules are tense, event type, aspect, and what we call the *Narrative Convention*. The Narrative Convention is that unless we (the readers) are given some sign or information to the contrary, we assume that the events of the story occurred in the order in which they are presented in the text. This is, of course, the same as the "narrative time progression" of Hirschman and Story (1981).

In English, narratives are typically written in the past tense. The past tense is used because in most narratives the events of the story are in the past with respect to the time of narration. The relationship between the events of the story and the real present plays no role in tense selection. Thus, even science-fiction stories about the (to us) distant future are written in the past tense. Because the events of the story are in the past with respect to the (usually fictional) narrator, the simple past and past progressive tenses are used to refer to events in the story present. References to the story past are made using the past perfect tenses, and references to the story future are made using the future-in-the-past tenses.

Perfective Events in the Simple Nonperfect Past

What we call *perfective events*, that is, nonprogressive accomplishments, achievements, and activities, have the temporal effect of moving the now-point forward when they are expressed in the simple past tense. Thus, in the base case, it is the occurrence of such perfective events in the story present that causes the story to develop in time. Perfective events work in the following fashion: their Reference Time, and therefore their Attachment Time, is placed after the current now-point, and then the now-point is updated to just after the Reference Time. The idea that in such cases the special Reference Time (our now-point) is moved to just after the event was introduced by Hinrichs (1986). In our system, this just after relationship is represented by having *epsilon* (ε) as the duration of the interval between the end of the Reference Time and the updated now-point. Each of the different perfective event types is understood in a slightly different way, however, because of the differing relationships between their Attachment Times and their Event Times.

The general pattern for perfective events in the past tense is shown in Fig. 7.10. We use a variable called *now*, whose value is the node which represents the current position of the story present. In many of the figures, numerical subscripts are used to indicate successive positions of the now-point; so "$_1$" indicates the first (or original) value of *now*, "$_2$" indicates the second value of *now*, and so on. It is important to emphasize that at any time during the reading of a narrative-line, there is only one value of the *now* variable. In addition, in this figure and in all subsequent figures showing the temporal structure of fragments

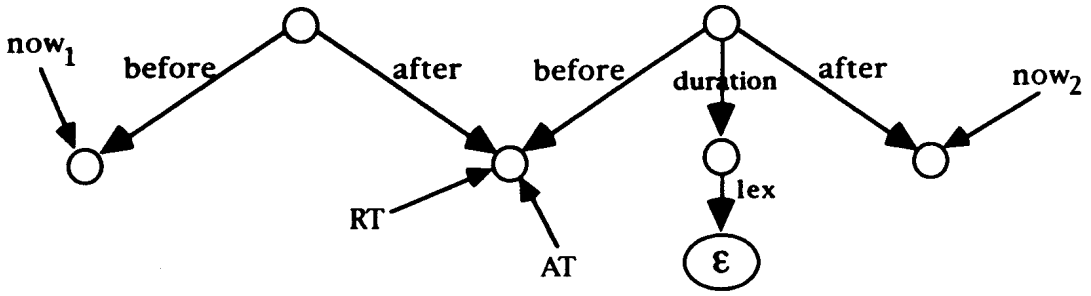


FIG. 7.10. The temporal effect of perfective events.

of narrative, we do not include the time of narration, the Speech Time. This is simply because, in a purely past tense narrative, the relations between the ST and the events of the story are always the same—the events are before the ST.

With accomplishment events, the entire event is understood as occurring after the current now-point, with the result that the event moves the now-point to just after the end of the time interval that it occupies. This follows from the equivalence of the AT and the ET in the case of complete accomplishments. Sequences of completed accomplishments are very common in narratives. Some typical examples are:

(1) I went to the door, unlocked it, and pulled it open. (Hammett, 1929/1980a, p. 206)

(2) The doctor wrote down an address on a page in his notebook, tore it out, and handed it to Poirot. (Christie, 1937/1984b, p. 73)

The representation for Example 1, a sequence of three accomplishments, is shown in Fig. 7.11. The subscripted *nows* show the successive positions of the now-point, and the subscripted RTs show the successive RTs. (We often abbreviate some of the more commonly used arc labels as follows: *before, after*, and *duration* are abbreviated as *b, a*, and *dur*, respectively; *supinterval, subinterval, final-subinterval*, and *initial-subinterval* are abbreviated as *sup, sub, f-s-i*, and *i-s-i*, respectively.) As Fig. 7.11 indicates, the three successive events are understood as occurring in their entirety in the order in which they are described. When all three of these events have occurred and are therefore part of the story past, the position of the story present is indicated by the fourth *now*. Also, with quoted speech, which occurs frequently in many types of narrative, the events consisting of the making of such statements (as opposed to the content of the statements) are accomplishment events, and they have the same temporal effects as do other accomplishment events.

With achievement events, sometimes only a final-subinterval of the event is understood as occurring after the current now-point. As we have seen, this is modeled by having the AT be a final-subinterval of the ET. Some typical examples of achievements (in italics, emphasis added) in narrative are:

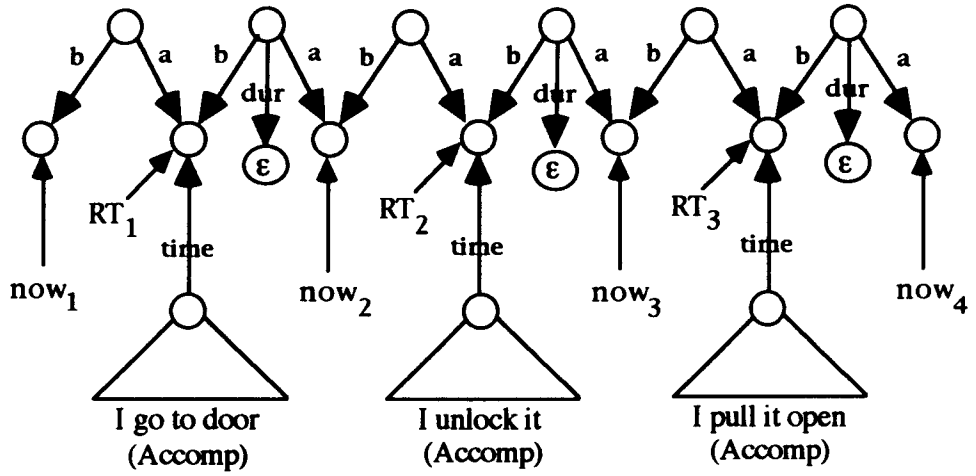


FIG. 7.11. Representation of "I went to the door, unlocked it, and pulled it open."

(3) ". . . The envelopes are missing too." (said Mr. Leggett)
Mrs. Leggett returned with her daughter, . . . (Hammett, 1929/1980a, p. 147)

(4) *We found an automatic elevator,* rode to the fifth floor, and went down a purple-carpeted corridor to the door just beyond the stairs on the left-hand side. (Hammett, 1929/1980a, p. 170)

The representation for Example 3 is shown in Fig. 7.12. Notice that the position of the start of the returning-event is left ambiguous; we can only be sure of the position of the end of the event.

The situation with simple past tense activity events is more complex than with the preceding two event types, because the relationship between the AT and the ET of simple activities is more complicated. As we mentioned, the most commonly occurring case in narratives is where the AT is an initial-subinterval of the ET. In this case, some piece of the event, including its beginning, occurs after the current now-point, and the now-point is moved to just after that initial-subinterval. The time of the end of the complete event cannot always be determined and so is left ambiguous in the representation. Following are some examples of this case; the activity sentences are in italics (emphasis added):

(5) "Don?" I said. *I walked towards him.* "Donald!" (Francis, 1976/1978, p. 12)

(6) ". . . it would have been difficult to put it in exactly the right position." (said Poirot) *Inspector Raglan stared at the little man.* Poirot, with an air of great unconcern, flecked a speck of dust from his coat sleeve. "Well," said the inspector, . . . (Christie, 1926/1939, p. 131)

(7) "How is your father?"
She laughed. "I was going to ask you." (Hammett, 1934/1980b, p. 591)

In Example 5, a character says something (an accomplishment) and then starts to walk towards another character. The question is, has the speaker stopped

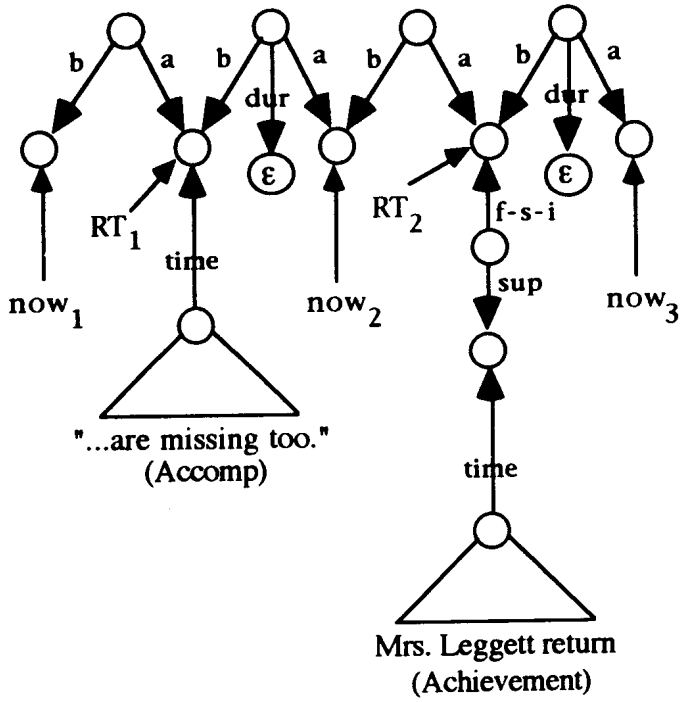


FIG. 7.12. Representation of complete achievements, Example 3.

walking when he makes the second statement? Because it seems unclear, this is modeled by leaving the end-time of the walking ambiguous with respect to the following event. The representation for this example is shown in Fig. 7.13.

In Example 6, the *staring* is definitely still going on when Poirot flecks a speck of dust from his sleeve. In Example 7, however, we know that the *laughing* is definitely over when the laugher starts talking. This follows from the world-knowledge that laughing and talking are incompatible. The complete boundedness of the laughing can be easily modeled by adding an *equiv/equiv* relation between the AT and the ET.

The representation of simple activities is complicated, however, by the fact that there are instances in which the AT is some arbitrary subinterval of the ET rather than the initial-subinterval. In this case, the times of the beginning and the ending of the complete event are not directly related to either of the now-points. An example of this case is:

(8) A small boy of twelve or thirteen stood there staring at us with . . .
I said: "Hello, son."
Collinson jumped around at the sound of my voice.
The boy said nothing. *He stared at me for at least another minute* . . . , then turned his back on me and walked away, . . . (Hammett, 1929/1980a, p. 169; emphasis added)

The staring-event described by the italicized sentence obviously did not start at this point in the story, but is instead only a part of the larger staring-event

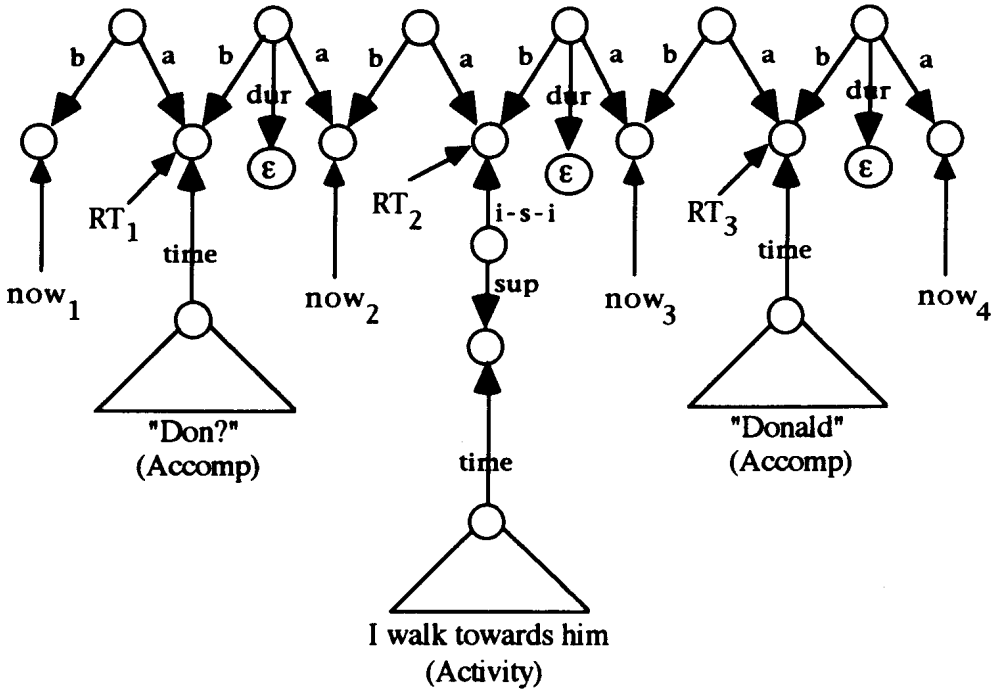


FIG. 7.13. Representation of simple activities, Example 5.

mentioned in the first sentence of this example. Fortunately, such cases are often signaled by the presence of a for-adverbial, such as the one in this example, where the duration is modified by a word such as *another* or *additional.*

The really central property of perfective events is that they imply the passage of time. This passage of time is captured, at least partly, in our representation by the movement of the now-point.

Hinrichs' (1986) approach to the treatment of perfective events differs from ours in that Hinrichs placed each new accomplishment or achievement within or during the then-current Reference Time, rather than after it, as we do. To Hinrichs' overall approach, Partee (1984) added the assumption that in a "linear narrative," the Reference Times strictly follow one another. Neither Hinrichs nor Partee used a representation of the present moment of the story, such as our now-point. Also, unlike us, Hinrichs and Partee treated simple activities in the same way as states and progressives, the handling of which we discuss in the next section.

Imperfective Events in the Nonperfect Past

The *imperfective events* are states and progressive accomplishments, achievements, and activities. When expressed in the simple past (for states) or the past progressive (for the other classes), imperfective events are understood as temporally containing the current now-point, so that the event is viewed from within from the current now-point. Because the now-point is ordinarily just after some perfective event, the imperfective event is tied to that event; that is, the imperfective event is typically seen as also containing the immediately preceding event. If the imperfective event

does not contain that event, then these two events are almost always seen as being causally related, with the perfective event causing the coming-into-being of the imperfective event. At any rate, our basic representation is ambiguous between these two cases, so we are not ordinarily concerned with this issue.

These properties of imperfective events are modeled by making the AT of the event (which, remember, is a sub-interval of the ET for states and progressives) equal to the current now-point. In addition, with imperfective events, there is no sense of temporal motion such as there is with perfective events. Therefore, the now-point stays where it is. In this way, successive states and/or progressives can be used to build up complex descriptions. Some typical examples with imperfective events are:

(9) ". . . I haven't seen Macauley since the murder and I haven't even been following it in the newspapers."

The telephone was ringing again. Nora gave us our drinks and went to answer it. (Hammett, 1934/1980b, p. 623)

(10) I went up there. Gabrielle, in a low-cut dark silk gown, was sitting stiff and straight on the edge of a leather rocker. Her face was white and sullen. She was looking at a handkerchief stretched between her hands. (Hammett, 1929/1980a, p. 267)

The representation for Example 9 is shown in Fig. 7.14, and that for Example 10 is shown in Fig. 7.15. Notice that in Example 9, we understand that the telephone starts to ring sometime before the speaker finishes his statement. In addition, the

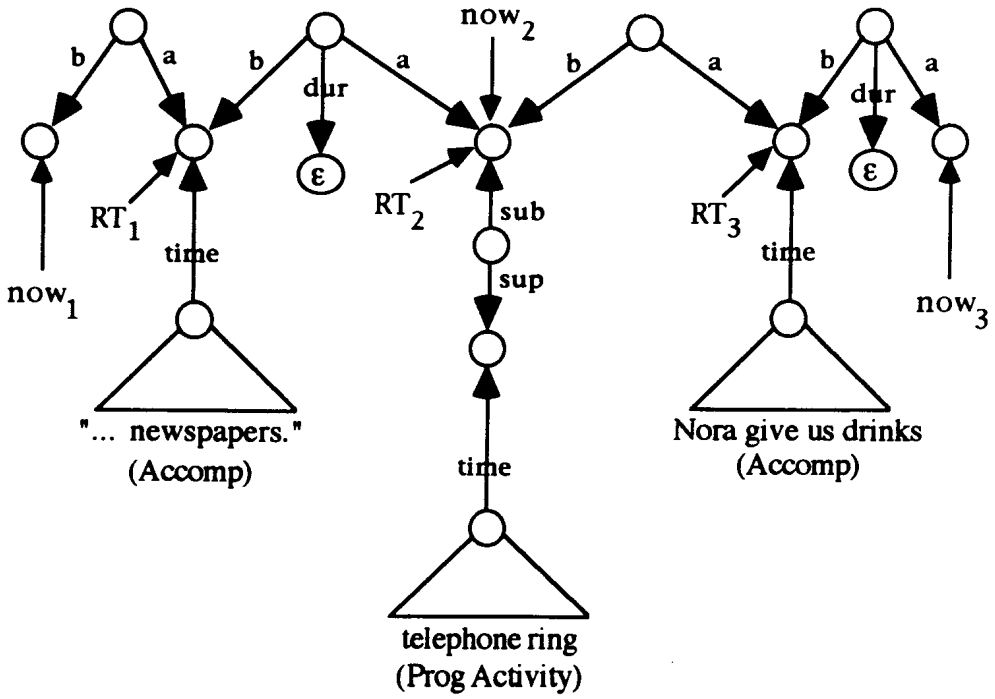


FIG. 7.14. Representation of imperfective events, Example 9.

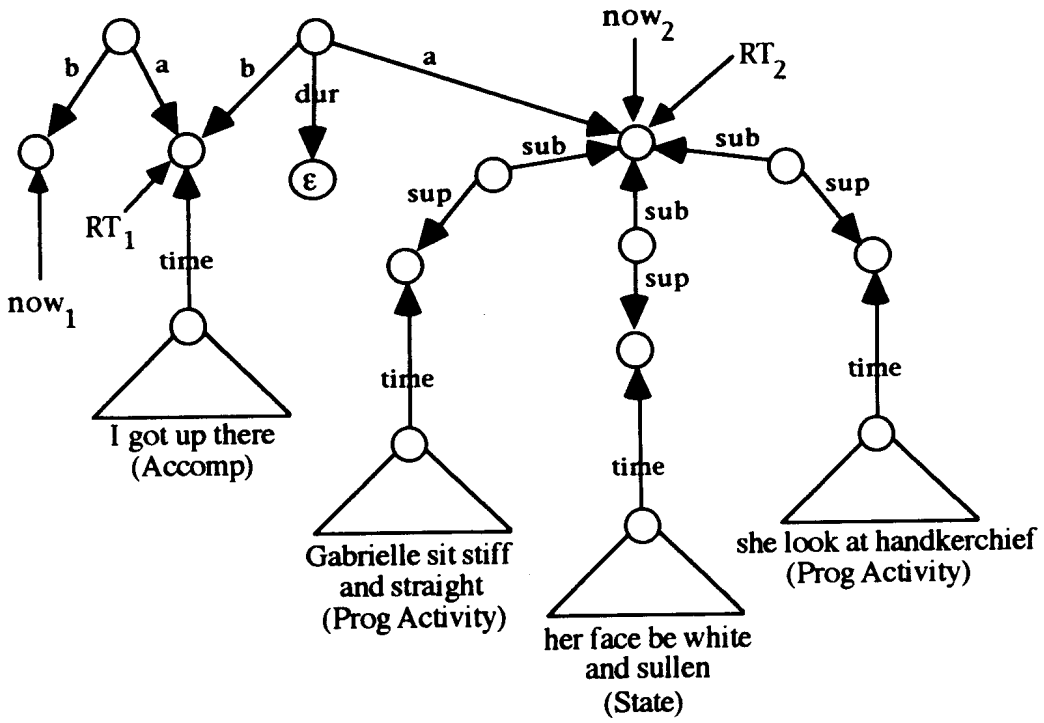


FIG. 7.15. Representation of imperfective events, Example 10.

telephone continues to ring until Nora answers it sometime after she gives out the drinks. If, in this example, the progressive *The telephone was ringing* is changed to the corresponding simple form *The telephone rang*, then we would understand that the telephone started to ring after the speaker completed his statement. Example 10 is a typical illustration of how a complex description of a situation at a single point of time can be built up by a series of progressive and/or stative sentences. We understand all of the events described by these progressive and stative sentences as temporally overlapping at least at the now-point.

Our treatment of states and progressives is essentially the same as that of Hinrichs and Partee. Hinrichs gave the following example (discussed in Partee, 1984) of a state that does not overlap the immediately preceding event:

> Jameson entered the room, shut the door carefully, and switched off the light. It was pitch dark around him because the Venetian blinds were closed. (p. 254)

Clearly the state of its being pitch dark does not start until Jameson switches off the light, and therefore this state cannot overlap or contain the event. Notice, though, that there is a causal connection between this event and the given state.

Events in the Past Perfect Tense

As we stated, the past perfect tenses (both simple and progressive) are used to refer to the story past. An event is placed in the story past by making its RT equivalent to the current now-point, thus making its AT before the current now-

point. Because the event is understood as being in the story past, it does not, regardless of its type, cause the now-point to move. Some examples of past perfect sentences in narratives are:

(11) "Are you sure?"
"No, but that's the best we've been able to do so far. There's Fitzstephan now." Looking through the cafe door, I had seen the novelist's lanky back at the hotel desk. "Excuse me a moment." (Hammett, 1929/1980a, p. 244)

(12) There was a sudden brusque movement from Theresa. She had risen and was standing by the mantelpiece. She quickly lit another cigarette. (Christie, 1937/1984b, p. 111)

The representation for Example 11 is shown in Fig. 7.16. In this example, it is clear that at least the beginning of the seeing of the novelist's (Fitzstephan's) back must have preceeded the stating of *There's Fitzstephan now*. Therefore, we could infer that the interval indicated as AT, node 2, is before the interval of the statement, node 1. Example 12 is interesting and unusual in that the sudden brusque movement described in the first sentence is the same event as the rising described in the following past perfect sentence. The use of the past perfect indicates that the rising is being described from a point of time that is after the brusque movement event. Such examples offer some support for the idea that past perfect events are before the now-point rather than before the event just before the now-point.

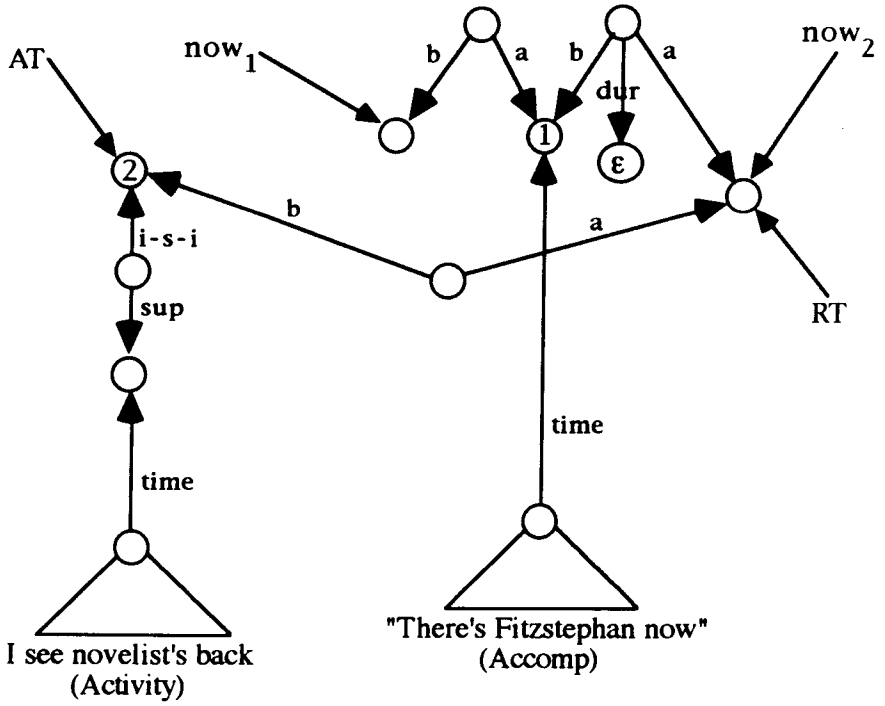


FIG. 7.16. Representation of events in the story past, Example 11.

NARRATIVE LINES WITH FRAME ADVERBIALS

Most extended narratives contain time adverbials. Time adverbials are used to specify temporal relations between events, to place events within calendrical intervals, and to give the durations of events. Time adverbials can be divided into two large classes according to how comfortably they fit into narrative contexts. What we call *nonnarrative adverbials* seem to be by their nature directly related to the Speech Time. Examples of such adverbials are *today, yesterday, tomorrow, this Tuesday,* and *three days ago.* Such adverbials are common in conversation but are somewhat awkward in narratives. When they do occasionally appear in narratives, there is usually a sense that the narrator is identifying very closely with the story present, and so the now-point is identified with the Speech Time. *Narrative adverbials,* on the other hand, are not directly tied to the Speech Time and so are much more free to function in narratives.

In this section, we expand our analysis of narratives to include narrative-lines containing members of the narrative subclass of *frame adverbials. Frame adverbials* refer to intervals of time which are used to bound or frame the temporal locations of events and of Reference Times (Bennett & Partee, 1972). There are two types of such adverbials: *interval*—large intervals of time, and *point*—small intervals of time. We call the interval referred to by such adverbials the *frame-interval.* (Additional classes of narrative adverbials were treated in Almeida, 1987.)

In the case in which the frame-interval gives the temporal location of an event, it is the Attachment Time of the event, and not its Event Time, that is directly related to the frame-interval. Therefore, in all such cases, the AT of the event is asserted to be a subinterval of, that is, during, the frame-interval. Given our earlier analysis of the ATs for different types of events, this means that it is incorrect to say that the frame-interval bounds the event, because it may only bound part of the event.

Since interval frame adverbials refer to large intervals of time, these intervals typically temporally contain not only the event(s) of the sentence containing the adverbial, but also, by default, the events of the succeeding sentences, until some new frame-interval is established. The frame-intervals referred to by point frame adverbials do not generally have this property because of their small size. The remainder of this section surveys several different types of frame adverbials.

The two prepositions *on* and *in* seem to have complementary distributions in the usage considered here, and so they are treated as having the same meaning. *On* occurs with NPs which refer to calendrical days, weekends, and subintervals of a day where the day is also mentioned or is strongly implied. *In* occurs with NPs that refer to calendrical intervals both larger and smaller than a day. In both cases, the preposition can often be deleted with no apparent change in meaning.

Adverbials of the form *on N(day-of-week)* generally refer to the day of that type within an already picked out week. On the other hand, adverbials of the

form *on a N(day-of-week)* are used when no such week has been established. For example, compare:

(13) We went to Boston last week. We arrived there on Monday. (vs. We arrived there on a Monday.)

(14) We went to Boston last month. We arrived there on a Monday. (vs. We arrived there on Monday.)

In Example 13, the first sentence picks out a week as a context and so the continuation sounds best with *on Monday*, which of course refers to the Monday of that week. In Example 14, however, no such week is picked out and so the continuation sounds best with *on a Monday*, because there is more than one Monday in a month.

By default, in a narrative, the "picked out" week is the current week of the story, that is, the week that contains the current now-point. Figure 7.17 shows the representation for the following case: It is a Monday in the story; we then read *On Thursday John walked to the store.* In this figure, node 1 represents the current week, and node 2 represents Monday, which contains the initial now-point. The presentential adverbial *on Thursday* picks out the Thursday (node 3) of the current week, and since Thursday is later in the week than Monday, the now-point is updated to during that Thursday. The RT of the event (an accomplishment) is then related to the now-point in the standard way for perfective events in the simple past tense and this RT is further made a subinterval of Thursday. Finally, the now-point is updated to just beyond this RT and is also made a subinterval of Thursday. In this way, Johns walk to the store is asserted to have been on Thursday, and the story present is updated to that Thursday, as well.

In the stories we examined, one of the most common types of on/in-adverbial has the form *on the following N(day-subinterval).* Some examples are:

(15) "The next thing to do is to catch the twelve o'clock train to Torquay tomorrow and verify our brilliant conclusions." [said Tommy]
Armed with a portfolio of photographs, Tommy and Tuppence duly established themselves in a first class carriage the following morning, and booked seats for the second lunch. (Christie, 1929/1984a, p. 172)

(16) When he returned to the flat on the following evening, Tuppence came flying out of her bedroom to meet him. (Christie, 1929/1984a, p. 57)

(17) On the following night he himself was given a proof. (Christie, 1929/1984a, p. 123)

(18) Franklin Clarke arrived at 3 o'clock on the following afternoon and came straight to the point without beating about the bush. (Christie, 1936/1941, p. 88)

All of the adverbials in these examples have parallel interpretations. The morning referred to in Example 15 is the morning of the day after the day on

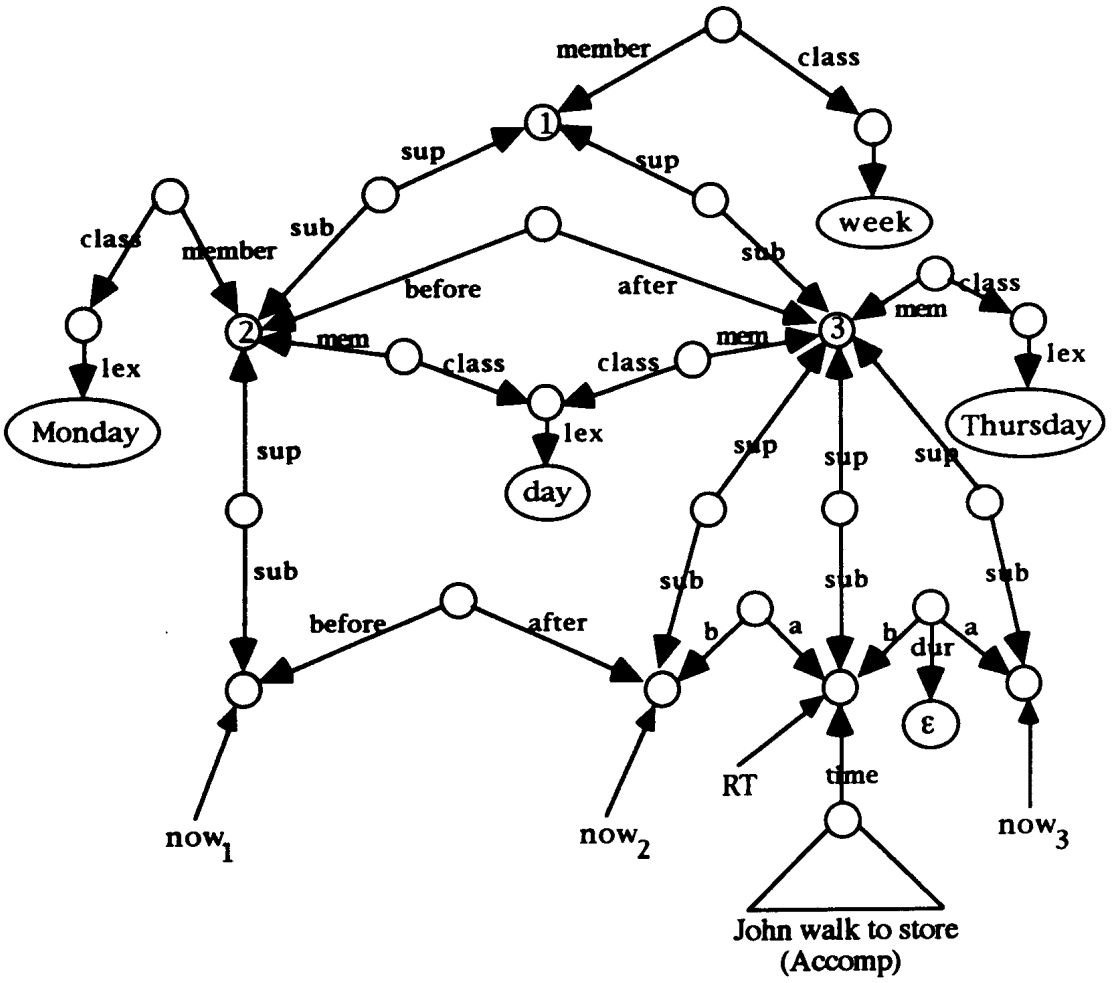


FIG. 7.17. Representation of "On Thursday John walked to the store."

which the preceding statement was made. In Example 16, the evening referred to is the evening of the day after the day of the immediately preceding occurrences. Similarly, in Example 17, it is the night of the next day that is being referred to, and in Example 18, the adverbial refers to three o'clock in the afternoon of the next day. The basic representation for *on the following N(day-subinterval)* is given in Fig. 7.18. Starting with the now-point during some day, the adverbial updates the now-point to sometime during the relevant subinterval of the next day. The event is then attached to this now-point in the usual way, and is asserted to be during that interval.

On/in the following N may also be used to refer to intervals other than day-subintervals. In order to describe the behavior of this adverbial in general, it is necessary to distinguish between *covering* and *noncovering* interval types. Examples of covering interval types are *days, weeks, months,* and *years.* They have the property that the complete set of instances of any of these types covers or partitions the timeline completely; that is, there are no gaps between successive instances of each of these types. With the noncovering interval types, however, there are gaps between successive instances of each of those types. Examples of

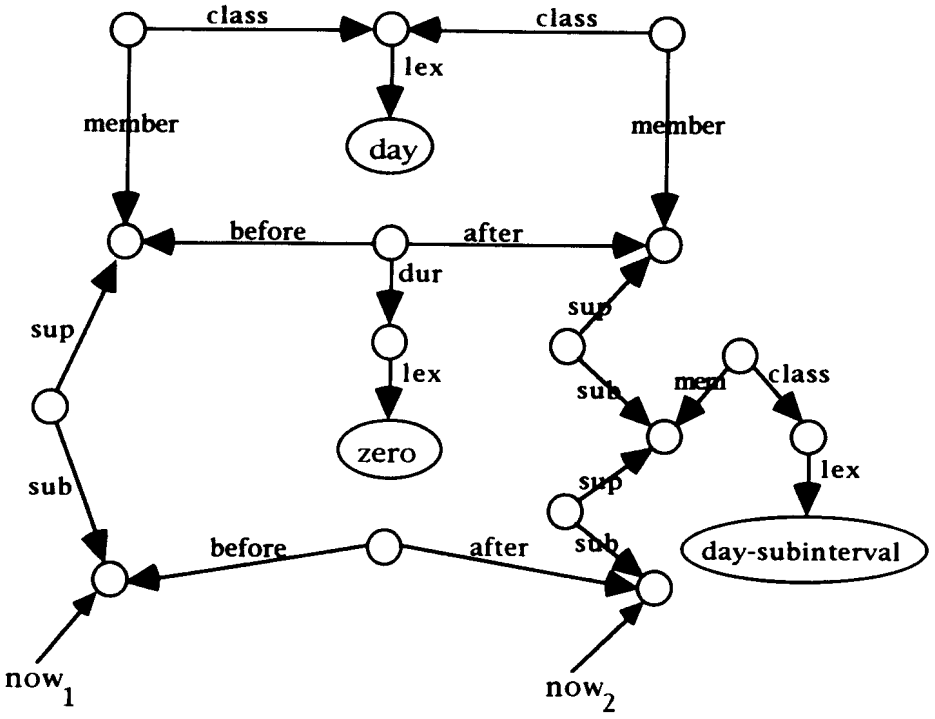


FIG. 7.18. Representation of "on the following N(day-subinterval)."

such interval types are *Mondays*, *Aprils*, and *mornings*. Typically, such intervals have *standard covering intervals* which contain them. So, for instance, Mondays are subintervals of weeks, Aprils are subintervals of years, and mornings are subintervals of days.

The general rule for interpreting *on/in the following N* has two cases. If *N* is a covering type, then the interval picked out by the adverbial is the instance of that covering type that immediately follows (or is met by) the current instance of that type. Thus, *on the following day* refers to the day immediately after the current day. If *N* is a noncovering type, then the interval picked out by the adverbial is the instance of that type that is a subinterval of the instance of its standard covering type that immediately follows the current instance of that covering type. Thus, as we have seen, *on the following afternoon* refers to the afternoon which is a subinterval of the day that immediately follows the current day. Adverbials of the form *on/in the previous N(interval)* are analogous to adverbials of the form *on/in the following N(interval)*, with the difference being that these adverbials refer in the opposite direction, that is, to the story past.

Examples of adverbials of the form *on/in that N(interval)* are:

(19) Somehow or other, a spade was duly produced, and that night, late, two figures might have been seen stealing into the grounds of the Red House. (Christie, 1929/1984a, p. 45)

(20) Spade returned to his office at ten minutes past five that evening. (Hammett, 1930/1984, p. 45)

(21) Later that day he drove down to Burminster Street, which runs between Chain Walk and Stafford Quay, . . . (Gilbert, 1982/1983, p. 130)

In a narrative, when a that-adverbial is used to refer to a covering interval, it is always the current instance of that covering type that is picked out. For instance, *that day* refers to the current day. With noncovering intervals, however, the interval picked out may be in the past, present, or future. Example 21 illustrates the use of the that-adverbial where the now-point is already during an instance of the type of interval being referred to. Of course, with a covering interval, such as *day*, this is necessarily the case. In such cases, the movement of the now-point is directed by the use of a modifier such as *later*, so that whereas the now-point to which the event will be related is moved ahead, it is still kept within the interval. When reference is made to a past segment of the interval, the adverb *earlier* is used, along of course with the past perfect tense. When the now-point is not during an instance of the type of interval being referred to, the interval picked out may be in the past or the future. This can only happen, of course, when the interval is of a noncovering type. In this case, the interval picked out is the instance of that type which is a subinterval of the current instance of that type's standard covering type.

Examples of adverbials of the form *on/in the next N(interval)* are:

(22) . . . , and the next day Ilaria drove her in the Fiat to the hairdresser, . . . (Francis, 1984/1985, p. 102)

(23) The next morning, during the drive to the office, Cenci said, ". . ." (Francis, 1984/1985, p. 62)

This adverbial seems to have the same meaning as *on/in the following N*. Interestingly, there seems to be a distinction in usage between *the next N* and *next N*—the adverbial with and without the determiner. The version with the determiner is used in narratives, whereas the version without the determiner is directly related to the Speech Time and is, therefore, a non-narrative adverbial.

Examples of adverbials of the form *at NP(point of time)* are:

(24) Spade returned to his office at ten minutes past five that evening. (Hammett, 1934/1984, p. 45)

(25) At half past five he went into the kitchen and made more coffee. (Hammett, 1934/1984, p. 235)

Although at-adverbials are classified as point-adverbials, it is useful to treat them as being interval adverbials where the interval involved is relatively small. Their representation is similar to the interval adverbial representations given previously.

The interval of an at-adverbial provides, first of all, a measure of vagueness; that is, the size of this interval defines how precisely we are referring to the point-of-time in question. For example, we can modify the adverbial, as in *at precisely eight o'clock, at about eight o'clock, at around eight o'clock*, etc. The other purpose of this interval is to account for the strangeness of sentences such as *At 3 o'clock John painted a picture* and, much worse, *At 3 o'clock John built a house*. The problem with these examples is that the events described are typically lengthy, and yet when combined with the point-adverbial, they are understood as being short; hence, we have a conflict. We account for this conflict by treating this situation in exactly the same way that we treat similar cases with the interval-adverbials; that is, we constrain the ATs of the associated events to be during the interval introduced by the adverbial. Of course, one way in which we can avoid the conflict is to understand the at-adverbial as to give the start-time of the extended event.

One important difference between the at-adverbial and the larger interval adverbials, is that the at-adverbial's interval is so small that succeeding events are unlikely to also be during that time. Instead, we place these events in the smallest interval containing that point of time.

AN IMPLEMENTATION

We implemented a system that can read a simple narrative and produce as output a model of the events of the story along with the temporal relations that hold among those events. The natural language parser is implemented as an Augmented Transition Network, and the story model is represented in SNePS. As the system processes each new sentence, it builds representations for the described event(s) and any new time intervals introduced in the sentence, integrating these representations into the developing story model. In this section, we show a run of our system using as input the following example narrative:

> John was walking to the office. John entered the office at three o'clock in the afternoon. The secretary was busy. The secretary was typing a letter. John waited for ten minutes. John left the office. On Thursday John returned in the morning. The secretary gave John a check. On the following Tuesday John returned to the office. John had lost the check on the previous afternoon.

At the beginning of each run, the system assigns a new value to the variable *now* (the now-point of the story), and it builds representations for the current (within the story) day and week. Reading the progressive accomplishment, *John was walking to the office*, adds the following assertions to the network:[1]

---

[1]Each expression enclosed in parentheses and beginning with "m<n>", where "n" is an integer represents a node labeled "m<n>". The rest of the expression lists the labeled arcs emanating from node "m<n>", the nodes these arcs point to, and any labeled arcs emanating from them, and so on. For example, (m18 . . .) and (m17 . . .) represent the following network:

(m18 (sup-interval (b7)) (sub-interval (b1)))
(m17 (event (m16 (time (b7)))) (act (b6)) (actor (b4)))
(m15 (sub-act (b6)) (act (m12 (to (b5)) (predicator (m9 (lex (walk)))))))
(m14 (class (m13 (lex (accomplishment))))
(member (m12 (to (b5)) (predicator (m9 (lex (walk)))))))
(m11 (member (b5)) (class (m10 (lex (office)))))
(m8 (named (b4)) (name (m7 (lex (John)))))
(m6 (sup-interval (b3)) (sub-interval (b2)))
(m5 (member (b3)) (class (m4 (lex (week)))))
(m3 (sup-interval (b2)) (sub-interval (b1)))
(m2 (member (b2)) (class (m1 (lex (day)))))

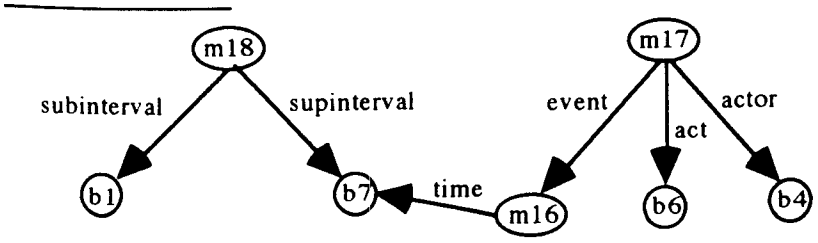
The initial value of *now* is node b1, the current day is represented by node b2, and the current week is represented by node b3.

Reading the accomplishment sentence, *John entered the office at three o'clock in the afternoon*, adds the following assertions to the network:

(m35 (sup-interval (b8)) (sub-interval (b12)))
(m34 (duration (m33 (lex (epsilon)))) (after (b12)) (before (b9)))
(m32 (sup-interval (b8)) (sub-interval (b9)))
(m31 (duration (b11)) (after (b9)) (before (b1)))
(m30 (sup-interval (b2)) (sub-interval (b10)))
(m29 (sup-interval (b10)) (sub-interval (b8)))
(m28 (member (b10)) (class (m27 (lex (afternoon)))))
(m26 (event (m25 (time (b9))))
(act (m23 (object (b5)) (predicator (m19 (lex (enter))))))
(actor (b4)))
(m24 (class (m13 (lex (accomplishment))))
(member (m23 (object (b5)) (predicator (m19 (lex (enter)))))))
(m22 (class (m21 (hour (m20 (lex (three)))))) (member (b8)))

Notice that the system assumes that the afternoon referred to in this sentence is the afternoon (node b10) of the current day (node b2). Three o'clock is represented by node b8. This sentence causes the now-point to be updated to a time (node b12) during three o'clock.

Reading the stative sentence, *The secretary was busy*, adds the following assertions to the network:



Node labels that appear in more than one expression represent the same node in each expression.

```
(m43 (sup-interval (b14)) (sub-interval (b12)))
(m42 (event (m41 (time (b14)))) (property (m38 (lex (busy)))) (object (b13)))
(m40 (class (m39 (lex (state)))) (member (m38 (lex (busy)))))
(m37 (member (b13)) (class (m36 (lex (secretary)))))
```

Since the now-point is not changed, the system understands the secretary to be busy at three o'clock.

Reading the progressive accomplishment sentence, *The secretary was typing a letter*, adds the following assertions to the network:

```
(m52 (sup-interval (b17)) (sub-interval (b12)))
(m51 (event (m50 (time (b17)))) (act (b16)) (actor (b13)))
(m49 (sub-act (b16))
   (act (m47 (perf-object (b15)) (predicator (m44 (lex (type)))))))
(m48 (class (m13 (lex (accomplishment))))
   (member (m47 (perf-object (b15)) (predicator (m44 (lex (type)))))))
(m46 (member (b15)) (class (m45 (lex (letter)))))
```

Again, the now-point is not changed and so the secretary is understood to be in the process of typing the letter at three o'clock.

Reading the activity sentence with a duration, *John waited for ten minutes*, adds the following assertions to the network:

```
(m66 (sup-interval (b10)) (sub-interval (b21)))
(m65 (duration (m33 (lex (epsilon)))) (after (b21)) (before (b19)))
(m64 (sup-interval (b10)) (sub-interval (b19)))
(m63 (duration (b20)) (after (b19)) (before (b12)))
(m62 (has-duration (b19))
   (duration (m56 (quantity (m55 (lex (ten)))) (unit (m54 (lex (minute)))))))
(m61 (initial-sub-interval (b19)) (sup-interval (b18)))
(m60 (event (m59 (time (b18)))) (act (m53 (lex (wait)))) (actor (b4)))
(m58 (class (m57 (lex (activity)))) (member (m53 (lex (wait)))))
```

This time, the now-point is moved to node b21. Notice that the event is assumed to have taken place during the current afternoon but not during three o'clock.

Reading the accomplishment sentence, *John left the office*, adds the following assertions to the network:

```
(m75 (sup-interval (b10)) (sub-interval (b24)))
(m74 (duration (m33 (lex (epsilon)))) (after (b24)) (before (b22)))
(m73 (sup-interval (b10)) (sub-interval (b22)))
(m72 (duration (b23)) (after (b22)) (before (b21)))
(m71 (event (m70 (time (b22))))
   (act (m68 (object (b5)) (predicator (m67 (lex (leave))))))
   (actor (b4)))
```

(m69 (class (m13 (lex (accomplishment))))
(member (m68 (object (b5)) (predicator (m67 (lex (leave)))))))

The now-point is moved to node b24. The leaving also takes place during the current afternoon.

Reading the achievement sentence, *On Thursday John returned in the morning*, adds the following assertions to the network:

(m96 (sup-interval (b29)) (sub-interval (b33)))
(m95 (duration (m33 (lex (epsilon)))) (after (b33)) (before (b31)))
(m94 (sup-interval (b29)) (sub-interval (b31)))
(m93 (duration (b32)) (after (b31)) (before (b27)))
(m92 (final-sub-interval (b31)) (sup-interval (b30)))
(m91 (sup-interval (b29)) (sub-interval (b27)))
(m90 (sup-interval (b25)) (sub-interval (b29)))
(m89 (event (m88 (time (b30)))) (act (m83 (lex (return)))) (actor (b4)))
(m87 (class (m86 (lex (achievement)))) (member (m83 (lex (return)))))
(m85 (member (b29)) (class (m84 (lex (morning)))))
(m82 (sup-interval (b25)) (sub-interval (b27)))
(m81 (duration (b28)) (after (b27)) (before (b24)))
(m80 (sup-interval (b3)) (sub-interval (b25)))
(m79 (duration (b26)) (after (b25)) (before (b2)))
(m78 (member (b25)) (class (m77 (lex (Thursday)))))
(m76 (member (b25)) (class (m1 (lex (day)))))

The system assumes that the Thursday referred to in this sentence is the Thursday of the current week. Also, because the sentence is in a nonperfect past tense, the system assumes that this Thursday is later in the week than the unnamed day during which the previously described events occurred. Therefore, the now-point (node b33) is updated to the morning (node b29) of this Thursday (node b25).

Reading the accomplishment sentence, *The secretary gave John a check*, adds the following assertions to the network:

(m107 (sup-interval (b29)) (sub-interval (b37)))
(m106 (duration (m33 (lex (epsilon)))) (after (b37)) (before (b35)))
(m105 (sup-interval (b29)) (sub-interval (b35)))
(m104 (duration (b36)) (after (b35)) (before (b33)))
(m103 (event (m102 (time (b35))))
(act (m100 (recipient (b4)) (object (b34)) (predicator (m97 (lex (give))))))
(actor (b13)))
(m101 (class (m13 (lex (accomplishment))))
(member (m100 (recipient (b4)) (object (b34)) (predicator (m97 (lex (give)))))))
(m99 (member (b34)) (class (m98 (lex (check)))))

This event is assumed to have occurred on Thursday morning.

Reading the achievement sentence, *On the following Tuesday John returned to the office*, adds the following assertions to the network:

```
(m125 (sup-interval (b39)) (sub-interval (b45)))
(m124 (duration (m33 (lex (epsilon)))) (after (b45)) (before (b43)))
(m123 (sup-interval (b39)) (sub-interval (b43)))
(m122 (duration (b44)) (after (b43)) (before (b40)))
(m121 (final-sub-interval (b43)) (sup-interval (b42)))
(m120 (event (m119 (time (b42))))
   (act (m117 (to (b5)) (predicator (m83 (lex (return))))))
   (actor (b4)))
(m118 (class (m86 (lex (achievement))))
   (member (m117 (to (b5)) (predicator (m83 (lex (return)))))))
(m116 (sup-interval (b39)) (sub-interval (b40)))
(m115 (duration (b41)) (after (b40)) (before (b37)))
(m114 (class (m1 (lex (day)))) (member (b39)))
(m113 (sup-interval (b38)) (sub-interval (b39)))
(m112 (member (b39)) (class (m111 (lex (Tuesday)))))
(m110 (after (b38)) (duration (m108 (lex (zero)))) (before (b3)))
(m109 (member (b38)) (class (m4 (lex (week)))))
```

The now-point (node b45) is updated to during the Tuesday (node b39) of the following week (node b38).

Reading the achievement sentence, *John had lost the check on the previous afternoon*, adds the following assertions to the network:

```
(m138 (sub-interval (b49)) (sup-interval (b47)))
(m137 (duration (b50)) (after (b45)) (before (b49)))
(m136 (final-sub-interval (b49)) (sup-interval (b48)))
(m135 (event (m134 (time (b48))))
   (act (m132 (object (b34)) (predicator (m126 (lex (lose))))))
   (actor (b4)))
(m133 (class (m86 (lex (achievement))))
   (member (m132 (object (b34)) (predicator (m126 (lex (lose)))))))
(m131 (sup-interval (b46)) (sub-interval (b47)))
(m130 (member (b47)) (class (m27 (lex (afternoon)))))
(m129 (sup-interval (b38)) (sub-interval (b46)))
(m128 (before (b46)) (duration (m108 (lex (zero)))) (after (b39)))
(m127 (member (b46)) (class (m1 (lex (day)))))
```

The afternoon referred to is the afternoon (node b47) of the day (node b46) immediately before the current day (node b39). Both the use of the past perfect tense and this type of adverbial indicate that this event occurred in the story-past. Consequently, the now-point is not changed.

SUMMARY

In this chapter, we examined some of the major issues involved in understanding the temporal structure of narratives. Central to our discussion were the concepts of the *narrative now-point* and a *narrative-line*. The *narrative now-point* is a special Reference Time, used to represent the present moment within the story. Much of the analysis of how different event-types, tenses, aspects, and time adverbials function within a narrative concerns their interaction with, and effect on, this now-point. We define a *narrative-line* as a stretch of narrative controlled by, or within the scope of, a single now-point. By restricting ourselves to basic "well-behaved" narratives, we are able to define and implement a simple set of general rules for extracting the temporal structure of a story from a narrative.[2]

[2]My representations for different event types have changed since the work reported in this chapter was done. These more recent representations are described in Almeida (1989, 1992).

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