Semantic Partition and the Ambiguity of Sentences Containing Temporal Adverbials*

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It has often been observed 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. I will argue 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 lexical 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 and Background/Focus constructions.

1 The data

Two types of explanations for the ambiguity of sentences such as (1) have been seen in the literature. Dowty (1979) proposes that *for*-phrases (as well as *since*- and *in*-phrases, which also exhibit two readings, he observes) are ambiguous, but then adds, "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)." An alternative claim, made by Mittwoch (1988) and Kamp & Reyle (1993), is that the ambiguity of (1) is due to an interaction between the adverbial and the perfect tense.

The treatment I propose allows a unified treatment of *for*-phrases (and other adverbial phrases) and is based in part upon the observation that the ambiguity found in sentences such as (1) is also found in simple tense sentences, thus ruling out the perfect tense as the cause of this ambiguity. After introducing a test that shows that simple tense sentences have this ambiguity as well and that in each case one reading is lost when the adverbial appears in initial position, I'll argue that Diesing's (1992) treatment of semantic partition can explain both the observed ambiguity and certain apparent counterexamples.

With the purpose of characterising the readings more precisely, consider an example in the past perfect tense:

(2) Mary had lived in Boston for four years.

According to Reichenbach (1947), in the past perfect the event time **E** during which Mary lived in Boston is interpreted as temporally prior to the reference time **R**, which, in turn, is prior to speech time **S**, represented as **E_R_S**. Sentence (2) has a reading in which Mary lived in Boston for the four years ending at **R** and a reading in which there was some four-year interval preceding **R** during which Mary lived in Boston. Adopting Klein's (1992) terminology, I will refer to the former reading, in which the four-year interval is interpreted as having a fixed position on the time axis, as **position-definite (p-definite)**, and I will refer to the latter reading as **non-p-definite**. Given that Reichenbach assigns the time point ordering **E_S,R** to the present perfect (where "**S,R**" indicates that **S** and **R** coincide temporally), it is possible to make the generalisation over both present perfect examples such as (1) and past perfect examples that the p-definite reading is one in which the event time **E** ends at **R** and the non-p-definite reading is one in which **E** is some time prior to **R**.

Now consider the simple future tense, to which Reichenbach assigns the ordering **S,R_E**.[1] My claim is that sentence (3) 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** (where **R** coincides with speech time):[2]

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

These readings are illustrated in (4):

(4) 

When the adverbial is in initial position as in (5) the non-p-definite reading is unavailable:

(5) For an hour Martha will be in her office.

The only available reading here is one in which Martha will be in her office for the hour beginning at **R**. The contrast is more clearly seen when the presence of another adverbial forces the non-p-definite reading, as below:

(6) 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 is ruled out. The awkwardness of the sentence when the *for*-phrase is in initial position, as in (6c) and (d), shows that the non-p-definite reading is incompatible with the *for*-phrase in this position.

This ambiguity arises with other adverbials, as well. Consider the following:

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

b. The rain will begin on Saturday.

c. John will live in Brooklyn in the summer.

There is a non-p-definite reading of (7a) in which Martha is in her office at some noon in the future, and a p-definite reading in which she is in her office at the noon most closely following **R** (= **S**). (If the sentence is spoken in the morning, for example, the p-definite reading is one in which *noon* refers to the noon of the current day.) Similarly for (7b) and (c), there is a non-p-definite reading in which the NP refers to some future Saturday or summer, and a p-definite reading in which it refers to the Saturday/summer most closely following **R**. There is also an unusual p-definite reading for *in* in examples such as (8):

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

This sentence has a non-p-definite reading according to which it takes ten weeks for the bridge to be built, and a p-definite reading according to which Smith & Co. begin to build the bridge ten weeks after **R**. In each of these examples the non-p-definite reading is lost when the adverbial is in initial position, as shown by the unacceptability of the phrase *one day* in the following examples:

(9) a. At noon Martha will be in her office (#one day).

b. On Saturday the rain will begin (#one day).

c. In the summer John will live in Brooklyn (#one day).

d. In ten weeks Smith & Co. will build a bridge (#one day).

It is important when constructing these examples that the NP object of the adverbial be interpretable both as a time whose position is fixed on the time axis and a time whose position is not fixed, such as "two hours," "Tuesday," or "the summer"; NPs such as *1989* and *next Tuesday* and examples containing scalar predicates such as *only* and *almost* behave differently. Examples which appear to be exceptions to the generalisation that the non-p-definite reading is lost when the adverbial is in initial position, such as the generic (10), will be discussed later.

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

Even simple past tense examples, which appear at first glance to be straightforwardly unambiguous, are shown to by ambiguous by the test. Consider (11):

(11) a. Mary swam for three hours.

b. For three hours Mary swam.

Using the phrase *once*, which forces the three-hour interval to be at a time well in the past, we can elicit a difference between the readings:

(12) a. Mary swam for three hours once.

b. #For three hours Mary swam once.

Reichenbach assigns the time point ordering **E,R__S** to the simple past, indicating that **E** and **R** are cotemporal. Because of this, the p-definite reading, in which **E** has some type of strict temporal relationship to **R**, should be equivalent to the non-p-definite reading. The examples in (12) show that there is a difference, however. Putting the examples in context gives us a clue as to what the difference is:

(13) a. Greg took the job at Kodak. In the winter he fixed copy machines.

b. Greg took the job at Kodak. He fixed copy machines in the winter once (which is why they offered him the job).

The only interpretation of (13a) is that first Greg was hired and during the following winter he fixed copy machines– a simple progression of the narrative. In (13b), however, the phrase *the winter* can refer to any winter in the past, in keeping with the generalisation we've made concerning the non-p-definite reading— that the time **E** is not fixed on the time axis. Because a narrative progresses as the reference time **R** is updated (Hinrichs 1981, Partee 1984), the p-definite reading of (13a) is one in which **E** must coincide with that updated **R**, while in the non-p-definite reading the reference time is determined by factors such as world knowledge rather than by the processes controlling narrative progression.

In sum, I have argued that a sentence of any tense containing a temporal adverbial such as *for two hours* or *until noon* has both a p-definite and a non-p-definite reading, and that only the p-definite reading is available when the adverbial is in sentence-initial position. Furthermore, the p-definite reading is one in which the event time **E** has a particular temporal relationship to **R** on the time axis as determined by tense and the preposition heading the adverbial.

As an aside, I should mention that a present perfect sentence such as (14) often has only a non-p-definite reading with an adverbial:

(14) a. John has been in the bath until midnight.

b. #Until midnight John has been in the bath.

Sentence (14a) is possible as a response to a query concerning whether it's true that John tends to hog the bathroom, but there is no p-definite reading, as (14b) shows. I won't go into detail here other than to note that I explain the lack of a p-definite reading in (Hitzeman 1994) in terms of a problem with time deixis: the p-definite reading of an *until*-sentence is one in which **E** ends at **R**, which is cotemporal with speech time in the present perfect tense. Therefore, in the p-definite reading that should be available in (14b), *midnight* would refer to speech time. Because one must use the indexical *now* to refer to speech time, the p-definite reading is ruled out because it is pragmatically odd.

2 A semantic partition solution

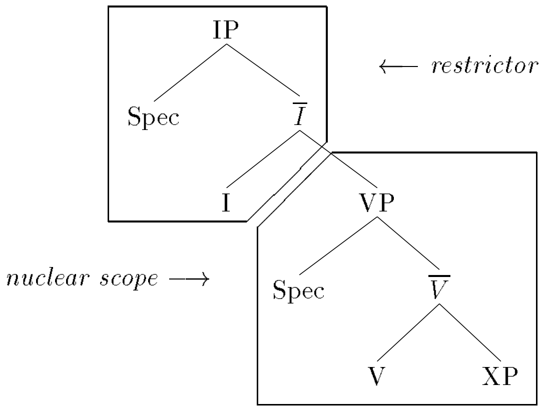
The solution I am going to propose is that the ambiguity we've been discussing is due to the way the process of mapping syntax onto semantics works rather than to an ambiguity of the adverbial. I will show how the ambiguity can be explained in terms of semantic partition, by incorporating the observations concerning temporal adverbials into Diesing's (1992) treatment of the different readings of indefinites as a semantic partition phenomenon.

2.1 The Mapping Hypothesis

Generic sentences such as *Dogs bark* are commonly represented semantically in terms of a tripartite structure consisting of an operator, a restrictor and a nuclear scope, e.g., GEN[dog(x)][bark(x)]. According to Diesing (1992), this interpretation is obtained by means of a "tree-splitting" operation which divides the syntactic tree into two parts (and a quantifier), and the two parts of the tree are interpreted in different semantic correlates. She extends this notion of *semantic partition* to the interpretation of indefinites, so that, e.g., if the NP *a cow* is in one portion of the tree it is interpreted as referring to a specific cow, and if it is in the other portion the cow referred to is nonspecific. Based on our observation that a sentence with a temporal adverbial has two interpretations and that the position of the adverbial affects the interpretation, I will argue that the ambiguity observed in a sentence with a temporal adverbial is also a result of semantic partition. In addition to providing an explanation for the ambiguity observed here, Diesing's formulation of semantic partition explains certain apparent counterexamples which 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):

(15) *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. One of the motivations for this operation is the following set of Dutch examples from Reuland (1988):

(16) 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 (16a), the interpretation is that these are two specific cows. In (16b), 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 evidence that VP-internal material is interpreted as nonspecific, while VP-external material is interpreted as specific.

2.2 Extending the Mapping Hypothesis to temporal adverbials

In order to extend Diesing's approach to temporal adverbials, we need to relate the specific/nonspecific interpretation of indefinites to that of p-definite/non-p-definite NPs, and to show 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.

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 more closely how the

Mapping Hypothesis produces the specific/nonspecific readings. Reuland's Dutch sentences provide an example of the difference between a specific reading (in (16a)) and the nonspecific reading (in (16b)). The interpretation of (16b) is obtained through existential closure; *twee koeien* can refer to any two cows. In contrast, in (16a) 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 described 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:

(17) 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 (18a) in which the existence of the ghosts is asserted but not presupposed, and another reading in (18b), where stressed *some* presupposes the existence of ghosts:

(18) 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:

(19) a. Every ghost roasted marshmallows.

b. Most ghosts sleep late.

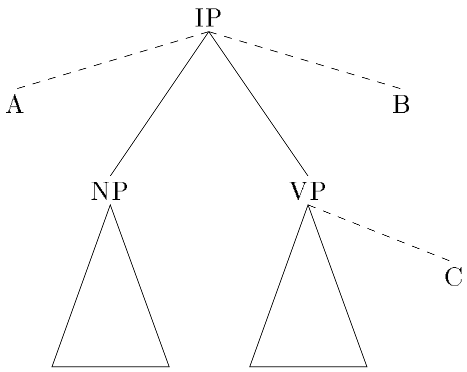
Like the specific reading, the presuppositional reading is one in which the referent of the NP is taken from the context (through accommodation, if necessary). In (18b), for example, there is a set of ghosts in the context and the NP *SOME ghosts* takes its referent from that set.

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 involve the context while the latter ones involve 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, 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 those NPs which can have both a p-definite and a non-p-definite interpretation, 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 2.3.)

Given that it is plausible that the two readings of weak NPs come about in a similar fashion to the two readings of a sentence with a temporal adverbial, 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) associates the p-definite reading with sentence-level attachment of the adverbial and the non-p-definite reading with VP-level attachment. This would give us the following (simplified) analysis of their possible S-structure positions, labelled A, B and C:

(20)



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.[3] 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, 1986). 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, 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 interpreted by the Mapping Hypothesis as p-definite/strong. This analysis correctly predicts that a sentence with an adverbial in position A at S-structure is unambiguously p-definite. The same argument applies to an adverbial in position B.

With an adverbial in sentence-final position containing a weak NP, 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 cause the sentence to be ambiguous.

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 when it is in initial position.

Further motivation for the conclusion 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 (21):

(21) 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 (21) 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 (21) 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).

2.3 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:

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

We also predict that any adverbial with an object that has a strong determiner will give the sentence a p-definite reading 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*:

(23) 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 (23b) acts like a weak determiner, allowing both a p-definite and a non-p-definite reading, as discussed for example (7c).

It would be unfortunate if the definite determiner did not behave in this context as one would predict on the basis of Milsark's categorisation because Diesing's explanation for Milsark's observations would lose some of its generality. However, we must note that there are other contexts in which definite NPs act like weak NPs, such as the the following examples from Poesio (1994):

(24) 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 similar to *the summer of a year*, either lexically or because they're elliptical, then we can say that whatever explanation accounts for examples such as (24) will also account for (23b). Of course we still need an explanation such as the one Poesio proposes for why "the X of a Y" constructions act like weak NPs, but this is outside the scope of this paper.

2.4 Explaining an apparent exception

Earlier I mentioned that generic sentences (Carlson, 1980) and sentences containing modals appear to be exceptions to the generalisation that when the adverbial is in initial position the sentence has only a p-definite interpretation. Consider the following:[4]

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

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

(26) 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 (25) contain an implicit generic operator, and those in (26) contain the explicit modals *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 (25a), for example, the phrase *one hour* refers to a nonspecific hour and in (25b) *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 (25) and (26) to *this afternoon*, which can only refer to a particular afternoon and therefore forces a p-definite reading. These necessarily p-definite phrases cannot appear with generics:

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

Having extended Diesing's treatment to temporal adverbials, we can use it to explain why these examples don't allow a p-definite reading. According to her hypothesis the presence of a 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 the NP *one hour* in (25a) is interpreted generically because it is in the restrictor clause of the generic operator. The interpretations of sentences such as (25) and (26) are not exceptions, therefore, but follow directly from Diesing's treatment.

3 Summary of the proposal

My central point is that it is not necessary to treat temporal adverbials as lexically ambiguous in order to explain the ambiguity of sentences such as (28):

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

My solution is an extension of 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. She argues that a subject in English has a specific interpretation if it is in the higher portion of the tree at LF and a nonspecific interpretation if it is within the VP. I argue that the NP object of an adverbial is also affected by this tree-splitting operation, so that if the NP *three years* in (28) is in the higher portion of the tree at LF the reading will be that Mary has lived in Amsterdam for the three years preceding reference time **R** and if it is attached at VP-level the reading will be that there was some three-year interval in the past during which Mary lived in Amsterdam. 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.

Notes

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[1] 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 relative temporal positions of S, R and E (and I in fact argue in Hitzeman (1993) that other configurations are possible), but without adverbs Reichenbach's basic set of translations used here are sufficient. In addition, the fact that the readings associated with the type of temporal adverbial I discuss here interact with these translations (as we shall see) is 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] The existence of two readings was pointed out to me by Marc Moens.

[3] 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.

[4] Example (25a) is due to Derek Gross.

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