# Semantic Partition and the Ambiguity of Sentences Containing Temporal Adverbials

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**Abstract**

The ambiguity of sentences such as (i) has been explained both in terms of an ambiguity of the *for*-phrase (Dowty, 1979) and in terms of an effect of the perfect (Kamp & Reyle, 1993):

(i) Mary has lived in Amsterdam for three years.

I argue against these approaches, showing that this ambiguity is also present in sentences in the simple tenses, and that a unified treatment of *for* (as well as other temporal adverbials) is possible once it is recognised that temporal adverbials are interpreted differently depending on their syntactic position. Rather than attributing the ambiguity of such sentences to an ambiguity of the adverbial, I argue that the interpretation of a sentence with a temporal adverbial is affected by the partition of the sentence into two portions which are interpreted as parts of different semantic correlates, much like Topic/Comment, Antecedent/Anaphor and Background/Focus constructions. Finally, I discuss how a treatment of "semantic par-

tition" such as that of Diesing (1992) can be extended to temporal adverbials and I provide details of how this treatment can be spelled out in Discourse Representation Theory (Kamp 1981, Heim 1982).

It has often been noted that sentences such as (1) are ambiguous:

(1) Mary has lived in Amsterdam for three years.

Sentence (1) has a reading in which there is some three-year interval in the past during which Mary lived in Amsterdam, and a reading in which Mary lives in Amsterdam at speech time and has done so for the three years preceding speech time. The ambiguity of such sentences has been explained both in terms of an ambiguity of the *for*-phrase (Dowty, 1979) and in terms of an effect of the perfect (Kamp & Reyle, 1993). I will argue against these approaches, showing that this ambiguity is also present in sentences in the simple tenses, and that a unified treatment of English *for* (as well as other temporal adverbials in English) is possible once it is recognised that temporal adverbials are interpreted differently depending on their syntactic position. Rather than attributing the ambiguity of such sentences to an ambiguity of the adverbial, I will argue that the interpretation of a sentence with a temporal adverbial is affected by the partition of the sentence into two portions which are interpreted as parts of different semantic correlates, much like Topic/Comment, Antecedent/Anaphor and Background/Focus constructions, and I will provide details of how this treatment can be spelled out in Discourse Representation Theory (Kamp 1981, Heim 1982).

Partee (1993) argues that the interpretation of these partitions can be formulated in terms of a tripartite structure consisting of an operator, a restrictor and a nuclear scope. The creation of such a structure is described by Diesing (1992) as involving a "tree-splitting" operation in which the syntactic tree is divided into two parts (and a quantifier), and the two parts of the tree are interpreted in different semantic correlates. Regarding temporal adverbials, I will argue that the reading of (1) in which Mary lives in Amsterdam at speech time and has done so for the three years preceding speech time is associated with sentence-level attachment of the adverbial, while the other reading, in which there is some three-year interval preceding speech time during which Mary lived in Amsterdam, is associated with VP-level attachment of the adverbial. This is not because *for* itself is ambiguous, but because in the mapping from syntax to semantics the higher portion of the tree is treated differently from the lower portion; with a sentence-level *for*-phrase the three-year interval must be interpreted as a particular interval and with a VP-level *for*-phrase the interval can be interpreted as any three-year interval in the past. This solution also explains why, in a sentence such as (2) in which the adverbial must be syntactically in the higher portion of the tree, the only reading available is the one in which Mary still lives in Amsterdam at speech time:

(2) For three years Mary has lived in Amsterdam.

I will begin by discussing the alternative proposals in more detail. I will then describe the relevant data and provide a test that shows that a sentence with a temporal adverbial is ambiguous in the simple tenses as well as the perfect tenses, and that this ambiguity is common to all adverbials of this sort. I will discuss the independently motivated idea that in the syntax-semantics interface the syntactic tree is split in two, and the two portions of the tree are interpreted as part of different semantic correlates. I will then relate the ambiguity associated with the temporal adverbials to the tree-splitting hypothesis, showing that temporal adverbials can appear in two syntactic positions, and that when they are attached in the higher syntactic position one reading of the sentence appears, while when they are attached in the lower syntactic position the other reading appears. My conclusion, therefore, will be that temporal adverbials should be included in the class of phenomena whose interpretation involves semantic partition.

# 1 Existing Treatments

## 1.1 A Montague Grammar approach

In (Dowty, 1979), Dowty gives the first comprehensive treatment of aspect within formal semantics, building on Montague's (1973) system. He also proposes a treatment for the ambiguity of sentences such as (1). He begins by giving a translation for *for* which indicates that the eventuality expressed by a sentence has a duration expressed by the NP object of the *for*-phrase. This gives sentence (3a) the translation in (3b):

(3) a. John slept for an hour.

b. $\exists t_1[\mathrm{PAST}(t_1) \wedge \text{an-hour}'(t_1) \wedge \forall t_2[t_2 \subseteq t_1 \rightarrow \mathrm{AT}(t_2, \text{sleep}'(j))]]$

Translation (3b) states that there is a one-hour interval $t_1$ in the past and that for all subintervals $t_2$ of $t_1$ (including $t_1$ itself) it is true that John sleeps.

Dowty points out that the reading described by his translation for *for* is not the only reading that a sentence with a *for*-phrase can have, however, discussing ambiguous examples such as (1), repeated below:

(4) Mary has lived in Amsterdam for three years.

Because of this observation, Dowty proposes that *for*-phrases (as well as *since*- and *in*-phrases, which also exhibit two readings, he observes) are ambiguous, and introduces an additional translation for *for* which captures the reading in sentences such as (2), in which the eventuality is still under way at speech time.[1]

Dowty then notes the following:

> The tactic of appealing to a double categorisation of *for*-adverbials admittedly looks rather ad hoc. But let it be noted that this tactic (or an equivalent one) is needed for other adverbials as well (p. 345-6).

He gives the example below, which is ambiguous between a reading in which it was taking John five minutes to solve the puzzle and one that can be paraphrased by *Five minutes later, John* *was solving the puzzle:*

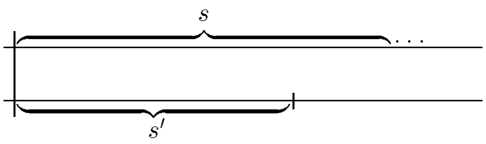
(5) John was solving the puzzle in five minutes.

Although a unified treatment of *for* is preferable, Dowty sees a double categorisation of *for* as unavoidable. However, it is possible to treat *for* as unambiguous, and I will propose such a treatment here.

## 1.2 Adverbials in Discourse Representation Theory

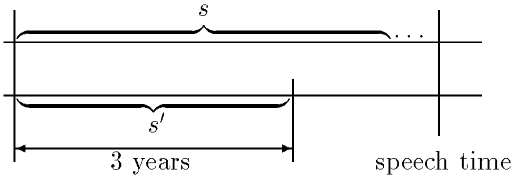
Kamp & Reyle (1993) claim that the ambiguity of (1) is due to the presence of the perfect tense. (See Mittwoch (1988) for a similar claim.) In Discourse Representation Theory (Kamp, 1981), the eventuality expressed by a sentence is introduced into the discourse. Kamp & Reyle claim that, in addition, the perfect introduces the result state of the eventuality into the discourse. The result state of an event begins when that event ends, but the result state of a state begins as soon as that state begins. For example, as soon as the state $s'$ of Mary living in Amsterdam begins, the result state $s$ in which Mary has lived in Amsterdam begins. This can be illustrated as in (6):

(6)




The reading of (1) in which Mary lived in Amsterdam for some three-year interval in the past can then be illustrated as in (7):

(7)




For the reading of (1) in which Mary lives in Amsterdam for the three years immediately preceding speech time, Kamp & Reyle claim that the *for*-phrase "...combines directly with the perfect (p. 580)." They continue:

> The semantics corresponding to this syntactic structure should be something like this: the perfect describes the result state $s$ as starting at the beginning of the underlying state $s'$ and as lasting for as long as three years, with the proviso that $s'$ has not yet come to an end. As $s$ and $s'$ are concurrent in this case, it is hard to tell whether the *for*-phrase should be seen as characterising $s$ or $s'$. However, we know of no case where a *for*-phrase can be used as characterising the result state described by a perfect. So we assume that again, as in our analysis of the first reading..., *for three hours* [sic] acts as a characterisation of $s'$ (pp. 580-1).

It would be convenient for purposes of explaining the ambiguity if it could be claimed that in one reading the *for*-phrase describes the duration of the eventuality and in the other it combines with the perfect to describe the duration of the result state introduced by the perfect. But Kamp & Reyle realize that this cannot be the case, since this would wrongly predict that the sentence *Mary has eaten for half an hour* would have a reading in which Mary ate half an hour ago and therefore, for half an hour, has been in the state of having eaten. They conclude that the *for*-phrase must describe the duration of the eventuality $s'$ in both readings. However, this is the same analysis illustrated in (7) except for the proviso that $s'$ has not come to an end at speech time. Their solution, therefore, is that the perfect gives two readings which are identical except that in one of them the eventuality $s'$ hasn't yet ended at speech time.

The problem of giving a semantics for this proviso, which is a difficult matter in itself, is complicated by the fact that the ambiguity appears in the simple tenses as well as in the perfect tenses, as I will show. As a result, the source of the proviso must be reconsidered. In the next section I will describe the simple tense data, and I will lead into my approach to the problem.

## 2 The simple tense data

Ultimately I will argue that a temporal adverbial may appear at sentence-level or at VP-level, and that its syntactic position affects its interpretation. In order to recognise this effect of position on interpretation, it is crucial to recognise that a sentence with a temporal adverbial is indeed ambiguous in the simple tenses as well as in the perfect. The purpose of this section is to describe the two readings associated with each adverbial in simple future tense sentences and to introduce a test for the presence of these readings. There are exceptions to the generalisations I will make about these readings; I will discuss these exceptions in Section 2.2 and propose a treatment for all the data in Section 4.

Reichenbach's (1947) treatment of tense now becomes relevant to this discussion, so I will briefly review it here. Reichenbach proposes to represent tense in terms of temporal relations between three time points: the point of event $E$ (the time at which the event occurs), the speech time $S$ (the time at which the sentence is spoken), and the point of reference $R$. In the past perfect sentence below, for example, $E$ is the point at which John's boss asks him to phone in, $S$ is the time the sentence was spoken, and $R$ is the point from which the event of John's boss asking him to phone in is viewed, namely the time that John picks up the phone:

(8) John picked up the phone. His boss had asked him to phone in.

The function of the past perfect here is to situate the event of asking prior to the event of John's picking up the phone, which, in turn, is prior to speech time. In contrast, in the simple past sentence of (8) the eventuality of John's picking up the phone precedes $S$ but the time from which the event is viewed, $R$, is considered to be simultaneous with $E$. The translations proposed by Reichenbach for the tenses of English are below, where "x_y" means that $x$ precedes $y$, and "x,y" means that $x$ and $y$ are simultaneous:

(9) Simple past: R,E__S

Simple future: S,R__E

Simple present: S,R,E

Present perfect: E__S,R

Past perfect: E__R__S

Future perfect: S__E__R

I will refer to these as **tense templates**. In general, the perfect forces $E$ to precede $R$. In the simple past, simple present and present perfect tenses $R$ is simultaneous with either $S$ or $E$, and therefore these tenses are represented with tense templates having only two distinct time points. Whether $R$ is simultaneous with $S$ or $E$ in these templates is important for the interpretation of temporal adverbials, as we shall see.

(Reichenbach actually suggests that the translation for the simple future tense is ambiguous between **S,R__E** and **S__R,E**, but he adds the latter translation to deal with sentences containing the temporal adverbs *now* and *tomorrow*. I agree that temporal adverbials affect the order of $S$, $R$ and $E$ (and I in fact argue in Hitzeman (1993) that other changes are possible), but without adverbs the basic translations in (9) are sufficient. In addition, the fact that the readings associated with the type of temporal adverbial I discuss here interact with the translations in (9) (as we shall see) is additional evidence that these are the appropriate translations for sentences without adverbs, and that it is the adverb that affects the translation rather than the translation itself that is ambiguous.)

## 2.1 The ambiguity

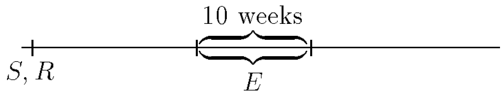
Consider the following examples of *in*-phrases:

(10) a. Smith & Co. will build a bridge in ten weeks.

b. In ten weeks Smith & Co. will build a bridge.

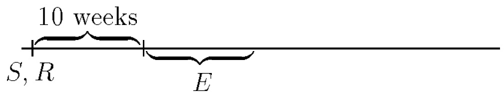
Sentence (10a) has two readings. The first reading is one in which it takes ten weeks for the bridge to be built, as illustrated in (11):

(11)




The only known relationship between $E$ and $S$ is that $E$ is some time after $S$ (=$R$), as indicated by the future tense. The second reading of (10a) is one in which ten weeks pass before Smith & Co. begin building the bridge, as illustrated in (12):

(12)




The reading in (12) is the only reading available when the adverbial is in initial position, as in (10b). An initial description of the generalization concerning the readings of a sentence with a temporal adverbial which I will argue for is that one reading places more constraints on the time of $E$. The phrase *ten weeks* in the readings illustrated in (11a) can refer to any ten week interval after $R$, while, in its interpretation in (12), it is constrained so that it must refer to the ten-week interval beginning at $R$. Of course, in the simple future tense R=S, so it is not clear from these data whether it is R involved here or S. In section 2.3 I will show that it is R rather than S that is important here, but for the moment I will allow for both possibilities.

I will adopt Klein's (1992) term **position-definite (p-definite)** to refer to an NP when (in appropriate context) its content fixes the position of a time span on the time axis as in (12), and I will call it **non-p-definite** when it is interpreted as expressing a time span whose position on the timeline is vague, as illustrated in (11) — We know that the NP refers to a ten-week interval after $S$, but we don't know the exact position of this interval, so it could be any one of an infinite set of such intervals (constrained, of course, by factors such as context and world knowledge). For example, *2:00 P.M. on January 9, 1983* is p-definite regardless of context since it refers to a particular time on the time axis, and expressions such as *yesterday* are p-definite in a context where the day of the utterance is known. I will add to this the definition of **optionally p-definite** to refer to expressions such as *Sunday*, which are p-definite when referring to a particular Sunday in sentences such as (13a) but which can also appear in sentences with a habitual interpretation such as (13b), in which *Sunday* refers not to a p-definite Sunday but to a series of non-p-definite Sundays:

(13) a. John went to the library on Sunday.

b. John often goes to the library on Sunday.

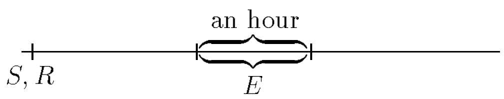
Measure terms are also optionally p-definite: *two hours* can refer to any two-hour period or to a particular two-hour period. To see the ambiguity in a sentence with a temporal adverbial, it is crucial that the NP object of the adverbial be optionally p-definite; only with such an object can the sentence have both a p-definite and a non-p-definite reading.

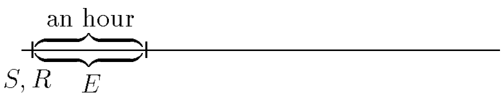
A similar contrast can be found with *for*-phrases:[2]

(14) a. Martha will be in her office for an hour.

b. For an hour Martha will be in her office.

Sentence (14a) has both a non-p-definite reading in which Martha will be in her office for some unspecified hour in the future and a p-definite reading in which Martha will be in her office for the hour beginning at $R$ (=$S$). These readings are illustrated in (15) and (16), respectively:

(15) 


(16) 


As with *in*, when the adverbial is in initial position the non-p-definite reading is unavailable; the only available reading of sentence (14b) is that Martha will be in her office for an hour beginning at $R$ (=$S$). The contrast is more clearly seen when the presence of another adverbial forces the non-p-definite reading, as below:

(17) a. Martha will be in her office for an hour one day next week.

b. Martha will be in her office one day next week for an hour.

c. #For an hour Martha will be in her office one day next week.

d. #One day next week for an hour Martha will be in her office.

The phrase *one day next week* moves the one-hour interval into the future so that the p-definite reading, in which the one-hour interval begins at $R$ (=$S$), is ruled out. The awkwardness of the sentence when the *for*-phrase is in initial position, as in (17c) and (d), shows that the non-p-definite reading is incompatible with the *for*-phrase in this position. I will use the acceptability of phrases such as *one day next week*, *once* and *some day* as tests for the non-p-definite reading.

*In*-phrases can have a different type of reading with certain objects, such as *1993*:

(18) The World Trade Center was bombed in 1993.

These *in*-phrases are similar to *on*- and *during*-phrases in that they give the interpretation that the eventuality is included in the time expressed by their NP object. I will call these the **inclusive** readings because they are characterised by the eventuality's inclusion within some temporal interval. These adverbials also each give a sentence two readings, one of which is unavailable when the adverbial is in initial position. To see this contrast it is again crucial to use a prepositional object that is optionally p-definite, such as *the summer*. The following examples show the contrast in readings and the difference in the ways that an optionally p-definite NP can be interpreted:

(19) a. John will live in Brooklyn in the summer.

b. In the summer John will live in Brooklyn.

(20) a. Chris will get a phone call during the 11:00 news.

b. During the 11:00 news Chris will get a phone call.

(21) a. The rain will begin on Saturday.

b. On Saturday the rain will begin.

Sentence (19a) has a reading in which John will live in Brooklyn in the summer most closely following $R$ (=$S$) and a reading in which there is a summer in the future during which John will live in Brooklyn which can be any summer in the future. Only the former, p-definite reading is available when the adverbial is in initial position as in (19b). Evidence for this is that the phrase *some day* is acceptable in (19a) but not (19b):

(22) a. John will live in Brooklyn in the summer some day.

b. #In the summer John will live in Brooklyn some day.

*At*-, *after*- and *before*-phrases relate the time of the eventuality to a point or interval in time. Like the adverbial phrases headed by *in* and *for*, they have two readings when their object is optionally p-definite:

(23) a. Martha will be in her office at noon.

b. At noon Martha will be in her office.

(24) a. Leslie will be in Boston before noon.

b. Before noon Leslie will be in Boston.

(25) a. Leslie will be in Boston after noon.

b. After noon Leslie will be in Boston.

In the specific reading of (23a) the eventuality is interpreted as occurring at the noon most closely following $R$ (=$S$) (or, more precisely, that *noon* is included in the time at which the eventuality occurs), and in the other reading it is a non-p-definite noon. Only the former reading is available when the adverbial is in initial position as in (23b), as can be seen by the unacceptability of the phrase *one day next week* when the adverbial is in initial position:

(26) a. Martha will be in her office at noon one day next week.

b. #At noon Martha will be in her office one day next week.

(27) a. Leslie will be in Boston before noon one day next week.

b. #Before noon Leslie will be in Boston one day next week.

(28) a. Leslie will be in Boston after noon one day next week.

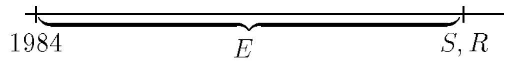
b. #After noon Leslie will be in Boston one day next week.

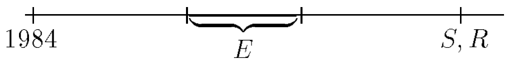
Finally, *since*-phrases exhibit a different set of inclusive readings. There is a p-definite reading of the sentences in (29), which can be paraphrased with "ever since," in which John has lived in Boston for the entire interval between 1984 and $R$ (=$S$), and there is a non-p-definite reading of (29a) in which there was an instance of John living in Boston between 1984 and $R$ (=$S$), say for June of 1989.

(29) a. John has lived in Boston since 1984.

b. Since 1984 John has lived in Boston.

The p-definite reading, illustrated in (30), is available whether the adverbial is in initial or final position, but the non-p-definite reading, illustrated in (31), is only available when the adverbial is in final position.

(30) 


(31) 


The non-p-definite reading is possible with telic eventualities as well, as in *John has changed the oil since his last trip west.*

Like the other adverbials, *since* has two readings, one of which is lost when the adverbial is in initial position. Also like the other adverbials, in one of these readings the eventuality is understood to occur at a particular interval and in the other reading the eventuality is understood to occur at an interval whose position is left vague. More precisely, in the p-definite reading the eventuality is understood to occur at the interval between $R$ (=$S$) and the time expressed by the NP object of *since*, while in the non-p-definite reading the eventuality is understood to occur at some interval included within the interval between $R$ (=$S$) and the time expressed by the NP object of *since*. *Since* is unusual among temporal adverbials in English because reference time $R$ is always part of its interpretation. Because of this, the test suggested above for distinguishing between the p-definite and non-p-definite readings is not useful with *since*; adding an additional adverbial to move the eventuality away from reference time is semantically impossible.

## 2.2 Apparent exceptions to the generalization

The non-p-definite reading is possible in **generic** sentences (Carlson, 1980) and sentences with a modal operator when the adverbial is in initial position:[3]

(32) a. In one hour Americans consume five million gallons of fuel.

b. In six minutes Martha could gap all twelve plugs.

The simple present tense gives (32a) a generic interpretation, and the modal *could* indicates that (32b) is also a generic sentence. Generic sentences such as these appear to be exceptions to the generalization that an adverbial in initial position causes the eventuality to be interpreted as occurring at a p-definite time. This is not the case, however; these data can be explained by the treatment of temporal adverbials I describe in Section 4. More specifically, I will show how Diesing's (1992) Mapping Hypothesis provides a way of distinguishing between the manner in which generic and non-generic sentences are semantically interpreted.

Another apparent exception is that the non-p-definite reading is available when the adverbial is in initial position if there's a scalar predicate associated with the event, such as *flat*, *only* or *entire*:

(33) In 10 seconds flat/only ten seconds John put the whole puzzle together.

b. In five seconds Floyd ate the entire apple.

In Section 4 I will argue that expressions such as these are similar to case marking in Turkish objects which signals whether the NP is to be interpreted as specific or nonspecific, and can be incorporated into my treatment by means of the same analysis suggested by Enç (1991) and Diesing for the Turkish data.

I will now set these examples aside until the treatment described in Section 4 shows us how they fit with the generalisations concerning the other data we have been discussing.

## 2.3 The role of time deixis

We've observed that, in general, adverbials have a p-definite reading and a non-p-definite reading, and the non-p-definite reading is lost when the adverbial is in initial position, but all that's been said concerning the difference between the p-definite and non-p-definite readings is that the p-definite reading places more constraints on the time of the eventuality. How can the p-definite reading be more precisely defined so as to make explicit the relationship it expresses between the time of the eventuality and $R$ (=$S$)? Taking a simple future tense sentence with a *for*-phrase such as *Mary will be in the office for an hour* the generalization seems to be that the hour must start at $R$ (=$S$). In a present perfect example such as *Mary has been in her office for an hour*, however, the hour is understood to end at $R$ (=$S$). In the p-definite reading of inclusive *in* in a simple future sentence such as *In the summer John will go to Boston*, the summer doesn't begin or end at $R$ (=$S$), but is the summer most closely following $R$ (=$S$).

The best generalization that can be formed concerning the p-definite reading at this point is that the temporal position of the eventuality is definite with respect to $R$ (=$S$). Here we can make use of the notion of **time deixis**, which involves interpreting a temporal expression relative to the context of the utterance. For example, the expression *yesterday* must be interpreted relative to speech time, i.e., *yesterday*, uttered on Day X, can only be used to mean *the day before Day X*. When an expression is interpreted relative to a contextually available time such as $S$ or $R$ as it is in the p-definite reading, I will say that it is **interpreted indexically** with respect to that time.

The notion of indexical interpretation is useful for all the adverbials but *since*: The *since*-phrase describes an interval beginning at (the last moment of) the time expressed by the adverbial's NP object and ending at speech time. In the p-definite ("ever since") reading the eventuality is understood to occur during this entire interval, and in the non-p-definite reading the eventuality is interpreted as occurring at some unspecified time within the interval. For *since*, therefore, the NP object is always interpreted as p-definite, although the time at which the eventuality occurs is optionally p-definite. It is possible, as Kamp suggests,[4] that *since* ought to be treated separately. However, although my definition is inadequate to describe the readings of *since*, the fact that *since* fits the pattern of having a p-definite and a non-p-definite reading and that the latter reading is lost when the adverbial is in initial position leads me to believe that *since* should be grouped with the other adverbials. Having no further suggestions to make in this matter, I will set *since* aside. The generalization that is important for the treatment I present in Section 4 is that the reading which is lost when the adverbial is in initial position is one in which the time at which the eventuality occurs is non-p-definite.

### 2.4 Summary

In this section I have described the types of readings a sentence containing a temporal adverbial can have. In general, there are two readings for each adverbial, one of which is unavailable when the adverbial is in initial position. The reading that is unavailable when the adverbial is in initial position is one in which the eventuality is interpreted as occurring at a non-p-definite time. When I present my final proposal in Section 4, I will use these observations to argue that these readings are associated with different syntactic positions of the adverbial. I also introduced the notion of position-definiteness (p-definiteness) which will be useful in identifying optionally p-definite NP objects, which allow both readings of a sentence with a temporal adverbial to appear, and I made the notion of p-definiteness more precise by arguing that in the p-definite reading the time at which the eventuality occurs is interpreted indexically with respect to $R$ (=$S$).

## 3 The effect of tense

Having shown that each adverbial is associated with two types of readings, I will now discuss the effect of tense on these readings and on the acceptability of a sentence with a temporal adverbial. The questions addressed in this section are as follows:

- In the p-definite reading, is the time at which the eventuality occurs interpreted indexically with respect to $R$ or $S$? For example, in the p-definite reading if *John will be in the garden* *at noon*, is *noon* interpreted as the noon most closely following $R$ or $S$? This is an important question if we want to generalise over all tenses.

- If a sentence with a temporal adverbial is generally ambiguous, why isn't this true of present perfect sentences which are either unambiguous (e.g., *John has lived in Boston in the summer*) or unacceptable (e.g., *#On Tuesday John has left*)?

(Note that when interpreting the data in this section it is important to avoid a generic or habitual interpretation, which would change the character of the interpretation of the adverbial. See Sections 2.2 and 4.4 for discussion.)

**Simple Past**

The simple future tense sentences in Section 2 showed that the p-definite reading is one in which the eventuality is constrained to occur at a time that stands in a certain relationship with either $R$ or $S$, which are equivalent in Reichenbach's tense template for the simple future tense. The simple past data gives support to the hypothesis that it is $R$ rather than $S$ that is relevant to the p-definite reading.

Native speaker intuitions are that there is only one reading of a simple past tense sentence with a temporal adverbial:

$$\text{(34)}\quad \text{Mary swam} \left\{ \begin{array}{l} \text{for an hour} \\ \text{until noon} \\ \text{in the summer} \\ \text{during the winter} \\ \text{on Tuesday} \\ \text{at noon} \\ \text{before noon} \\ \text{after noon} \end{array} \right.$$

However, tests show that there is a different interpretation for a sentence with the adverbial in initial position than when it is in final position. Evidence that the non-p-definite reading is present in the examples in (34) is that they are acceptable with the expression *once*, which forces the time the eventuality occurs to be non-p-definite:

$$\text{(35) Mary swam} \left\{\begin{array}{c}\text{for an hour}\\ \text{until noon}\\ \text{in the summer}\\ \text{during the winter}\\ \text{on Tuesday}\\ \text{at noon}\\ \text{before noon}\\ \text{after noon}\end{array}\right\} \text{once.}$$

The non-p-definite reading is unavailable when the adverbial is in initial position, as shown by the unacceptability of the expression *once* in these sentences:

$$\text{(36)} \quad \left.\begin{array}{l}\text{For an hour}\\ \text{Until noon}\\ \text{In the summer}\\ \text{During the winter}\\ \text{On Tuesday}\\ \text{At noon}\\ \text{Before noon}\\ \text{After noon}\end{array}\right\} \text{Mary swam (\#once).}$$

In contrast to the simple future tense examples, the p-definite reading for the simple past tense is not one in which the eventuality stands in a certain relationship to $S$; the hour in *For an hour Mary swam* is an hour in the past that does not intersect with $S$. The NP object of the adverbial is interpreted indexically in the p-definite reading of a simple past tense sentence as it is in a simple future sentence, however, as the awkwardness of the sentences with *once* in (36) shows. One possibility is that the indexical interpretation is done with respect to $R$ rather than $S$. Note that while Reichenbach assigns future tense the tense template **S,R__E**, he assigns past tense the template **E,R__S**, so that $S$ and $R$ are equivalent in future tense but not in past tense. If we assume $R$ to be used in the indexical interpretation of the NP objects of the adverbials in (36) rather than $S$, we correctly predict the interpretation that the time at which the eventuality occurs is in the past but does not intersect with $S$. From this point on I will assume that the type of indexical interpretation relevant for temporal adverbials is done with respect to $R$.

**Past perfect**

The past perfect data reconfirm the generalisation that the non-p-definite reading is lost when the adverbial is in sentence-initial position, and that the p-definite reading is one in which the NP object of the adverbial is interpreted indexically with respect to $R$. The p-definite reading is one in which the final point of the interval on which the eventuality occurred is $R$, as in the sentences in (37):

(37) a. Mary had lived in Boston for six years. She began to consider a move.

b. Sarah had felt confident about her knowledge of ancient Greek until the exam.

The non-p-definite reading in the past perfect is one in which at some non-p-definite interval before $R$ the eventuality occurred:

(38) $\text{Mary had been in Boston} \left\{ \begin{array}{l} \text{for an hour} \\ \text{until noon} \\ \text{in the summer} \\ \text{during the winter} \\ \text{on Tuesday} \\ \text{at noon} \\ \text{before noon} \\ \text{after noon} \end{array} \right.$

This reading can be paraphrased with *once*, as in *Mary had been in Boston for an hour once.*

In keeping with the generalisation concerning the simple tenses, the non-p-definite reading is lost when the adverbial is in initial position:

$$(39)\quad \left.\begin{array}{l}\text{For an hour}\\ \text{Until noon}\\ \text{In the summer}\\ \text{During the winter}\\ \text{On Tuesday}\\ \text{At noon}\\ \text{Before noon}\\ \text{After noon}\end{array}\right\}\ \text{Mary had been in Boston.}$$

The unavailability of the non-p-definite reading is shown by the unacceptability of these examples with *once*, as in *#For an hour Mary had been in Boston once.*

The future perfect data are similar to the data for past perfect, and are discussed in detail in Hitzeman (1993).

### Present perfect

The present perfect differs from the other tenses we have seen in that it (generally) allows no p-definite reading: in the non-p-definite reading for the present perfect sentences below there is an instance of the eventuality at some non-p-definite time in the past. This reading can be forced by the adverb *before*:

$$(40)\quad \text{Mary has swum}\ \left\{\begin{array}{l}\text{for an hour}\\ \text{until noon}\\ \text{in the summer}\\ \text{during the winter}\\ \text{on Tuesday}\\ \text{at noon}\\ \text{before noon}\\ \text{after noon}\end{array}\right\}\ \text{before.}$$

The interpretation for *Mary has swum for an hour before*, for example, is that there was a one-hour interval sometime in the past during which Mary swam.

In *Mary has swum for an hour*, the p-definite reading is one in which Mary has swum for the hour preceding $R$ ($=S$), paraphrased as *Mary has just swum for an hour*. The p-definite reading is difficult for *until*, as shown by the awkward paraphrase #*Mary has just swum until noon.*

Placing the adverbial in initial position results in an unacceptable sentences for all the adverbials except *for*:

(41)
For an hour
#Until noon
#In the summer
#During the winter
#On Tuesday
#At noon
#Before noon
#After noon
John has been in the bathtub.

The unacceptability of the p-definite reading for most adverbials doesn't fit the generalisation we've made for the other tenses, and requires some explanation.

## 3.1 Explaining the present perfect data in terms of time deixis

In terms of their acceptability in various positions, *for* and *until* behave identically except for the p-definite reading in the present perfect tense. This difference can be explained in terms of a difference in the way they specify the time at which an eventuality occurs, as illustrated by the following examples:

(42) a. Martha will be in her office until noon.

b. Martha will be in her office for an hour.

In (42a), *until* indicates that the eventuality occurs on an interval ending at $[\![\textbf{noon}]\!]$, where $[\![\ ]\!]$ is the function that maps an expression onto its denotation. In one reading of (42a), *noon* is p-definite and is indexically interpreted with respect to $R$ ($=S$), so that $[\![\textbf{noon}]\!]$ is the noon most closely following $R$ (=$S$). In the other reading of (42a), *noon* is non-p-definite, so that $[\![\textbf{noon}]\!]$ refers to some noon in the future. The time at which the eventuality begins is unspecified by *until*, but can be specified by the processes controlling narrative progression as in (43) or by context:

(43) Martha will arrive at 10:00. She'll be in her office until noon.

In a simple future tense discourse such as (43) the events are understood to occur sequentially; it is understood that Martha will enter her office just after she arrives and will remain in her office until noon. If we think of an interval as a set of consecutive points on the time axis, the interval during which Martha is in her office can be can be written as a pair of endpoints, **[10:00, noon]**. Because the initial point of the interval is unspecified for sentence (42a), the interval can be written as **[x, noon]**, where **x** is the initial point of the interval and may be specified by context, world knowledge or other factors. In general an *until*-phrase will indicate that an eventuality occurs on the interval $[\mathbf{x},\ (\mathbf{beg}\ [\![\mathbf{NP}]\!])]$, where **beg** is a function returning the initial point of the time denoted by the NP.[5] I will refer to this interval as the **interval template**, and when an endpoint of the interval template is linked to a specific time in the p-definite reading or by the processes controlling narrative progression or other factors, I will say that the interval template has been **instantiated**.

The object of a *for*-phrase expresses not a point but a measured amount of time, so the interval template for *for* is $[\mathbf{x},\ \mathbf{x}+[\![\mathbf{NP}]\!]]$. For example, in (42b) $[\![\mathbf{NP}]\!]$ is an amount of time equal to one hour, and the interval template is therefore **[x, x+1hour]**. If the hour is indexically interpreted with respect to $R$ (=$S$) in the future tense sentence (42b), the interval template is instantiated to become **[R, R+1hour]**. Context or the processes controlling narrative progression may also instantiate the interval template by introducing information concerning when the interval begins or ends, as in (44):

(44) Martha will arrive at 10:00. For an hour she'll be in her office.

The interpretation here is that the hour during which Martha will be in her office begins at 10:00, so the interval template is instantiated as **[10:00, 10:00+1hour]**, or simply **[10:00, 11:00]**.[6]

Recall that the p-definite reading of *until* is unacceptable with the present perfect while the p-definite reading of *for* is acceptable:

(45) a. For several minutes Mary has watched the elephants.

b. #Until noon Mary has been in the bathtub.

The general interval template for *for* is **[x, x+⟦NP⟧]** and the template for *until* is **[x, (beg ⟦NP⟧)]**, so in the examples above the template for *for* is **[x, x+several minutes]** and for *until* is **[x, noon]**. Both *for* and *until* give the interpretation that the eventuality occurs during the interval template (in contrast with adverbials such as *by* and *after* which give the interpretation that the eventuality occurs before or after the template), so the interval template expresses the event time $E$, and, as described by Reichenbach's tense template for the present perfect (**E__S,R**), $E$ precedes $R$ (=$S$). The difference arises in the p-definite reading, when the NP is interpreted indexically with respect to $R$: this reading will cause the final endpoint of each interval template to be equated with $R$, thus giving the interpretation that the eventuality continues (at least) until $R$. Because $R = S$ in present perfect, the eventuality continues (at least) until $S$. For the *for*-phrase, it is not a problem for the interval to end at $S$, but for the *until*-phrase this results in a problem with time deixis. Setting the final endpoint of **[x, noon]** to $S$ means that (45b) is equivalent to (46):

(46) Mary has been in the bathtub until now.

Using *noon* in (45b) instead of *now* leads the hearer to believe that another *noon* is being spoken of. Consider a case in which Mary suggests to John at noon that they go to lunch at noon. The natural interpretation of this suggestion is that she means a noon on another day or that she doesn't know that it is noon. The use of an indexical is necessary in this type of situation, just as it is crucial for me to use the term *me* instead of *Janet* to refer to myself. (This is a pragmatic rather than a semantic problem because in certain limited situations it is possible for *noon* to refer to the current time, as in a case in which Mary is waiting for John, and, knowing it is noon, says to her friend, "He told me he would arrive at noon.")

In conclusion, the differences in the acceptability of *for* and *until* in sentences in the present perfect tense can be accounted for by the difference in their interval templates, causing deictic problems for *until* but not *for*. Consider the other adverbials which were unacceptable in a sentence in present perfect tense:

$$(47)\quad \left.\begin{array}{l} \#\text{In the summer} \\ \#\text{During the winter} \\ \#\text{On Tuesday} \\ \#\text{At noon} \\ \#\text{Before noon} \\ \#\text{After noon} \end{array}\right\} \text{John has been in the bathtub.}$$

Like *until*, instantiating the interval templates for these adverbials causes deictic problems, e.g., *Tuesday* cannot refer to the day on which it is spoken, and the interval template and the present perfect tense combine to produce this pragmatic conflict. Evidence for this explanation is that acceptable sentences can be formed with NPs such as *1989*, which can be referred to "by name" when they are ongoing at speech time. For example, (48) is acceptable when spoken during 1989:

(48) In 1989 John has been repeatedly late to practice.

### 3.2 Summary

The data in Section 2 showed that when an English adverbial of the form [P NP] has an optionally p-definite object it gives a sentence two readings, one of which is lost when the adverbial is in initial position. Section 3 then showed that this generalisation holds for all tenses and that the p-definite reading is one in which the time that the eventuality occurs is indexically determined with respect to $R$. The lack of the p-definite reading for most adverbials in a present perfect sentence was attributed to problems with time deixis related to the interval templates for certain adverbials. I will now propose an explanation of these generalisations in terms of semantic partition.

# 4 A semantic partition solution

As shown in Sections 2 and 3, a sentence with a temporal adverbial has two readings, one of which is lost when the adverbial is in initial position. One way to explain this observation is by claiming that adverbials are ambiguous. The non-p-definite reading for *for an hour* might be analysed as (49):

(49) $\lambda P \lambda x \lambda e$ (dur($e$) = 1 hour) $\wedge$ ($\forall k \in e$ $P(x)(k)$)

The p-definite reading would be the same as the non-p-definite reading with some sort of additional specification that the time at which the eventuality occurs is to be interpreted as p-definite through indexical interpretation with respect to $R$, indicated here by the predicate *Q:*

(50) $\lambda P \lambda x \lambda e$ (dur($e$) = 1 hour) $\wedge$ ($\forall k \in e$ $P(x)(k)$) $\wedge$ Q($e$)

Aside from the fact that it would be difficult to develop a semantics for the predicate $Q$, analysing all adverbials as ambiguous is an uneconomical approach. A preferable explanation would be that temporal adverbials are unambiguous and that the interpretation that the time at which an eventuality occurs is p-definite in (50) is caused by some external factor or factors. This is the type of explanation I will propose here. In particular, I describe how the ambiguity can be explained in terms of semantic partition, by incorporating the observations concerning temporal adverbials into Diesing's (1992) treatment of the different readings of indefinites as a semantic partition phenomenon. With this approach, the ambiguity in a sentence with a temporal adverbial is introduced by the processes mapping syntax onto semantics rather than by ambiguity of the adverbial.

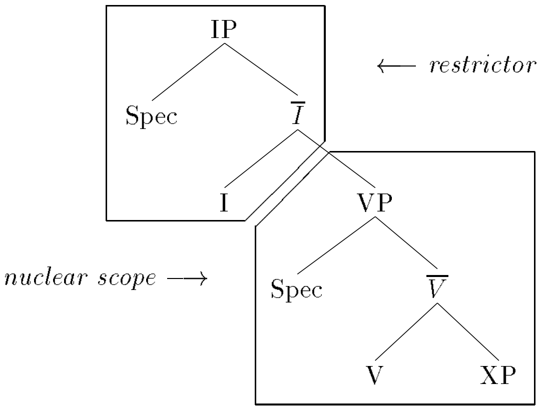
Diesing gives a series of examples in which an NP is interpreted as specific if it is syntactically positioned external to the VP and as nonspecific if it is within the VP. She argues that this semantic partitioning occurs in the mapping from syntax to semantics. I will argue that her Mapping Hypothesis can be extended to temporal adverbials, i.e., when an adverbial is syntactically located external to the VP the time at which the eventuality occurs is interpreted as specific (p-definite), and when the adverbial is attached at VP-level the time at which the eventuality occurs is interpreted as nonspecific (non-p-definite). Finally, I will review the problems discussed in Section 2.2 and discuss how they are eliminated by Diesing's treatment.

## 4.1 The Mapping Hypothesis

*Semantic partition*, the idea that in certain cases a sentence consists of two parts which behave differently semantically, has been used to describe phenomena such as Topic/Comment, Antecedent/Anaphor and Background/Focus constructions. The particular formulation of semantic partition which I will consider here is that of Diesing (1992), who makes an innovative attempt to precisely specify what is involved in the creation of certain of these constructions, focussing on generic sentences and the interpretation of indefinites. In addition to providing an explanation for generalisations made here concerning adverbials, Diesing's formulation of semantic partition explains the exceptions to these generalisations mentioned in Section 2.2 that would be otherwise difficult to explain.

Diesing proposes that there is a mapping procedure that divides the syntactic tree (at the level of LF in languages such as English and at the level of S-structure in languages such as Dutch) into two parts which correspond to two different parts of the semantic representation, and illustrates the syntactic division as follows (p. 9):

(51) *Mapping Hypothesis (tree splitting)*




In the transition from syntax to semantics, items in the IP (=S) area are treated differently from those in the VP area: when an operator such as the generic operator is present, items in the IP area are mapped into the restrictor clause of that operator and are bound by it and items in the VP area are mapped into the nuclear scope and are bound by existential closure. This split is also responsible for cases in which, there being no operator present, items in the IP area are interpreted as specific and items in the VP area are interpreted as nonspecific. After describing some of Diesing's motivation for the Mapping Hypothesis, I will argue that temporal adverbials can appear syntactically at sentence-level or at VP-level at LF, and that the Mapping Hypothesis affects the interpretation of a sentence with an adverbial so that when an adverbial is at sentence-level the time at which the eventuality occurs is p-definite, and when the adverbial is at VP-level the time at which the eventuality occurs is non-p-definite.

Diesing gives quite a bit of evidence for the tree-splitting operation, including Reuland's (1988) observations concerning Dutch subjects and Enç's (1991) observations concerning Turkish objects. The following examples are from Reuland:

(52) a. Fred denkt dat [$_{IP}$ twee koeien op het dak liggen].
Fred thinks that two cows on the roof lie.
'Fred thinks that two (specific) cows are lying on the roof.'
b. Fred denkt dat [$_{IP}$ er [$_{VP}$ twee koeien op het dak liggen]].
Fred thinks that there two cows on the roof lie
'Fred thinks that there are two cows lying on the roof.'

According to Reuland, when the phrase *twee koeien* is in subject position as in (52a), the interpretation is that these are two specific cows. In (52b), where *er* is in subject position and *twee koeien* is within the VP, the two cows can be interpreted as any two cows. Given Diesing's assumption that the tree-splitting operation occurs at S-structure in Dutch, these data provide additional evidence that VP-internal material is interpreted as nonspecific, while VP-external material is interpreted as specific.

According to Enç (1991), Turkish distinguishes between direct object NPs that are interpreted as specific and those that are not by means of morphological case marking. Diesing discusses the following examples from Enç:

(53) a. Ali bir kitab-ɨ aldɨ.

Ali one book-Acc bought

'A book is such that Ali bought it.'

b. Ali bir kitap aldɨ.

Ali one book bought

'Ali bought some book or other.'

In (53a) the object *kitap* is marked with accusative case and can only have a specific reading. The object in (53b) is unmarked, and can only have a nonspecific reading. Diesing notes that this is in accord with her claim: material in the VP is interpreted as nonspecific unless otherwise specified by the morphological case marking. As further evidence, Diesing points out that there are unambiguously specific determiners in Turkish, and when they appear within the VP their objects are obligatorily marked with accusative case:

(54) a. Ali her kitab-ɨ okudu.

Ali every book-Acc read.

'Ali read every book.'

b. *Ali her kitap okudu.

## 4.2 Extending the Mapping Hypothesis to temporal adverbials

In order to extend Diesing's approach to temporal adverbials, we need to first relate the specific/nonspecific interpretation of indefinites to that of p-definite/non-p-definite NPs, and we then need to argue that at LF (where the Mapping Hypothesis applies in English) temporal adverbials can attach either in the IP area or in the VP area, and that each of these placements of the adverbial corresponds to a different reading. As a result, we will have a unified analysis of each temporal adverbial and the ambiguity of a sentence with a temporal adverbial will be attributed to a mapping procedure which interprets IP material as p-definite and VP material as non-p-definite.

The similarity between the specific/nonspecific interpretations of NPs and the p-definite/non-p-definite readings of temporal adverbials can be seen if we examine the workings of the Mapping Hypothesis more closely to see how it produces the specific/nonspecific readings and Milsark's (1974) presuppositional/nonpresuppositional readings, which Diesing equates. Reuland's Dutch examples provide an example of the difference between a specific reading (in (52a)) and the nonspecific reading (in (52b)). The interpretation of (52b) is obtained through existential closure; *twee koeien* can refer to any two cows. In contrast, in (52a) there is some knowledge about which cows are being spoken of; the referent of *twee koeien* is taken from the context of the utterance.

Diesing argues that the specific/nonspecific readings can be equated with the presuppositional/nonpresuppositional readings noted by Milsark (1974). Milsark distinguishes between two types of determiners: *weak* determiners such as *a*, *some* and *three*, which can appear with a subject in *there*-insertion contexts, and *strong* determiners such as *the*, *all* and *most*, which cannot appear in these contexts:

(55) a. There is/are a/some/a few/many/three fly (flies) in my soup.

b. *There is/are the/every/all/most fly (flies) in my soup.

Another distinction between these two types of determiners, Milsark notes, is that strong determiners presuppose the existence of the entities they are applied to, while weak determiners are ambiguous, having both a presuppositional and a nonpresuppositional reading. For example, the weak determiner *some* has one reading in (56a) in which the existence of the ghosts is asserted but not presupposed, and another reading in (56b), where stressed *some* presupposes the existence of ghosts:

(56) a. There are some ghosts in my house.

b. SOME ghosts are in the pantry; the others are in the attic.

Strong determiners such as *every* and *most* only allow a presuppositional reading, as in the following examples, where the existence of ghosts is presupposed:

(57) a. Every ghost roasted marshmallows.

b. Most ghosts sleep late.

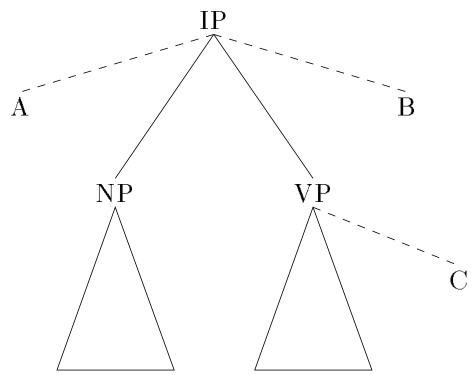
Like the specific reading, the presuppositional reading is one in which the referent of the NP is taken from the context (through accommodation, if necessary). In (56b), for example, there is a set of ghosts in the context and the NP *SOME ghosts* takes its referent from that set.

The p-definite reading can be related to the specific reading in a similar fashion; In the p-definite reading, the time the event occurs is determined relative to the contextually-determined time $R$. We can generalise over Diesing's specific/nonspecific readings, Milsark's presuppositional/non-presuppositional readings and the p-definite/non-p-definite readings discussed here by saying that the former interpretations are done with respect to the context and the latter ones through existential closure.

Diesing proposes to account for the difference in the specificity (or presuppositionality, equivalently) of strong and weak determiners in English by claiming that they are treated differently at LF. In Government and Binding Theory (Chomsky, 1981), the scope of a quantifier is determined at LF through the movement rule of *Quantifier Raising (QR)* (May 1977, May 1985). While May treats both strong and weak quantifiers alike with respect to QR, Diesing proposes that strongly quantified NPs behave like quantifiers at LF, adjoining to IP, and weak quantifiers are ambiguous, and may or may not adjoin to IP. An important consequence of this treatment is that it associates the strong readings of weak NPs with the restrictive clause and the weak readings with the nuclear scope. With the additional observation that it is these weak determiners (along with *the*) which form optionally p-definite NPs, the relationship between the Diesing/Milsark readings and the specific/nonspecific readings is strengthened. (I will give a suggestion as to a possible reason *the* acts like a weak determiner in temporal adverbial contexts in Section 4.3.)

Given that it is plausible that the two readings of weak NPs come about in a similar fashion to the two readings of a temporal adverbial with an optionally p-definite object, we can extend the Mapping Hypothesis to temporal adverbials if we can show that the p-definite reading is associated with sentence-level attachment of the adverbial at LF and the non-p-definite reading with VP-level attachment at LF. Based on the observation that only the p-definite reading is available when the adverbial is in initial position, Dowty (1979) claims that a difference in the syntactic placement of the adverbial is associated with the difference in meaning, and attributes the p-definite reading to sentence-level attachment of the adverbial and the non-p-definite reading to VP-level attachment. This would give us the following (simplified) analysis of their possible S-structure positions, labelled A, B and C:

(58)




What happens to an adverbial with a weak NP object in position A at S-structure? To determine this we must review Diesing's treatment of NPs. A weak NP subject originates at D-structure in the [Spec,VP] position according to the VP-Internal Subject Hypothesis, which Diesing adopts.[7] It then raises at S-structure in languages like English to the subject ([Spec,IP]) position in order to satisfy requirements such as Case and agreement (Kitagawa, 1976). Because it has a trace within the VP it can lower at LF back to that position in a manner analogous to that of raising predicates (See (May, 1977) and (May, 1985)). Unlike the subject, there is no reason to think that a sentence-level adverbial has raised at S-structure; it has no motivation for movement such as Case or agreement. We can therefore assume, in keeping with the principles put forward in (Chomsky, 1991), that the adverbial has not moved. Because it has not raised, it has no VP-internal trace position to return to. Therefore a weak NP object of an adverbial that is at sentence-level at S-structure does not lower but instead must raise to adjoin to IP at LF and is therefore interpreted by the Mapping Hypothesis as p-definite/strong. This analysis correctly predicts that an S-structure adverbial in position A is unambiguously p-definite. The same argument applies to an adverbial in position B.

With an adverbial with a weak NP in sentence-final position, the sentences are ambiguous, as we have seen. When the adverbial is in final position at S-structure it is either in position B or position C. According to Diesing's hypothesis, a weak NP in position C may raise at LF or remain in place, so such an adverbial will result in either a p-definite or a non-p-definite reading.

In summary, when an adverbial is in initial position at S-structure it is in position A, then raises to adjoin to IP at LF, where the Mapping Hypothesis interprets it as p-definite. When the adverbial is in final position at S-structure, it is either in position B where it must adjoin to IP at LF or in position C where it may or may not raise at LF. If it raises, the Mapping Hypothesis causes it to be interpreted as p-definite, and if not, as non-p-definite, thus correctly predicting the ambiguity observed in a sentence with an adverbial in sentence-final position at S-structure and the lack of ambiguity in a sentence with an adverbial in initial position.

An interesting result of concluding that it is the LF position of a temporal adverbial that determines its interpretation is that it allows us to explain the ambiguity in examples such as (59):

(59) Susan has lived in Boston for three years and has worked at Kodak for six years.

The adverbials can either both take on p-definite readings or both non-p-definite readings, and yet because the VPs are conjoined the adverbials must both be attached at VP-level; to analyse (59) as a case of conjoined sentences would give a ridiculously complex syntactic structure. Yet if it is the level of LF at which an adverbial gets its p-definite or non-p-definite interpretation, the ambiguity of (59) is easily explained in the same way that we explained the ambiguity of a sentence with an adverbial in position C at S-structure (along with a rule for across-the-board extraction from a conjoined phrase).

## 4.3 Problems with definite descriptions

One problem in extending Diesing's treatment to temporal adverbials is that both Diesing and Milsark group the definite determiner in the set of strong determiners, but in the temporal adverbial data it acts like a weak determiner in the sense that a temporal adverbial with an object such as *the summer* is ambiguous. More specifically, if we extend Diesing's treatment to adverbials, we correctly predict that any adverbial with a weak NP object will cause a sentence to have both a p-definite and a non-p-definite reading:

(60) Martha will be in her office for an/a few/many/three hour(s).

(In fact, all weak determiners are optionally p-definite.) We also predict that any adverbial with an object that has a strong determiner will give the interpretation that the eventuality occurs at a p-definite time because, whether the adverbial is attached at VP-level or not, the NP will raise at LF to be interpreted as part of the restrictor clause. This analysis makes correct predictions for all strong determiners except *the*:

(61) a. John lived in Boston during every/all/most leap year(s) for the past 30 years.

b. John lived in Boston during the summer.

The determiner *the* in sentence (61b) acts like a weak determiner, allowing both a p-definite and a non-p-definite reading, as discussed in Section 3. (With the exception of *the*, all strong determiners are necessarily p-definite.)

It is unfortunate that the definite determiner data stray from the predicted pattern because Diesing's explanation for Milsark's observations was quite a nice result provided by her treatment. We may find a solution to this problem by examining other contexts in which definite NPs act like weak NPs, such as the the following examples from (Poesio, 1994):

(62) a. John got these data from the student of a linguist.

b. I usually had breakfast at the corner of a major intersection.

Something about the "the X of a Y" construction allows both a strong and a weak interpretation. If we consider expressions such as *the summer* to have a semantics like *the summer of a year* either lexically or because they're elliptical, then we can say that such expressions fall outside of Milsark's classification, which doesn't deal with such complex NPs. Of course we still need an explanation for why "the X of a Y" constructions act like weak NPs, but this is outside the scope of this paper.

### 4.4 Explaining the apparent exceptions

There were examples discussed in Section 2.2 that appeared to be exceptions to the generalisation that when the adverbial is in initial position the time at which the eventuality occurs is p-definite. These examples can be divided into two classes: those which involve generic quantifiers or modal operators and those in which an item occurs which is lexically marked in such a way that it forces the sentence to take on a reading which is contrary to the generalisations discussed here. In the sentences below, for example, the time intervals expressed by the NPs are non-p-definite intervals:

(63) a. In one hour Americans consume 10 million gallons of fuel.

b. On New Year's Eve people crowd into Times Square.

(64) a. In six minutes Martha could gap all twelve plugs.

b. In three minutes John can do fifty push-ups, nine chin-ups and a cartwheel.

The sentences in (63) contain an implicit generic operator, and those in (64) contain the explicit modal operators *could* and *can*, respectively. We've observed that when the adverbial is in initial position the sentence has a p-definite reading, but this is not true for these generic and modal examples. In (63a), for example, the phrase *one hour* refers to any hour rather than a particular hour and in (63b) *New Year's Eve* refers to New Year's Eves in general rather than to a particular New Year's Eve. Compare the adverbials in (63) and (64) to *this afternoon*, which can only refer to a particular afternoon and therefore forces the p-definite reading. These necessarily p-definite phrases cannot appear with generics:

(65) #This afternoon Americans consume five million gallons of fuel.

Diesing's hypothesis allows us to explain why these examples don't allow a p-definite reading. According to her hypothesis the presence of the generic or modal operator does not result in the specific/nonspecific interpretation; instead, when such an operator is present, items higher in the tree are interpreted as part of the restrictor clause and items lower in the tree as part of the nuclear scope of that operator. Thus, instead of being interpreted as p-definite, the time at which the eventuality occurs in a generic sentence is interpreted generically. The interpretations of sentences such as (63) and (64) are not exceptions, therefore, but follow directly from Diesing's treatment.

The second set of examples includes those which contain items such as *only* and *entire* which select for elements of semantic scales, as well as items such as *yesterday* and *some day* whose semantic interpretation forces reference either to a p-definite or non-p-definite time:

(66) a. In ten seconds flat/only ten seconds John put the whole puzzle together.

b. In five seconds Floyd ate the entire apple.

(67) a. John left yesterday.

b. Some day John will leave.

The time scale involved in the interpretation of the examples in (66) is <...eight seconds, nine seconds, ten seconds, eleven seconds...>. The items *only* and *flat* select for an element of this scale, and because these elements are (non-deictic) amounts of time only the non-p-definite reading is possible. *Yesterday* means something like "the day before the day containing S" and this lexical semantic information cannot be changed to give *yesterday* a non-deictic interpretation. Similarly, *some day* can't refer to a particular day, and so (67b) only has a non-p-definite interpretation.

These types of example are similar to Enç's Turkish examples shown in (53). Recall from the discussion of these examples that the Mapping Hypothesis applies at S-structure in Turkish, so that items within the VP are interpreted as nonspecific. However, an NP within the VP area can be interpreted as specific if it has accusative case. Both Turkish NPs with accusative case and the examples above, which are restricted to having either p-definite or non-p-definite readings because of their lexical entries, can be treated similarly: Since strong NPs can only be interpreted as part of the higher portion of the tree, it is not surprising that morphemes and lexical items such as *yesterday* are similarly required to be interpreted in a particular portion of the tree.

### 4.5 Summary of the proposal

My central point is that it is not necessary to treat temporal adverbials as ambiguous in order to explain the ambiguity of sentences such as (68):

(68) Mary has lived in Amsterdam for three years.

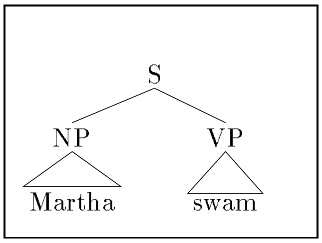
My solution follows from Diesing's (1992) Mapping Hypothesis, which specifies that in the interface between syntax and semantics the phrase structure tree is split in two, and the two parts of the tree are mapped onto different semantic correlates. The result is that when the adverbial is located in the higher portion of the tree the eventuality is understood to occur at a p-definite time and when it is located in the lower portion of the tree the eventuality is understood to occur at a non-p-definite time, explaining the two readings of the sentence. The loss of one reading when the adverbial is in initial position is caused by the lack of a VP-internal trace position for it to lower to at LF, thus forcing it to be interpreted as part of the higher portion of the tree. I also explained the observation that certain present perfect tense sentences are unacceptable with a temporal adverbial by arguing that the p-definite reading is ruled out due to problems with time deixis, and showed how other apparent exceptions such as generic sentences can be explained by means of the Mapping Hypothesis.

## 5 DRS construction rules

This section contains a formalisation in Discourse Representation Theory (DRT) (Kamp, 1981)[8] of the treatment of temporal adverbials given in this paper. I will give a very brief introduction to the relevant parts of DRT, assuming the reader's familiarity with Kamp's work. (See also Kamp's original 1981 paper, Partee (1984) or Kamp & Reyle (1993).) I roughly follow the style of Kamp & Reyle (1993).

In DRT, Discourse Representation Structures (DRS's) serve as a level of representation between syntax and model-theoretic interpretation, and therefore the DRT level of representation is an appropriate one in which to represent the operations of the Mapping Hypothesis. Heim (1982) views DRT as a replacement for LF, while Diesing views LF as the input to the DRS construction process.[9] I believe this treatment of temporal adverbials will work equally well with either approach, but I will adopt Diesing's view here to maintain uniformity with her treatment.

A DRS is constructed through the use of DRS construction rules (CR's). The initial DRS $K$ is drawn as a box containing the phrase structure tree $\gamma$ of the current sentence in the discourse. The initial DRS for the sentence *Martha swam* (ignoring tense and other features) is as follows:

(69)


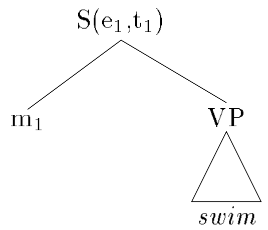

Construction rules are "triggered" when $\gamma$ matches a triggering configuration specified in the rule, at which point the rule "fires," i.e., the instructions contained in the rule are carried out upon the DRS. These instructions simplify $\gamma$, introducing a variable for each NP as well as descriptions of the tense and aspect of the sentence. A simplified version of the final DRS for *Martha swam* is below:

$$(70)\quad \boxed{\begin{array}{l} e_1 \;\; t_1 \;\; m_1 \\ \mathrm{martha}(\mathrm{m}_1) \\ \mathrm{e}_1\!: \boxed{\mathrm{swim}(\mathrm{m}_1)} \\ \mathrm{e}_1 \;@\; \mathrm{t}_1 \end{array}}$$

Variables are introduced at the top of the DRS box in what is called the "universe" of $K$, or $U_K$. Statements are introduced into the body of the DRS, the set of conditions $Con_K$. The variables $t_i$ represent times, $\mathrm{e}_i$'s represent events and $\mathrm{s}_i$'s represent states. The expression $e_1 \; @ \; t_1$ indicates that the event $e_1$ occurs at time $t_1$. I will also use the expression $t_1 \supset\!\subset t_2$ to indicate that time $t_1$ abuts on $t_2$. The embedded DRS box

$$(71)\quad \mathrm{e}_1\!: \boxed{\mathrm{swim}(\mathrm{m}_1)}$$

is another way of writing the reduced tree $\gamma$, which, after processing, is as follows:

(72) 


This complex syntactic structure represents a predicate **swim** whose arguments are $m_1$ (representing Mary), the event $e_1$ and the time $t_1$ at which $e_1$ occurs.

I will discuss each type of construction rule proposed here, beginning with the initial rule that interprets the sentence, then the rules for adverbials and interpreting temporal NPs. Finally I will list the syntactic rules and give an example.

## 5.1 *CR.S*

The DRS construction rule for sentences, *CR.S*, is the top-level rule which applies whenever a sentence is processed.[10] It keeps track of narrative progression, introduces event variables and relations between time points as indicated by the tense of the sentence (leaving adverbials and temporal NPs to be processed by other rules) and performs the tree-splitting operation of the Mapping Hypothesis. I will now explain each of these functions in detail, and I will show the rule at the end of this section.

### 5.1.1 Tense and narrative progression

Narrative progression is dealt with by means of Kamp & Reyle's *Rpt*. It is necessary to distinguish between two types of reference times: Reichenbach's *R* and an additional reference time used in DRT. Kamp & Reyle call Reichenbach's *R* the *Temporal Perspective point (TPpt)* to reflect Reichenbach's idea that this is the time from which the event is viewed, and they call the other reference time, which is used to track narrative progression, the *Rpt*. The distinction is motivated by the following example:

(73) Fred arrived at 10. He had got up at 5; he had taken a long shower, had got dressed and had eaten a leisurely breakfast. He had left the house at 6:30. (Kamp&Reyle 5.161)

In (73) the *TPpt* of each of the past perfect sentences is the time of Fred's arrival, but the *Rpt* changes as the narrative progresses. Kamp & Reyle describe how the *Rpt* may be determined, giving the following two cases, where S is the current sentence (p. 545):

(74) The part of the discourse preceding S contains an earlier event-sentence in the past tense. For this case we stipulate that the reference point be the discourse referent representing the event described by the most recent past tense event-sentence before S.

(75) The antecedent part of the discourse contains no past tense event-sentence. In this case we let the reference point be the location time of the most recent past tense state-sentence. Otherwise we set the reference point equal to some new arbitrary time (represented by a new discourse referent).

The reference times for future tense are chosen similarly. I will use the statement $Rpt := o$ to indicate that the *Rpt* has been set, where $o$ is chosen according to the above algorithm.

I will follow Kamp (1979), Hinrichs (1981), and Partee (1984) in assuming that a new event is interpreted as following the current *Rpt*, while a new state overlaps it. For example, the event of the fox ducking into the foxhole is interpreted as occurring after the fox hears the noise in (76a), but the state of the fox being in the foxhole is interpreted as overlapping the event of the fox hearing the noise in (76b):

(76) a. The fox heard a noise. He ducked into the foxhole.

b. The fox heard a noise. He was in the foxhole.

The choice of the *TPpt* depends on the tense of the sentence. I will follow Kamp & Reyle in their use of the feature *TENSE* to express the relationship between the eventuality and the *TPpt*. When *TENSE* has the value *pres* the time of the eventuality coincides with the *TPpt*, when it has the value *past* the time of the eventuality precedes the *TPpt*, and when it has the

Table 1: The values for *TP* and *TENSE*.

| | **TP** | **TENSE** |
|---|---|---|
| Simple Past | *past* | *pres* |
| Simple Future | *pres* | *fut* |
| Present Perfect | *pres* | *past* |
| Past Perfect | *past* | *past* |
| Future Perfect | *fut* | *past* |

value *fut* the time of the *TPpt* precedes the eventuality. Similarly, I will use the feature *TP* to express the relationship between the *TPpt* and the speech time. The values for *TP* and *TENSE* for each tense are shown in Table 1. (My use of the feature *TP* differs from that of Kamp & Reyle because I retain Reichenbach's original set of relationships between tense points, described in Section 2.2, rather than the extended set that Kamp & Reyle use.)

When *TP* has the value *pres*, the *TPpt* is the same as speech time, which Kamp & Reyle refer to as **n**. When *TP* does not have the value *pres*, the eventuality whose time is the time of the *TPpt* must be found. For example, in (73) the *TPpt* for each of the past perfect sentences is the time of Fred's arrival. How to decide what this eventuality is is a difficult problem, and beyond the scope of this work. I will assume that some algorithm exists to accomplish this, and when *TP* has a value other than *pres* I will set the *TPpt* to $\alpha$, which represents the appropriate *TPpt*.

### 5.1.2 Aspect

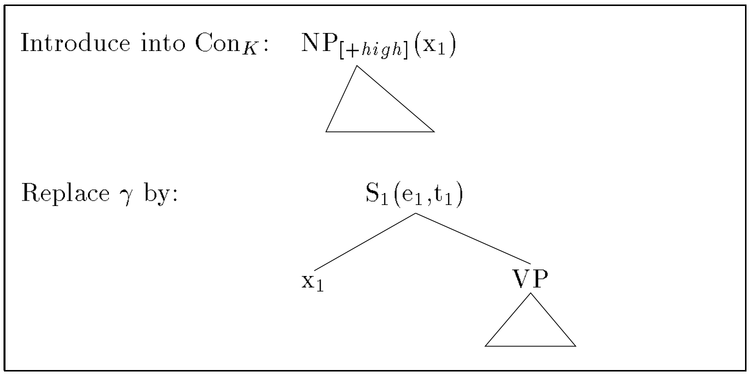
I also adopt Kamp & Reyle's *STAT* feature, which identifies the eventuality expressed by a sentence as either stative or nonstative. As a result, the selectional properties of *for* and *until* are inadequately represented. For example, activity sentences such as *John swam* are treated as nonstative and, since *for*- and *until*-phrases are acceptable with both activities (–STAT) and states (+STAT) but not events (–STAT), there is no way to use the STAT feature to correctly predict the acceptability of a *for* or *until* phrase. I have arbitrarily used the restriction that *for* and *until* are acceptable with sentences marked +STAT thereby making incorrect predictions concerning activities, but, because this matter is not crucial to the main points I wish to make here, I will not attempt to modify the Kamp & Reyle approach in order to rectify this situation.[11]

### 5.1.3 The Mapping Hypothesis

The tree-splitting operation of the Mapping Hypothesis is implemented in *CR.S*. Material from the IP area of $\gamma$ (i.e., the portion of the tree within the sentence S (=IP) but external to the VP) is mapped onto one semantic correlate, while material from the VP area is mapped onto another.[12] For English we must assume that $\gamma$ is a tree in LF; the trees shown in the rules are simplified somewhat for purposes of exposition.

A tree, $\gamma$, whose root is an S with an NP and a VP as its children, is introduced into the DRS. When the Mapping Hypothesis applies, the higher portion of the tree is split from the lower portion, as below:

(77)




This illustrates the default tree-splitting operation in which the higher, IP portion of the tree (which, in this example, consists of just the NP) is marked as *+high* so it will be interpreted as specific, and the lower, VP portion of the tree is interpreted as nonspecific. Sentence-level adverbials are also marked *+high* at this stage, and VP-level adverbials are marked as *–high* when the VP is processed in a later rule.

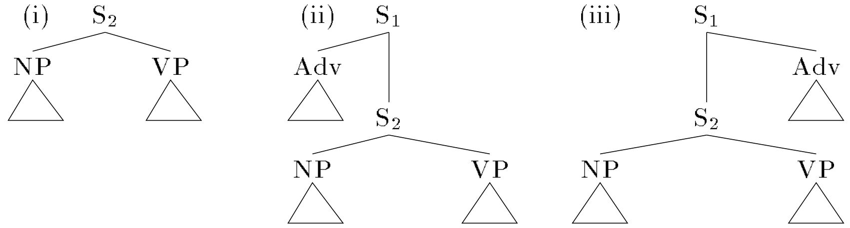
For simplification, the only subjects I look at are proper nouns, which don't raise at LF, and I assume that any NPs within the VP have either raised and have been treated by another rule, or have remained within the VP according to Diesing's treatment.

### 5.1.4 The rule

The construction rule $CR.S$ is shown below.

$\mathrm{CR.S}_{\langle TP, TENSE, STAT \rangle}$:

**Triggering Configurations:**

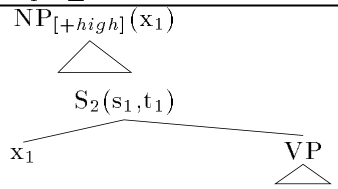



| | |
|---|---|
| Introduce into $\mathbf{U}_K$: | new discourse referent $x_1$ |
| | new time discourse referent $t_1$ |
| Choose **Rpt**: | Rpt := o |
| Choose **TPpt**: | If TP = *pres*, then TPpt := **n** |
| | If TP $\neq$ *pres*, then TPpt := $\alpha$ |

If STAT = +, then:

| | |
|---|---|
| Introduce into $\mathbf{U}_K$: | new state discourse referent $s_1$ |
| Introduce into $\mathbf{Con}_K$: | $s_1$ @ $t_1$ |
| If $\gamma$ = (i), then: | Rpt $\subseteq s_1$ |

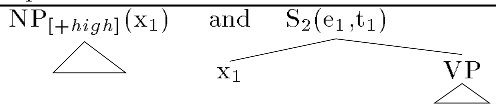
Replace $\gamma$ by:




If STAT = −, then:

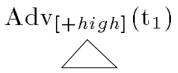
| | |
|---|---|
| Introduce into $\mathbf{U}_K$: | new event discourse referent $e_1$ |
| Introduce into $\mathbf{Con}_K$: | $e_1$ @ $t_1$ |
| If $\gamma$ = (i), then: | Rpt < $e_1$ |

Replace $\gamma$ by:




If $\gamma \neq$ (i), then:

Introduce into $\mathbf{Con}_K$:




If TP = *past*, then:

Introduce into $\mathbf{Con}_K$: TPpt < **n**

If TP = *fut*, then:

Introduce into $\mathbf{Con}_K$: TPpt > **n**

If *TENSE* = *pres*, then:

Introduce into $\mathbf{Con}_K$: $t_1$ = TPpt

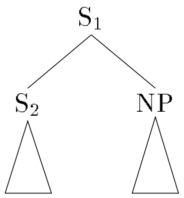
If *TENSE* = *fut*, then:

Introduce into $\mathbf{Con}_K$: $t_1$ > TPpt

If *TENSE* = *past*, then:

Introduce into $\mathbf{Con}_K$: $t_1$ < TPpt

Any NP adjoined to IP through QR should also be interpreted as specific (+high); I assume that this is done by another rule. The sort of rule needed to handle these NPs is one that selects for a triggering configuration of the following form:

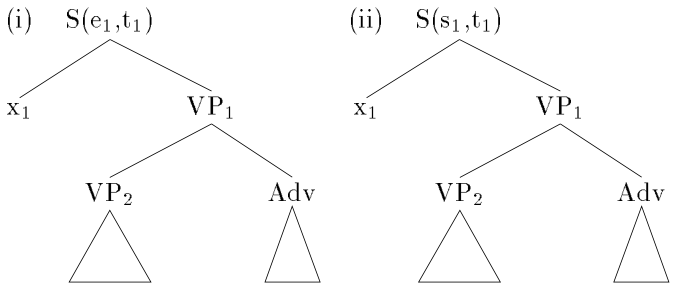
(78)



This rule assigns the NP a p-definite (specific/presuppositional) reading by finding its referent in the context, and replaces the triggering configuration $\gamma$ by the tree $S_2$.

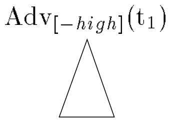
We require an additional rule for cases in which the adverbial is attached at VP-level:

CR.VP-Adv:

**Triggering Configurations** $\gamma \in$ **Con**$_K$**:**

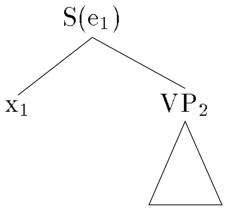



Introduce into **Con**$_K$**:**



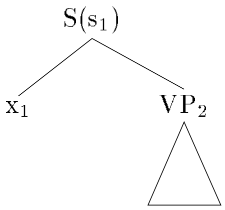

If $\gamma$ = (i), then:

Replace $\gamma$ by:




If $\gamma$ = (ii), then:

Replace $\gamma$ by:




The VP-level adverbial is separated from the body of $\gamma$ and is assigned a *-high* feature so that it will be interpreted as part of the nuclear scope.

## 5.2 *CR.Adv, CR.P-definite-temporal-NP* and *CR.Have*

The rules *CR.Adv, CR.P-definite-temporal-NP* and *CR.Have* have simple functions, and are described briefly below:

- The category *Adv* embraces both adverbs and adverbials, and its presence allows a smaller number of phrase structure rules by distinguishing these categories from other types of prepositional phrases. The main purpose of the following rule is to pass the $\pm$*high* feature and the time argument from the Adv node to the PP node, where they will ultimately be used to interpret the time at which the eventuality occurs as p-definite or non-p-definite:

CR.Adv:

Triggering Configurations $\gamma \in \mathrm{Con}_K$: $\mathrm{Adv}_{[\alpha high]}(\mathrm{t}_1)$

$$\begin{array}{c} \mathrm{Adv}_{[\alpha high]}(\mathrm{t}_1) \\ | \\ \mathrm{PP} \\ \triangle \end{array}$$

Replace $\gamma$ by: $\mathrm{PP}_{[\alpha high]}(\mathrm{t}_1)$

$$\begin{array}{c} \mathrm{PP}_{[\alpha high]}(\mathrm{t}_1) \\ \triangle \end{array}$$

- Some NPs must either rigidly designate a date/time/year/etc. (as in *23rd June 1993*) or must be interpreted in a certain way with respect to the context (as in *this Tuesday*, which must refer to the Tuesday just before or just after speech time). These NPs have a +p-definite feature associated with them in the lexicon and lexical redundancy rules give them a *+high* feature so that they are forced to appear at sentence-level at LF. The rule *CR.P-definite-temporal-NP* selects for a +p-definite NP and performs the necessary operations to interpret the NP correctly. For the purpose of this discussion it may be assumed that this rule simply places such NPs in the DRS on the assumption that there are later procedures that give them the appropriate interpretation. A similar rule will process -p-definite expressions.

- *CR.Have*, used for perfect tense sentences, marks the S as *+PERF* and simply places the VP it subcategorizes for in the DRS.

## 5.3 Adverbial rules

### 5.3.1 Features

Before describing the rules for temporal adverbials I'll describe a set of features used by the rules for specifying the selectional restrictions prepositions place on their NP objects. For our purposes, it is useful to classify these expressions according to their p-definiteness. Recall from Section 2.1 that, for example, *2:00 P.M. on January 9, 1983* is p-definite regardless of context since it refers to a specific time on the time axis, and expressions such as *yesterday* are p-definite in a context where the day of the utterance is known. The lexical content alone, without knowledge of the day of the utterance, is insufficient to fix the position of *yesterday* on the time axis. I have also used the term **optionally p-definite** to refer to expressions such as *Sunday*, which are p-definite when referring to a particular Sunday in sentences such as (79a) but which can also appear in sentences with a habitual interpretation such as (79b), in which *Sunday* refers not to a specific Sunday but to a series of nonspecific (non-p-definite) Sundays:

(79) a. John went to the library on Sunday.

b. John often goes to the library on Sunday.

The p-definite expressions which cannot appear in sentences with a habitual interpretation and are necessarily p-definite, such as *2:00P.M. on January 9, 1983*, I will call **uniquely p-definite.**[13]

These expressions can also be classified as **measure terms**, **clock-calendar terms**, and NPs that express events. Measure terms express an amount of time, such as *two hours, 63 seconds* and *several days.* They can be necessarily non-p-definite as in *two seconds flat*, uniquely p-definite, as in *those two days* or optionally p-definite, as in *two days*, which can either refer to an interval of two days that has been pinpointed by context or other factors, or to some two-day interval whose position on the time axis is left vague. Clock-calendar terms express times or dates such as the uniquely p-definite expressions *2:00 P.M. on 12 June 1983*, *this Sunday* and *1985*, and the optionally p-definite *Sunday* and *the summer*. NPs that express events include the uniquely p-definite expressions *that party* and *World War II* (as in the phrase *during World War II*), and the optionally p-definite expressions *dinner* and *a party* (as in the phrase *during dinner*). I will assume that the prepositions that head temporal adverbials are lexically marked with features that correspond to the categories that the prepositional object must fall into. Examples of the possible combinations of features are shown in Table 2.

Three additional features that we have not yet discussed are listed in the chart: ±*durative*, ±*simply_measure* and ±*simply_event*. Certain adverbials are sensitive to whether their object expresses a single point or an interval of some duration, making the feature ±*duration* necessary. For example, *for* requires a *+duration* expression such as *an hour* and is unacceptable with a punctual, *–duration* expression as in *#for noon*, while *at* requires a *–duration* expression, as shown by the examples *at noon* and *#at an hour*. The feature ±*simply_measure* is needed for adverbials which are acceptable with a measure phrase only if it also has the feature *+p-definite*: these adverbials are inclusive *in*, *until*, *during*, *since*, *by* and *before*, all of which are unacceptable with a *+simply_measure* expression such as *two hours*. Similarly, some adverbials are acceptable with an event expression only if it has the feature *+p-definite*. These adverbials, *since* and *by*, are unacceptable with a *–p-definite* event expression such as *a party*, and are therefore marked with the feature *–simply_event*.

The type of NP object an adverbial takes is restricted lexically by certain of these features, but is otherwise flexible as long as the adverbial is able to use the NP to construct the type of interval or point necessary for it to perform its semantic role of placing the eventuality in some relationship with that interval or point. For example, *since* takes as its argument an expression denoting a uniquely p-definite point such as *noon this Friday*, but it will accept any expression that denotes a p-definite interval as well and uses the final point of the interval as its uniquely p-definite point. Consider example (80):

(80) John has been unhappy since the war.

Table 2: Examples of temporal NPs and their features.

| durative | p-definite | measure term | clock-calendar term | event NP | simply_measure | simply_event | *Example* | *Adverbials* |
|---|---|---|---|---|---|---|---|---|
| + | + | + | − | − | − | − | *those two hours* | *for, in (noninclusive), in (inclusive), until, since, during, by, before, after* |
| + | + | − | + | − | − | − | *1989*<br>*last Sunday* | *in (inclusive), until, since, during, by, before, after* |
| + | + | − | − | + | − | − | *the party* | *until, since, during, by, before, after* |
| + | ∅ | − | + | − | − | − | *March*<br>*Sunday* | *in (inclusive), until, since, during, by, on, before, after* |
| + | ∅ | − | − | + | − | + | *a party* | *until, during, before, after* |
| + | ∅ | + | − | − | + | − | *two hours* | *for, in (noninclusive), after* |
| − | + | − | + | − | − | − | *that midnight* | *until, since, at, by, before, after* |
| − | ∅ | − | + | − | − | − | *midnight* | *until, since, at, by, before, after* |

Table 3: The acceptability of certain adverbials with different clock-calendar features.

| | +time | +day | +month/year | +season | *Example* |
|---|---|---|---|---|---|
| **for** | # | # | # | √ | #for noon/Sunday/March/1989 |
| **in (inclusive)** | # | # | √ | √ | #in noon/Sunday<br>in March/1989 |
| **during** | # | # | √ | √ | #during noon/Sunday<br>during March/1989 |
| **at** | √ | # | # | # | at noon<br>#at Sunday/March/1989 |
| **on** | # | √ | # | # | #on noon/March/1989<br>on Sunday |

Sentence (80) has the interpretation that there was a specific war, and for the interval beginning at the final point of the war and ending at speech time, John has been unhappy.

One additional set of features is required to divide the clock-calendar items into subcategories according to whether they express times, days, months, years or seasons. This is necessary because, as shown in Table 3, some adverbials discriminate between these subcategories. A second additional set of features is required to divide p-definite expressions into subcategories according to whether they are necessarily indexically interpreted with respect to $S$ or $R$. For example, an NP such as *this Sunday* is necessarily interpreted with respect to the speech time, referring to the Sunday nearest to speech time, while an NP such as *Sunday* may be interpreted indexically, but can also refer to a Sunday in the far future or to a series of Sundays, as in *Marc used to take the trash out on Sunday.*

The adverbials *in (noninclusive)*, *at* and *on* discriminate between these categories, as shown in Table 4. The general requirements of each adverbial are listed in Table 5.

Table 4: Examples of p-definite NPs.

| *Indexically interpreted with respect to:* | *Examples* | *Adverbials* |
|---|---|---|
| $S$ | *the last two hours*<br>*that midnight* | *for, in (inclusive), until, since, during, at, by, before, after* |
| $R$ | *the previous two hours*<br>*the following midnight*<br>*the following Sunday* | *for, in (inclusive), until, since, during, by, on, before, after* |
| (neither) | *those two hours*<br>*1989*<br>*midnight*<br>*Sunday* | *for, in (noninclusive and inclusive), until, since, during, at, by, on, before, after* |

Table 5: The features an adverbial requires its NP object to have.

| **Adverbial** | **Required Features** |
|---|---|
| **for** | +measure<br>+durative |
| **in (noninclusive)** | +measure<br>+durative<br>-indexical_wrt_S<br>-indexical_wrt_R |
| **in (inclusive)** | +durative<br>-event_NP<br>-time, -day<br>-simply_measure |
| **until** | -simply_measure |
| **since** | -simply_measure<br>-simply_event |
| **during** | +durative<br>-time, -day<br>-simply_measure |
| **at** | -durative<br>-indexical_wrt_R<br>-day, -month/year |
| **by** | -simply_measure<br>-simply_event |
| **on** | +durative<br>-p-definite<br>+clock_calendar<br>-indexical_wrt_S<br>-time, -month/year |
| **before** | -simply_measure |
| **after** | (no restrictions) |

### 5.3.2 The rules

The features the adverbial requires of its object are specified in the triggering configuration of each construction rule. *CR.For*, for example, is triggered by the following configuration:

(81)

**Triggering Configuration**

$\gamma \in$ **Con**$_K$**:** $PP_{[\alpha high]}(t_1)$

Prep — for

NP $\begin{bmatrix} +measure \\ +durative \end{bmatrix}$

This rule will fire when the current DRS contains a PP whose object is marked with the features *+measure* and *+durative* (and perhaps other features). The feature $\pm$*high* will be passed down from the PP to the NP later in the rule.

The interval template is given in the construction rule for each adverbial, although it is more apparent in some rules than in others. It is apparent in the construction rules for adverbials such as *until* and *since* which do more than simply place the eventuality within [[**NP**]], and it is not as apparent in the rules for adverbials such as *at* and *on* where the interval template is whatever interval the NP object expresses. In the rule for *until*, for example, the interval template appears in the following instruction:

(82) Introduce into **Con**$_K$**:** $t_1 = [t_4, (\text{beg } t_3)]$

Recall that *until*'s interval template is **[x, (beg [[NP]])]**. In the above instruction, $t_1$ is the time at which the eventuality occurs, $t_3$ is the time [[**NP**]], and $t_4$ is the contextually determined time **x**. The instruction indicates that the eventuality occurs during the time specified by the interval template. In the rule for *on* the corresponding instruction is as follows:

(83) Introduce into **Con**$_K$**:** $t_1 \subseteq t_2$

When the NP is processed, the rule *CR.Optionally-p-definite-temporal-NP* adds to the current DRS the condition *NP(*$t_1$*)*, so, for example, the statement *Sunday(*$t_1$*)* or *noon(*$t_1$*)* may be added to the DRS. Because I treat points as atomic intervals, both *noon*, which expresses a point in time, and *Sunday*, which expresses an interval of some duration, introduce intervals into the discourse.[14] The interval template for *on* is simply the interval expressed by the NP, and the instruction above indicates that $t_1$ (the time of the eventuality) is included within the template.

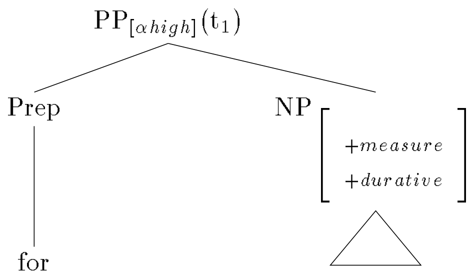
I will now describe the construction rules for several adverbials.

### 5.3.3 *For*

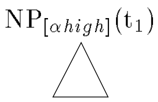
The interval template for *for* is $\mathbf{[x,\ x{+}[\![NP]\!]]}$ and the time discourse referent $t_1$ refers to the time expressed by the NP, yet to be processed. The restriction that *for* is only acceptable with clauses with the feature STAT = + is implemented in the syntactic rules (See Section 5.1.2 for discussion).

CR.for:

**Triggering Configuration** $\gamma \in$ **Con**$_K$**:**




Replace $\gamma$ with:




### 5.3.4 *Until*

*Until* is unusual in that a specific reading in present perfect tense results in a problem with time deixis, as in (84):

(84) #Until noon John has stayed in bed.

In the positioning reading, *noon* must refer to $R$, but in present perfect $R$ is equivalent to $S$, so *noon* must refer to the current time. Few expressions can felicitously refer to the current time, as discussed in Section 3.1. Because this is a pragmatic problem, it is better treated in a pragmatic module rather than during semantic interpretation. However, I have noted in the construction rules the situations in which this problem occurs.

As in the rule for *for*, the restriction that this rule will only fire for a sentence with STAT = + is implemented in the syntax.

CR.until:

**Triggering Configuration** $\gamma \in \mathbf{Con}_K$**:**

$\mathrm{PP}_{[\alpha high]}(\mathrm{t}_1)$

Prep — $\mathrm{NP}_{[-simply\_measure]}$

until

Introduce into $\mathbf{U}_K$**:** new time discourse referents $\mathrm{t}_3$ and $\mathrm{t}_4$

Introduce into $\mathbf{Con}_K$**:** $\mathrm{t}_1 = [\mathrm{t}_4, (\mathrm{beg}\ \mathrm{t}_3)]$

If $\alpha = +$, then:

If *TENSE* = *fut*, then:

Introduce into $\mathbf{Con}_K$**:** $\mathrm{TPpt} \supset\subset \mathrm{t}_4$

If *TENSE* = *past* and TP = *pres*, then:

*Deictic problems occur.*

$\mathrm{NP}_{[\alpha high]}(\mathrm{t}_3)$

Replace $\gamma$ with:

### 5.3.5 *On*

CR.on:

**Triggering Configuration $\gamma \in$ Con$_K$:**

$\mathrm{PP}_{[\alpha high]}(\mathrm{t}_1)$

Prep — on

NP $\begin{bmatrix} +durative \\ -p{-}definite \\ +clock\_calendar \\ -indexical\_wrt\_S \\ -time \\ -month/year \end{bmatrix}$

**Introduce into U$_K$:** new time discourse referent $\mathrm{t}_2$

**Introduce into Con$_K$:** $\mathrm{t}_1 \subseteq \mathrm{t}_2$

If NP has the feature *–self_refers*, then *(to avoid deictic problems)*:

**Introduce into Con$_K$:** $\neg \boxed{\begin{array}{l} t_3 \\ \mathrm{t}_3 \subseteq \mathbf{n} \\ \mathrm{t}_3 \subseteq \mathrm{t}_2 \end{array}}$

Replace $\gamma$ with: $\mathrm{NP}_{[\alpha high]}(\mathrm{t}_2)$

## 5.4 NP rules

### 5.4.1 Measure terms

*CR.Measure-of-time-NP* handles NPs such as *two hours* or *nine years* which express amounts of time. The statement $\mathrm{t}_1 = [\mathrm{t}_2, \mathrm{t}_2 + \mathrm{mt}_1]$ gives us a way of referring to the amount as an interval so that its position can be described relative to other time points.

CR.Measure-of-time-NP:

**Triggering Configuration** $\gamma \in$ **Con**$_K$**:** $\mathrm{NP}_{[+measure]}(\mathrm{t}_1)$

**Constraint:** NP is not marked as ±p-definite

*(i.e., it's optionally p-definite)*

Introduce into $\mathbf{U}_K$**:** new time discourse referent $\mathrm{t}_2$

measure time $\mathrm{mt}_1$

Introduce into **Con**$_K$**:** $\mathrm{t}_1 = [\mathrm{t}_2, \mathrm{t}_2{+}\mathrm{mt}_1]$

If NP has feature *+high (i.e., it's at sentence-level, so will be interpreted as p-definite)*:

If *TENSE* = *past*, then:

Introduce into **Con**$_K$: $\mathrm{t}_1 \supset\!\subset \mathrm{TPpt}$

If *TENSE* = *fut*, then:

Introduce into **Con**$_K$: $\mathrm{TPpt} \supset\!\subset \mathrm{t}_1$

If *TENSE* = *pres*, then:

Introduce into **Con**$_K$: $\mathrm{Rpt} \supset\!\subset \mathrm{t}_1$

Replace $\gamma$ by: $\mathrm{NP}(\mathrm{mt}_1)$

### 5.4.2 Optionally p-definite expressions

Optionally p-definite expressions such as *Sunday* and *the summer* are interpreted indexically with respect to $R$ if they are marked *+high*. If *Sunday* is indexically interpreted, for example, it must be the closest Sunday to $R$. Tense determines whether the Sunday is to be the closest Sunday before or after $R$.

CR.Optionally-p-definite-temporal-NP:

Triggering Configuration $\gamma \in \mathrm{Con}_K$: $\mathrm{NP}_{[-measure]}(\mathrm{t}_1)$

Constraint: NP is not marked as $\pm$*p-definite* *(i.e., it's optionally p-definite).*

**If NP has feature *+high:***

If *TENSE* = *past* and TP $\neq$ *pres*, then: *(future perfect or past perfect)*

Add to $\mathbf{Con}_K$: $\boxed{\begin{array}{l} t_2 \\ \mathrm{t}_1 < \mathrm{t}_2 \leq \mathrm{TPpt} \end{array}} \Rightarrow \boxed{\neg \boxed{\mathrm{NP}(\mathrm{t}_2)}}$

If TP = *fut*, then: *(future perfect tense)*

Add to $\mathbf{Con}_K$: $\mathrm{t}_1 < \mathrm{TPpt}$

If *TENSE* = *pres* and TP = *past*, then: *(simple past tense)*

Add to $\mathbf{Con}_K$: $\boxed{\begin{array}{l} t_2 \\ \mathrm{t}_1 < \mathrm{t}_2 \leq \mathbf{n} \end{array}} \Rightarrow \boxed{\neg \boxed{\mathrm{NP}(\mathrm{t}_2)}}$

If *TENSE* = *past* and TP = *pres*, then: *(present perfect tense)*

Add to $\mathbf{Con}_K$: $\mathrm{t}_1 = \mathrm{TPpt}$

*Deictic problems occur if NP doesn't refer to an ongoing time (*e.g., the current summer)

If *TENSE* = *fut*, then: *(simple future tense)*

Add to $\mathbf{Con}_K$: $\mathrm{TPpt} < \mathrm{t}_1$ and

$\boxed{\begin{array}{l} t_2 \\ \mathrm{TPpt} < \mathrm{t}_2 \leq \mathrm{t}_1 \end{array}} \Rightarrow \boxed{\neg \boxed{\mathrm{NP}(\mathrm{t}_2)}}$

Replace $\gamma$ by: $\mathrm{NP}(\mathrm{t}_1)$

## 5.5 Syntactic rules

The syntactic rules introduce several features, most of which are used to mark the type of temporal expression an NP is and to determine its acceptability as the object of certain adverbials, as described in Section 5.3.1. I also use the feature *STAT* to indicate the aspectual class of a sentence, although I only do this for expository reasons; I do not intend to make the claim that aspect should be represented in the syntax in this fashion. I assume tense, verb form, agreement, etc., to be determined before DRS construction rules are applied, and the values of TP and TENSE to be determined accordingly.

The feature *-culmination* is associated with the prepositions *for* and *until*. It allows only *+STAT* VPs to combine with *for*- and *until*-phrases and indicates (in accordance with Moens & Steedman (1988)) that any *+STAT* phrase that combines with such an adverbial passes the feature -*STAT* to its parent. This is helpful in narrative progression, wherein a sentence with a *for*- or *until*-phrase acts like a telic.

1. $\mathrm{Adv}_{[\delta culmination]} \longrightarrow \mathrm{PP}_{[\delta culmination]}$

2. $\mathrm{PP}_{[\delta culmination]} \longrightarrow \mathrm{P}_{[\delta culmination]}\ \mathrm{NP}$

3. $\mathrm{S}_{[\alpha STAT]} \longrightarrow \mathrm{S}_{[\alpha STAT]}\ \mathrm{Adv}_{[+culmination]}$

4. $\mathrm{S}_{[\alpha STAT]} \longrightarrow \mathrm{Adv}_{[+culmination]}\ \mathrm{S}_{[\alpha STAT]}$

5. $\mathrm{S}_{[-STAT]} \longrightarrow \mathrm{S}_{[+STAT]}\ \mathrm{Adv}_{[-culmination]}$

6. $\mathrm{S}_{[-STAT]} \longrightarrow \mathrm{Adv}_{[-culmination]}\ \mathrm{S}_{[+STAT]}$

7. $\mathrm{S}_{[\alpha STAT]} \longrightarrow \mathrm{NP}\ \mathrm{VP}_{[\alpha STAT]}$

8. $\mathrm{VP}_{[-STAT,\gamma PERF]} \longrightarrow \mathrm{VP}_{[+STAT,\gamma PERF]}\ \mathrm{Adv}_{[-culmination]}$

9. $\mathrm{VP}_{[\alpha STAT,\gamma PERF]} \longrightarrow \mathrm{VP}_{[\alpha STAT,\gamma PERF]}\ \mathrm{Adv}_{[+culmination]}$

10. $\mathrm{VP}_{[\alpha STAT,+PERF]} \longrightarrow \mathrm{Aux}\ \mathrm{VP}_{[\alpha STAT,-PERF]}$

11. $\mathrm{NP} \longrightarrow \mathrm{PN}$

12. PN $\longrightarrow$ **John, Rossini, Martha, Smith & Co., Lincoln, Mary, ....**

13. $P_{[-culmination]}$ $\longrightarrow$ **until, for**

14. P $\longrightarrow$ **in, at, before, by, during**

15. Aux $\longrightarrow$ have

16. $VP_{[-STAT,-PERF]}$ $\longrightarrow$ **swim a lap, write an opera, build the bridge, ....**

17. $VP_{[+STAT,-PERF]}$ $\longrightarrow$ **love John, live in Amsterdam, be a communist, ....**

18. $NP_{\left[\begin{array}{l} +durative \\ +p\!-\!definite \\ +measure \\ -clock\_calendar \\ -event\_NP \\ -simply\_measure \\ -self\_refers \end{array}\right]}$ $\longrightarrow$ **those two hours, that minute, those three years, ....**

19. $NP_{\left[\begin{array}{l} +durative \\ +p\!-\!definite \\ -measure \\ +clock\_calendar \\ -event\_NP \\ +day \\ +indexical\_wrt\_S \\ -self\_refers \end{array}\right]}$ $\longrightarrow$ **last Sunday, next Tuesday, ....**

20. $NP_{\left[\begin{array}{l} +durative \\ +p\!-\!definite \\ -measure \\ +clock\_calendar \\ -event\_NP \\ +day \\ +indexical\_wrt\_S \\ +self\_refers \end{array}\right]}$ $\longrightarrow$ **this Fourth of July, this Sunday, ....**

21. $\mathrm{NP}\begin{bmatrix} +durative \\ +p\text{-}definite \\ -measure \\ +clock\_calendar \\ -event\_NP \\ +indexical\_wrt\_S \\ +month/year \end{bmatrix} \longrightarrow$ **this coming March, last September, ....**

22. $\mathrm{NP}\begin{bmatrix} +durative \\ +p\text{-}definite \\ -measure \\ +clock\_calendar \\ -event\_NP \\ +indexical\_wrt\_S \\ +month/year \\ +self\_refers \end{bmatrix} \longrightarrow$ **this March, this September, ....**

23. $\mathrm{NP}\begin{bmatrix} +durative \\ +p\text{-}definite \\ -measure \\ +clock\_calendar \\ -event\_NP \\ +month/year \\ +self\_refers \end{bmatrix} \longrightarrow$ **1989, 1993, ....**

24. $\mathrm{NP}\begin{bmatrix} +durative \\ +p\text{-}definite \\ -measure \\ -clock\_calendar \\ +event\_NP \\ -simply\_measure \\ -simply\_event \\ +self\_refers \end{bmatrix} \longrightarrow$ **the party, the war, ....**

25. $\mathrm{NP}\begin{bmatrix} +durative \\ -measure \\ +clock\_calendar \\ -event\_NP \\ +day \\ -self\_refers \end{bmatrix} \longrightarrow$ **Sunday, Monday, Tuesday, ....**

26. NP $\begin{bmatrix} +durative \\ -measure \\ +clock\_calendar \\ -event\_NP \\ +month/year \\ -self\_refers \end{bmatrix}$ $\longrightarrow$ **March, February, August, ....**

27. NP $\begin{bmatrix} +durative \\ -measure \\ +clock\_calendar \\ -event\_NP \\ +season \\ +self\_refers \end{bmatrix}$ $\longrightarrow$ **the summer, the winter, ....**

28. NP $\begin{bmatrix} +durative \\ -measure \\ -clock\_calendar \\ +event\_NP \\ +simply\_event \\ -self\_refers \end{bmatrix}$ $\longrightarrow$ **a party, a war, ....**

29. NP $\begin{bmatrix} +durative \\ +measure \\ -clock\_calendar \\ -event\_NP \\ +simply\_measure \\ -self\_refers \end{bmatrix}$ $\longrightarrow$ **a few minutes, three weeks, three years, an hour, ....**

30. NP $\begin{bmatrix} -durative \\ +p-definite \\ -measure \\ +clock\_calendar \\ -event\_NP \\ +time \\ -self\_refers \end{bmatrix}$ $\longrightarrow$ **that midnight, ....**

31. NP $\begin{bmatrix} -durative \\ +p-definite \\ -measure \\ +clock\_calendar \\ -event\_NP \\ +time \\ +indexical\_wrt\_S \\ -self\_refers \end{bmatrix}$ $\longrightarrow$ **3:00 today, ....**

32. NP $\begin{bmatrix} -durative \\ -measure \\ +clock\_calendar \\ -event\_NP \\ -simply\_event \\ +time \\ -self\_refers \end{bmatrix}$ $\longrightarrow$ **midnight, noon, 3:32 p.m., 6:00, ....**

## 5.6 Lexical redundancy rules

A series of lexical redundancy rules are given in Table 6. Note that all +p_definite expressions (i.e., those that are necessarily p-definite such as *1989* and *that summer*) are also marked *+high*, forcing them to appear at sentence-level at LF.

Table 6: Lexical redundancy rules.

| **If an NP has this feature:** | **It also has these features:** |
|---|---|
| *+p_definite* | *+high* |
| *-durative* | *-month/year, -day* |
| *+durative* | *-time* |
| *-clock_calendar* | *-time, -day, -month/year, -season* |
| *+time* | *-day, -month/year, -season* |
| *+day* | *-time, -month/year, -season* |
| *+month/year* | *-time, -day, -season* |
| *+season* | *-time, -day, -month/year* |
| *+simply_event* | *+event_NP* |
| *-event* | *-simply_event* |
| *+simply_measure* | *+measure* |
| *-measure* | *-simply_measure* |
| *+indexical_wrt_R* | *-indexical_wrt_S* |
| *+indexical_wrt_S* | *-indexical_wrt_R* |

| **If an NP lacks this feature:** | **It has this feature:** |
|---|---|
| *+indexical_wrt_S* | *-indexical_wrt_S* |
| *+indexical_wrt_R* | *-indexical_wrt_R* |

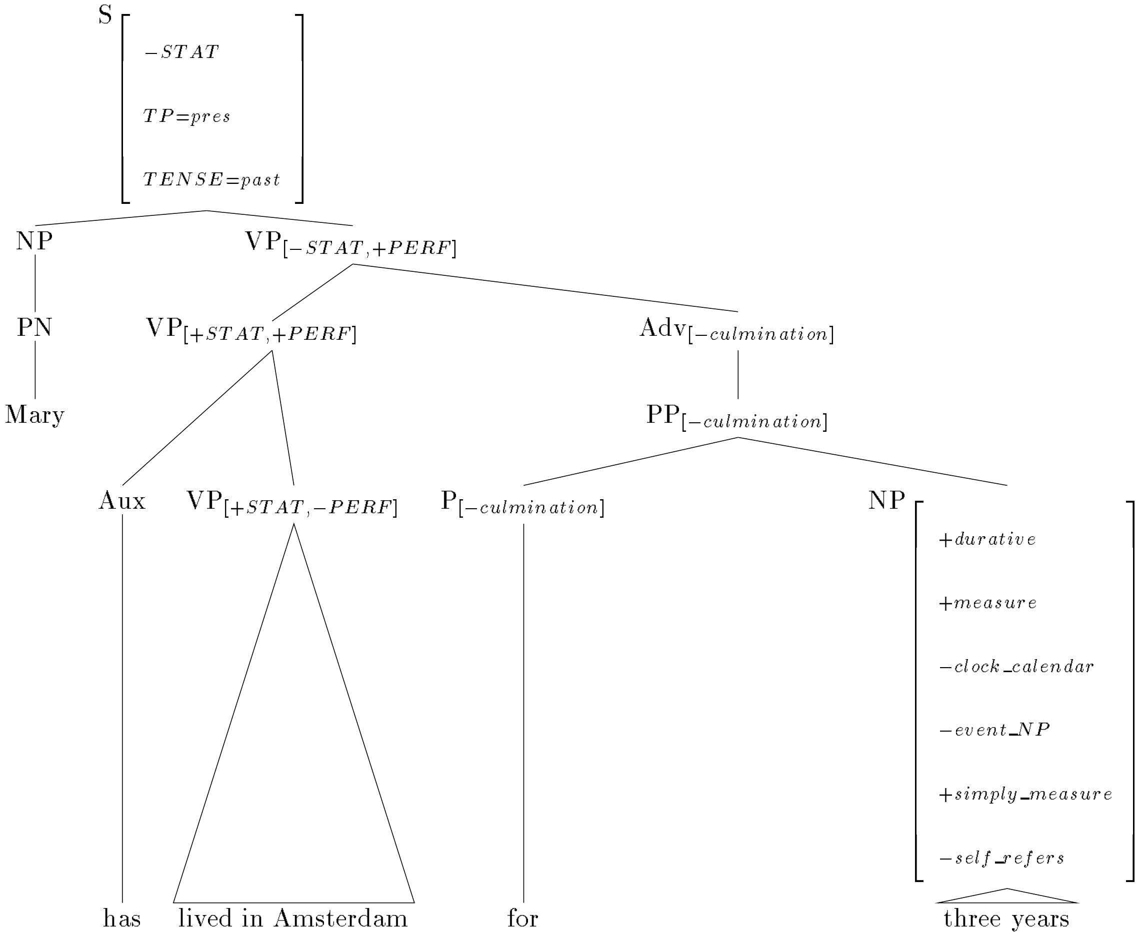
## 5.7 An example

This example shows how the tree-splitting operation of the Mapping Hypothesis allows a sentence such as (85) to have both p-definite and a non-p-definite reading:

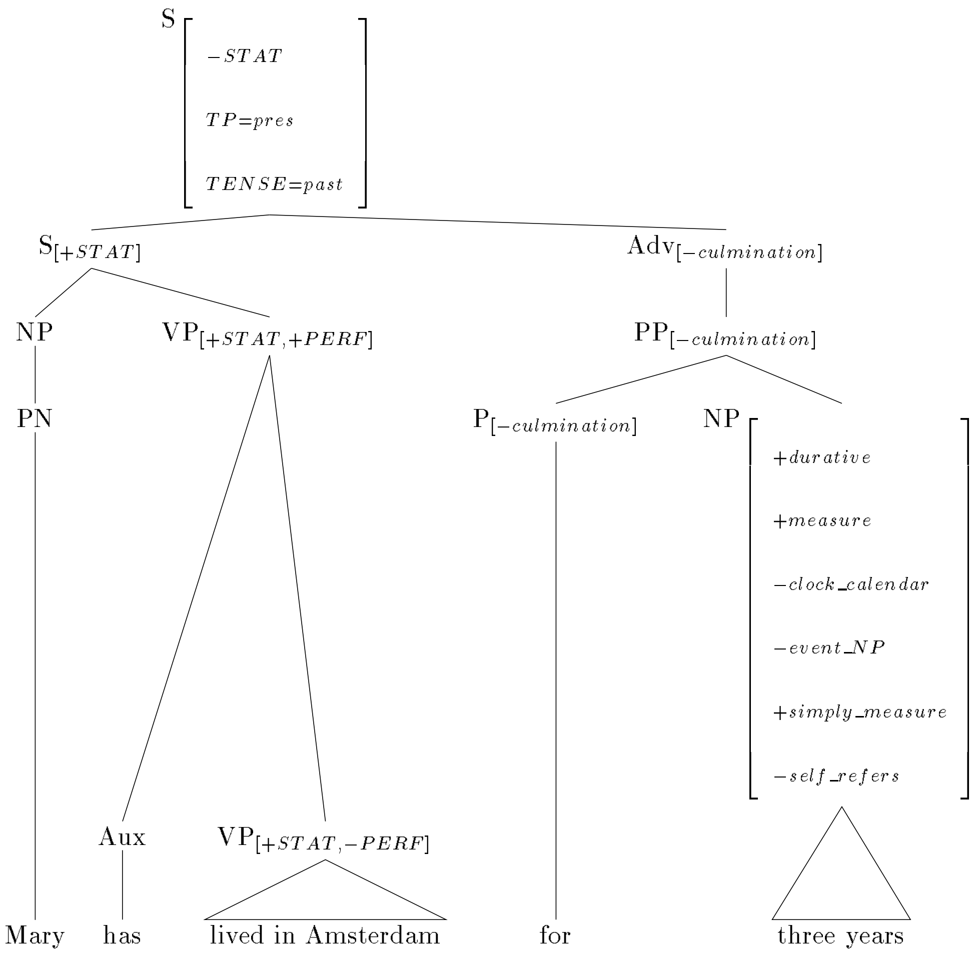
(85) Mary has lived in Amsterdam for three years.

There are two possible syntactic positions for the temporal adverbial in (85) at LF, illustrated below:

(86) *VP-level:*


S
−STAT
TP=pres
TENSE=past
NP
VP[−STAT,+PERF]
PN
VP[+STAT,+PERF]
Adv[−culmination]
Mary
PP[−culmination]
Aux
VP[+STAT,−PERF]
P[−culmination]
NP
+durative
+measure
−clock_calendar
−event_NP
+simply_measure
−self_refers
has
lived in Amsterdam
for
three years

(87) *Sentence-level:*



Processing the tree $\gamma$ in (86) yields the following DRS:

(86′)

$x_1 \;\; t_1 \;\; e_1 \;\; t_2 \;\; mt_1$

$\mathrm{e}_1$ @ $\mathrm{t}_1$
$\mathbf{o} < \mathrm{e}_1$
$\mathrm{Mary}(\mathrm{x}_1)$
$\mathrm{t}_1 < \mathbf{n}$
$\mathrm{e}_1$: $\boxed{\text{live in Amsterdam}(\mathrm{x}_1)}$
$\mathrm{t}_1 = [\mathrm{t}_2, \mathrm{t}_2 + \mathrm{mt}_1]$
three years($\mathrm{mt}_1$)

Processing the tree $\gamma$ in (87) yields this DRS:

(87′)

$x_1 \;\; t_1 \;\; e_1 \;\; t_2 \;\; mt_1$

$\mathrm{e}_1$ @ $\mathrm{t}_1$
$\mathrm{Mary}(\mathrm{x}_1)$
$\mathrm{e}_1$: $\boxed{\text{live in Amsterdam}(\mathrm{x}_1)}$
$\mathrm{t}_1 < \mathbf{n}$
$\mathrm{t}_1 = [\mathrm{t}_2, \mathrm{t}_2 + \mathrm{mt}_1]$
$\mathrm{t}_1 \supset\!\subset \mathbf{n}$
three years($\mathrm{mt}_1$)

The difference between (86′) and (87′) is that in (86′) Mary can have lived in Amsterdam at any time in the past (in this example narrative progression constrains the time at which she lives in Amsterdam through the statement $\mathbf{o} < \mathbf{e}_1$, but this constraint should be flexible and dependent on context) while in (87′) the time at which Mary lives in Amsterdam must continue to the present, as enforced by the condition $\mathbf{t}_1 \supset\!\subset \mathbf{n}$.

# Notes

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[1] More precisely, Dowty uses the notion of the "extended now." See McCoard (1978) or Dowty (1979), pp. 341-2 for details.

[2] This was pointed out to me by Marc Moens.

[3] Example (32a) is due to Derek Gross.

[4] Personal communication.

[5] The function **beg** is necessary for examples in which the NP expresses an interval or event of some duration, such as *the party*.

[6] An alternative to these interval templates is that when a *for*-phrase indicates that the duration of an eventuality $e$ is one hour it is expressed as **duration(e,1hour)**. Then if other factors indicate that the initial point of this one-hour interval is 10:00 as in (44), a statement such as **begins(e,10:00)** might be added. I use interval templates here because they allow me to show more clearly the interaction of temporal adverbials with the present perfect tense.

[7] The exact position of the subject at D-structure varies in different proposals, an issue which Diesing sets aside. See her footnote 5, Chapter 2, page 138 for discussion.

[8] Heim (1982) developed a very similar theory called "File Change Semantics (FCS)" at the same time as Kamp, and both are generally given credit for these theories. However, the theories have changed in different ways through the years, and the reader should be aware that this discussion centers on DRT, not FCS.

[9] Heim discusses File Change Semantics rather than DRT, but see footnote 8.

[10] $\overline{S}$ is irrelevant here because I don't treat questions, quantifiers or other cases in which constituents are in COMP or attached higher than at sentence level. See Hitzeman (1993) for a

treatment of the generic operator.

[11] See (Hitzeman, 1993) for a proposed solution to this problem.

[12] Here the GB terminology of Diesing mixes with the type of syntax generally used in DRT. The reader should note that I use the terms IP and S interchangeably, and that I use the expression "the IP portion of the tree" because this is how the Mapping Hypothesis refers to the higher portion of the tree.

[13] More precisely, uniquely p-definite expressions cannot appear in a sentence with a habitual interpretation if they are within the scope of the generic operator (as I discuss in (Hitzeman, 1993)) and are therefore forced to refer to a series of times rather than one time, but they can appear in such sentences if they are outside the scope of the generic operator, where it is possible for them to refer to a unique time.

[14] An interval [a, b] = [[$a_1$,...,$a_n$], [$b_1$,...,$b_m$]] refers to the continuous time interval that begins at point $a_1$ and ends at point $b_m$. I assume for simplicity that it will always be the case that $a_n \leq b_1$.

# References


Bartsch, R. and T. Vennemann: 1972, *Semantic Structures*, Athenaum Verlag, Frankfurt/Main.

Carlson, Gregory N.: 1980, *Reference to Kinds in English*, in J. Hankamer (ed.), *Outstanding Dissertations in Linguistics*, Garland Publishing, New York.

Chomsky, Noam: 1981, *Lectures on Government and Binding*, Dordrecht: Foris.

Chomsky, Noam: 1991, 'Some Notes on Economy of Derivation and Representation', in R. Freidin (ed.), *Principles and Parameters in Comparative Grammar*, MIT Press.

Cooper, Robin: 1974, 'Montague's Semantic Theory of Adverbs and the VSO Hypothesis', in E. Kaisse and J. Hankamer (eds.), *Papers from the Fifth Annual Meeting of the North Eastern Linguistic Society*, Cambridge, MA.

Diesing, Molly: 1992, *Indefinites*, The MIT Press, Cambridge, MA.

Dowty, David R.: 1979, *Word Meaning and Montague Grammar*, D. Reidel, Dordrecht.

Dowty, David R.: 1986, 'The Effects of Aspectual Class on the Temporal Structure of Discourse: Semantics or Pragmatics?', *Linguistics and Philosophy*, **9**(1), 37-61.

Enç, Murvet: 1991, 'The Semantics of Specificity', *Linguistic Inquiry*, **22**, 1–25.

Heim, Irene: 1982, *The Semantics of Definite and Indefinite Noun Phrases*, PhD thesis, University of Massachusetts at Amherst.

Hinrichs, Erhard W.: 1981, *Temporale Anaphora in Englischen,* StaatsExamen thesis, Universität Tubingen.

Hinrichs, Erhard W.: 1985, *A Compositional Semantics for Aktionsarten and NP Reference in English*, Ph.D. thesis, The Ohio State University.

Hitzeman, Janet: 1993, *Temporal Adverbials and the Syntax-Semantics Interface*, Ph.D. thesis, Department of Linguistics, University of Rochester, Rochester, New York.

Kamp, Hans: 1979. 'Events, Instant and Temporal Reference', in R. Bauerle, U. Egli, and A. von Stechow (eds.), *Semantics from Different Points of View*, pp. 376–417, Springer-Verlag.

Kamp, Hans: 1981, 'A Theory of Truth and Semantic Representation', in J. Groenendijk, T. Janssen, and M. Stokhof (eds.), *Formal Methods in the Study of Language*, Mathematical Centre, Amsterdam.

Kamp, Hans and Uwe Reyle: 1993, *From Discourse to Logic*, Studies in Linguistics and Philosophy, Vol. 42, Kluwer Academic Publishers, Dordrecht.

Kitagawa, Yoshi: 1986, *Subject in Japanese and English*, PhD thesis, University of Massachusetts, Amherst.

Klein, Wolfgang: 1992, 'The Present Perfect Puzzle', *Language*, **68**(3), 525–552.

Kuno, S.: 1975, 'Empathy and Syntax', in S. Kuno (ed.), *Harvard Studies in Syntax And Semantics*, pp. 1–73, Harvard University Press, Cambridge, MA.

May, Robert: 1977, *The Grammar of Quantification*, Ph.D. thesis, MIT.

May, Robert: 1985, *Logical Form: Its Structure and Derivation*, MIT Press, Cambridge, MA.

McCoard, Robert W.: 1978, *The English Perfect: Tense-Choice and Pragmatic Inferences*, Vol. 38 of *North-Holland Linguistics Series*, North-Holland Publishing Company, Amsterdam.

Milsark, G.: 1974, *Existential Sentences in English*, Ph.D. thesis, MIT.

Mittwoch, Anita: 1988, 'Aspects of English Aspect: On the Interaction of Perfect, Progressive and Durational Phrases', *Linguistics and Philosophy*, **11**, 203–254.

Moens, Marc and Mark Steedman: 1988, 'Temporal Ontology and Temporal Reference', *Computational Linguistics*, **14**(2), 15–28, June.

Montague, Richard: 1973, 'The Proper Treatment of Quantification in English', in K. J. J. Hintikka et al. (eds.), *Approaches to Natural Language*, pp. 221–242, D. Reidel, Dordrecht.

Partee, Barbara Hall: 1984, 'Nominal and Temporal Anaphora', *Linguistics and Philosophy*, **7**, 243–286.

Partee, Barbara: 1993, 'Quantificational Domains and Recursive Contexts', in *31st Annual Meeting of the Association for Computational Linguistics*, pp. 224–225, Ohio State University, June 22-6.

Poesio, Massimo: 1994, 'Weak Definites', in *Proceedings of the Fourth Conference on Semantics and Linguistic Theory (SALT 4)*, Cornell University Press.

Reichenbach, Hans: 1947, *Elements of Symbolic Logic*, McMillan.

Reinhart, Tanya: 1983, *Anaphora and Semantic Interpretation*, The University of Chicago Press, Chicago, IL 60637.

Reuland, E.: 1988, 'Indefinite Subjects', in *Papers from the Eighteenth Annual Meeting of the North Eastern Linguistic Society*, pp. 375–394, Amherst, GLSA, University of Massachusetts.

Ross, J.: 1973, 'Nearer to Vee', Mimeographed handout, MIT, Cambridge, MA.