The Proportion Problem and DRT*

Toshiyuki Ogihara

University of Washington

Department of Linguistics

Box 354340

Seattle, WA 98195–4340

U.S.A.

1. Introduction

In this article, I will discuss the so-called proportion problem (Kadmon 1987) associated with Discourse Representation Theory (Kamp 1981b, Heim 1982, etc.). Particular attention is paid to those examples in which the restrictive clause consists of either a temporal adverbial clause or an *if*-clause. The main point of this article is that the proportion problem suggests that it is misguided to regard quantificational adverbs as unselective quantifiers. After discussing various problems with the classical DRT approach, I shall present my own analysis of the data. This proposal is based upon Kratzer's (1989) situation-based theory but is considerably different from the recent proposals made in the same framework, such as von Fintel (1994).

Lewis (1975) presents a very influential analysis of adverbs of quantification, according to which an adverb of quantification is an unselective quantifier in that it binds an unlimited number of distinct variables, unlike selective quantifiers such as $\exists$ and $\forall$. Lewis discusses sentences like the following:

(1) a. Riders on the Thirteenth Avenue line seldom find seats.
b. A quadratic equation usually has two different solutions.

Lewis considers two possible analyses of these quantificational adverbs: (i) they are quantifiers over times; (ii) they are quantifiers over events. Lewis argues that (1a) disproves the first analysis because the entities that the adverb *seldom* quantifies over, i.e. riders on the thirteenth avenue, are not evenly distributed over the time continuum. Therefore, letting *seldom* quantify over intervals during which someone is a rider of the subway results in the wrong prediction. Lewis also rejects the possibility that an adverb of quantification quantifies over events . As (1b) shows,

frequency adverbs can be used to talk about entities which have no location in time and do not participate in events. (1b) simply means 'most quadratic equations have two different solutions'. Having considered examples such as (1a) and (1b), Lewis suggests that adverbs of quantification are quantifiers over 'cases'. In the theory Lewis advocates, a case is a "tuple of its participants, which are values of the variables that occur free in the open sentence modified by the adverb" (Lewis 1975:7). This analysis of quantificational adverbs is adopted in the classical DRT proposal (Kamp 1981b, Heim 1982). Although it is not the main purpose of this article to show the details of how the logical structures suitable for semantic interpretation are obtained from the surface syntactic structures, I will briefly discuss some basic patterns here.

(2) a. QAdverb, when/if S_1, S_2.
b. When/if S_1, [$_{S2}$ ... QAdverb ...].
c. QAdverb, S_1, S_2

A sentence of the form (2a) or (2b) is transformed into the logical structure of the form (2c). Indefinite NPs are treated as open sentences containing free variables. For example, *a farmer* translates as FARMER (x). In some cases, the restrictive clause is absent, and it must somehow be reconstructed from the context to produce the right semantic result. Logical structures of the form (2c) have the truth conditions given in (3a–c), depending upon the quantificational adverb involved. (3a–c) provide the right truth conditions as long as the consequent has no new free variables:[1,2]

(3) a. Always [ψ, ϕ] is true iff every assignment to the free variables in ψ which makes ψ true also makes ϕ true.

b. Usually/Often [ψ, ϕ] is true iff more than fifty percent of the assignments to the free variables in ψ which make ψ true also make ϕ true.

c. Seldom [ψ, ϕ] is true iff few assignments to the free variables in ψ which make ψ true also make ϕ true.

I assume that if a new variable is introduced in the consequent part (but not in the antecedent part), the variable is not caught by the adverb of quantification and is existentially closed within the consequent clause. This roughly corresponds to the mechanism proposed in Chapter 2 of Heim (1982). Let us examine the empirical consequences of this proposal in detail.

Generic sentences often refer to 'cases' implicitly in that they appear to have no expressions that serve as free variables. For example, (4a) implicitly quantifies over times at which Caesar awakes. (4b) would be one way of representing the semantic structure of (4a):

(4) a. Caesar seldom awoke before dawn.

b. Seldom [Caesar awakes at *t* & *t* precedes the speech time, (Caesar awakes at *t* & *t* precedes the speech time &) *t* is before dawn]

(5a), on the other hand, requires a more complex analysis:

(5) a. Riders on the Thirteenth Avenue line seldom find seats.

b. Seldom [*x* rides a train on the Thirteenth Avenue line at *t*, *x* occupies a seat at *t*]

c. Seldom [*e* is someone's riding a train on the Thirteenth Avenue line, *e* is someone's riding a train on the Thirteenth Avenue line seated]

Two possible analyses of (5a) are presented here: (i) *seldom* quantifies over rider-time pairs as in (5b); (ii) *seldom* quantifies over events as in (5c). Lewis's mathematical example (6), however, does not seem to involve time intervals or events:

(6) A quadratic equation usually has two different solutions.

(6) means that a majority of quadratic equations have two different solutions, and this interpretation does not involve times or events, at least not in an obvious way. Thus, Lewis suggests that in this example, the relevant 'cases' are quadratic equations:

(7) Usually [*x* is a quadratic equation, *x* has two different solutions]

(8a), a donkey sentence with a conditional, is analyzed as in (8b):

(8) a. If a man owns a donkey, he always beats it.
b. Always [*x* is a man & *y* is a donkey & *x* owns *y*, *x* beats *y*]

Although the DRT analysis of adverbial quantifiers is largely successful, it has downplayed, to an excessive degree in my view, the tense-related complications associated with donkey sentences. I do not intend here to suggest that temporal matters are ignored in DRT. On the contrary, this approach was originally conceived by Kamp (1979, 1981a) in an effort to account for some problems with tense and aspect in French. However, when donkey sentences are discussed in DRT, they are treated as if they are atemporal. Partee (1984) discusses donkey

sentences and their temporal analogues and attempt to establish a parallel, but she does not consider cases in which an adverb quantifies over both nominal and temporal objects at the same time. Although this has the advantage of keeping the donkey anaphora problem relatively simple, this simplification is not always warranted. We shall see in this article some complex examples that involve both temporal and nominal anaphora. They will lead us to conclude that a simple unselective quantifier approach to quantificational adverbs is inadequate.

Let us briefly look at how sentences with a temporal adverbial clause and an adverb of quantification are analyzed by the rules given in (3). (9) appears to be a case in which a quantificational adverb quantifies over time intervals, which are not overtly indicated in the sentence.

(9) When Mary called John, he was always asleep.

I assume, tentatively, that (9) has a logical representation given in (10):

(10) Always [Mary calls John at *t*, John is asleep at *t*][3]

The analysis given in (10) predicts the right interpretation for (9). (9) is predicted to be true if and only if the set of times at which Mary calls John is included in the set of times at which John is asleep. This appears to give us the right truth conditions because *is asleep* is a stative predicate and is assumed to have the subinterval property (Bennett and Partee (1972)). However, as we shall see, other *when*-clauses present more complex temporal relations with matrix clauses and do not receive a straightforward account. Moreover, it is clear that the analysis given in (10) does not extend to the temporal adverbial clauses that involve *before* or *after*. I will discuss such complications in detail in the next section.

2. Examples without Adverbs of Quantification

Let us set aside examples involving quantificational adverbs, and consider non-quantified examples, i.e., sentences of the form *When/Before/After* S_1, S_2 in which each clause describes one single event. Let us consider *when* first. In the above discussion of example (9), each interval at which the *when*-clause is true is also a time at which the main clause is true. However, this is empirically inadequate when we turn to examples like (11a–c) due to Hinrichs (1986:75).

(11) a. John broke his arm when he wrecked the Pinto.
b. When the Smiths moved in, they threw a party.
c. When the Smiths threw a party, they invited all their old friends.[4]

These examples suggest that there are various possible temporal relations between *when*-clauses and main clauses.[5] On the basis of examples like (11a–c), Hinrichs (1981, 1986) contends that a *when*-clause introduces a reference time and the two events in question are located within this reference time. Partee (1984) proposes a different account. Her idea is to introduce a new reference time 'just after' the *when*-clause event. The event described by the main clause is located within this new reference time. She acknowledges that Hinrichs' proposal covers more cases but says that her proposal "gives a more unified account of the introduction of reference times in the linear case (p. 261)."[6] We can say at least that the *when*-clause event and the main clause event must be temporally close to each other.

At first sight, no such 'temporal proximity constraint' is imposed on *before* or *after* when the temporal adverbial clause and the main clause describe a single event each. For example, the two events described in (12) do not have to be temporally close to each other:

(12) John entered college before Mary did.

In some cases, however, temporal proximity seems to play a role in determining the truth conditions (or perhaps felicity conditions) for sentences involving *before* or *after*. Consider the following example:

(13) John had breakfast before he went to bed.

It would be odd to utter (13) in the following situation: one day John woke up at seven. He had breakfast, went to work, returned to his apartment at eight in the evening, and went to bed at eleven. (Assume that he had lunch and dinner in the meantime.) It is true that John's having breakfast temporally precedes his going to bed. However, given what John did on that day, (13) is a very misleading statement. I think it is best to account for (13) in terms of Hinrichs' proposal. There is a contextually determined reference time within which the two events in question are located, and the reference time for (13) is a relatively short interval around the breakfast time. Thus, it is arguable that even if we restrict our attention to non-quantificational cases, *before*- and *after*-clauses are subject to the temporal proximity constraint regarding the two events involved. We shall show later that this type of constraint is absolutely necessary to account for quantificational cases.

3. Adverbs of Quantification and Temporal Adverbial Clauses

As mentioned above, Partee (1984) assumes that a *when*-clause interacts with a main clause in such a way that the main clause event is placed "just after" the *when*-clause event. Although Partee does not make clear how the concept of "just after"

should be formalized, I tentatively assume that we need a contextually defined relation that applies to two intervals and decides whether they are close enough in the given context. Partee assumes that the temporal proximity requirement of *when*-clauses carries over to quantificational cases. Consider (14).

(14) a. When John telephoned Dr. Jones, his secretary always answered.

b. Always [*e* is John's telephoning Dr. Jones and *t* is immediately after *e*, there is an event of his secretary's answering which obtains within *t*]

The interpretation of (14b) is that for each pair <*e*, *t*> such that *e* is an event of John's telephoning Dr. Jones and *t* is the time immediately after *e*, there is an event of his secretary's answering located within *t*. It is assumed here that each event of John's telephoning Dr. Jones is matched up with a unique time interval because the interval assigned to *t* is the time 'just after' *e*. As desired, (14a) is interpreted to mean that for each event of John's telephoning Dr. Jones, there is an event of his secretary's answering that immediately follows it. Partee notes, however, that it is not possible to extend her idea to examples involving *before* or *after*. Partee (1984:272) considers examples like (15).

(15) Before John makes a phone call, he always lights up a cigarette.

Partee observes that introducing in the 'antecedent box' a reference time for the event in the main clause would result in the interpretation that John lights up a cigarette at all times preceding each phone call, rather than that he lights a cigarette sometime before each phone call.

(16) Always [*x* = John & *y* is a phone call & *e* is *x*'s making *y* & *t* precedes *e*, there is an *e*′ such that *z* is a cigarette & *e*′ is *x*'s lighting up *z* & *e*′ obtains within *t*]

Since the second reference time is introduced in the 'antecedent box' as a free time variable, it is caught by the unselective quantifier *always*. Note here that *t* is merely required to precede *e*. Therefore, for any given value of *e*, all the intervals which precede the temporal extension of *e* would qualify as a value of *t*. This leads to the erroneous prediction mentioned above. One possible solution to this problem suggested by Partee is to introduce a reference time in the consequent part, rather than in the antecedent part. However, if we introduce a new time and/or event in the consequent part, a new problem arises. Consider the following representation:

(17) Always [*x* = John & *y* is a phone call & *e* is *x*'s making *y*, there is a *t* such that *t* precedes *e* & *z* is a cigarette & *e*′ is *x*'s lighting up *z* & *e*′ obtains at *t*]

(17) is also problematic in that one single event of John's lighting up a cigarette which precedes all events of John's making a phone call is enough to make the sentence true.

In order to avoid these problems, Stump (1985) imposes a temporal proximity constraint upon *before* cases and *after* cases, as well as *when* cases. According to this proposal, (17) must be modified as in (18) in the spirit of Stump's proposal.

(18) Always [*x* = John & *y* is a phone call & *e* is *x*'s making *y*, there is a *t* such that *t* precedes *e* and *t* is temporally close to *e* & *z* is a cigarette & *e*′ is *x*'s lighting up *z* & *e*′ obtains at *t*]

In section 5 and 6, we will reconsider the problem associated with temporal adverbial clauses in connection with the proportion problem.

4. Some General Problems with the Original DRT Approach

The recent studies on DRT reveal many empirical problems with the unselective quantifier approach associated with classical DRT. One such problem is the so-called PROPORTION PROBLEM (Kadmon 1987), which is exemplified by the following sentences:

(19) a. Most women who own a dog are happy.
b. If a farmer owns a donkey, he is usually rich.

According to the original DRT approach, (19a) is predicted to be true if and only if the following conditions are satisfied:

(20) For most of the pairs <*x*,*y*> such that *x* is a woman and *y* is a dog that *x* owns, *x* is happy.

However, (20) predicts the wrong result in the following situation: there is a woman who owns fifty dogs and is happy, and there are nine other women who own one dog each and are unhappy. Intuitively, (19a) is false under the situation just described, but the truth conditions given in (20) predict that it is true. The problem is that *most* as used in (19a) intuitively quantifiers over women, but (20) predicts that it quantifies over woman-dog pairs. In terms of DRT, this means that

most must only bind the variable for women, and the variable for dogs must be bound by an existential quantifier with narrow scope.

This problem has a temporal analogue. Consider the example in (21a–b). It is presented by Kadmon (1987), who attributes it to Bäuerle and Egli (1985).

(21) a. When an aunt comes, I usually go to the cinema.

b. Usually [*x* is an aunt & *x* comes at *t*, I go to the cinema at *t*][7]

If *usually* quantifies over aunt-time pairs, (21a) is predicted to be false in the following situation: at one time, ten aunts came together and I did not go to the cinema, but ten other times a single aunt came, and I did go to the cinema. This prediction goes against the native speaker's intuitions. What we need here is quantification over intervals at which some aunt comes, not over interval-aunt pairs. The problems associated with (19a–b) and (21) suggest that adverbial quantifiers may be selective quantifiers after all.[8]

Another problem was pointed out by Schubert and Pelletier (1989:200), who discuss the following example:

(22) If I have a quarter in my pocket, I will put it in the parking meter.

The DRT semantics requires that if the speaker has some quarters in his pocket, he or she puts all of them into the parking meter. However, our intuitions tell us that putting one quarter, if the speaker has any, is sufficient to make the sentence true. Schubert and Pelletier account for the asymmetric reading for the quantificational version of (22), i.e., (23), by assuming that *always* can serve as a selective quantifier which controls only the time variable (1989:245).[9]

(23) If a man has a quarter in his pocket, he always puts it in the parking meter.

(23) also supports the claim that adverbs of quantification behave like selective quantifiers at least in some cases.

However, in other cases, making the quantifiers selective is not enough to obtain the right truth conditions. Let us consider (24), which is due to Kamp (1990).

(24) In the 70s I lived in France. When I was in Paris, I often paid a visit to the Louvre.

Though the second sentence of (24) has several possible interpretations, I will concentrate upon the following: the speaker visited Paris on several different occasions in the 70s, and a visit to the Louvre was included in many of his visits to Paris. Note that this interpretation cannot be obtained by positing the following logical representation:

(25) Often [I am in Paris at *t*, I pay a visit to the Louvre sometime within *t*]

Given that *I am in Paris* has the subinterval property and that time is dense, we are forced to conclude that as soon as the speaker visits Paris once, there are an infinite number of intervals that can be values of the variable *t* in the above formula. It is easy to see, then, that the condition given in the consequent cannot be satisfied. A possible solution is to let *often* quantify over maximal intervals *t* at which *I am in Paris* is true in that there is no interval t' such that $t \subseteq t'$ and *I am in Paris* is true at t'.

But this cannot be accomplished straightforwardly given our current system. The question is how this can be done in a principled manner.

5. A New Type of Proportion Problem

The last problem presented in the previous section casts doubt upon the idea that the proportion problem can be solved simply by assuming that an adverb of quantification is a selective quantifier. In the temporal examples involving temporal adverbial clauses, the domain of quantification must be selected carefully. In other words, in addition to selecting the right variable(s), it is necessary to impose some additional restrictions upon the possible values that these variables can assume. However, there are some examples that show that the right domain of quantification cannot be obtained either by making the quantifier selective and/or by constraining the values of the variable(s).

Consider (26), which was introduced earlier as (15).

(26) Before John makes a phone call, he always lights up a cigarette.

According to Partee's analysis, (26) is predicted to be false in the following situation: one day John makes two phone calls in a row, and he only smokes before the first phone call. On other days, he makes one phone call per day, and he smokes immediately before each phone call. However, our intuition is that (26) is true in this situation. It seems that if John makes two phone calls in a swoop, they count as "one collective event," so to speak, on a par with the other phone calls which were made in isolation. And the adverb *always* quantifies over such situations, not in reference to the individual phone calls. Note here that it is not sufficient to let *always* quantify over the set of intervals at which a phone call is

made because the two continuous phone call events occupy different time intervals. Nor does it work to let *always* quantify over interval-phone call pairs. Rather, quantification must be made in reference to SITUATIONS, each of which includes either a unique phone call event if it is made in isolation OR a series of phone calls that are made on one occasion. It seems impossible to derive such SITUATIONS from the syntactic and semantic information available at the surface sentence level. This leads us to suspect that the set of intervals is pragmatically chosen and is used as the domain of quantification for the adverbial quantifier. This line of reasoning leads to a very different analysis of adverbs of quantification than the one assumed in the classical DRT analysis.

A similar problem occurs with *when*. Consider the following example:

(27) When John smokes a cigarette, Mary always puts on her gas mask.

The story goes as follows: John is a heavy smoker, and Mary hates cigarette smoke. Therefore, whenever he smokes, she puts on her gas mask to protect her health and also to demonstrate how much she hates cigarette smoke. Partee's (1984) analysis provides the following logical representation for (27):

(28) Always [*x* is a cigarette & *e* is John's smoking *x* & *t* is immediately after *e*, Mary puts on her gas mask at *t*]

This representation predicts that the sentence is false in the following situation: Whenever John smokes, he smokes many cigarettes, not just one. As soon as he starts smoking, Mary puts on her gas mask, and she does not take it off until he stops smoking. This is repeated every day. This means that she does not put on her mask every time he starts smoking a new cigarette. However, the judgment seems

to be that (27) is true in the current scenario. If this judgment is correct, *always* does not quantify over individual smoking-a-cigarette events. Instead, it makes reference to situations in which John smokes and checks whether there is an event of Mary's putting on her gas mask in conjunction with each such situation. Just as in (26), one possible solution is to use a pragmatically induced set of intervals as the domain of quantification for quantificational adverbs.

This type of pragmatically-oriented analysis is absolutely necessary to account for the behavior of so-called non-factual *before*. For example, (29) does not entail that John actually killed himself in any of the suicidal situations. On the contrary, our pragmatic knowledge tells us that his wife prevented him from committing suicide in each critical situation.

(29) John's wife always came to his rescue before he jumped out of the window.

Since there are no actual *before*-clause events, it is necessary to reconstruct a set of relevant intervals from the context. This type of analysis is pursued in Ogihara (1995).

6. Toward a New Theory

As we have seen above, it would be very difficult to pursue a selective quantifier approach because the variables to be selected and the domain of quantification to be used must be constrained in a very unpredictable and context-dependent way. Although the process of domain selection is undoubtedly heavily pragmatic in nature, it would be better to be able to provide a general statement about the semantic contribution that an adverbial quantifier makes. From this perspective,

some recent proposals such as Berman (1987), Heim (1990), and von Fintel (1994) that are based upon a situation semantic theory invented by Kratzer (1989) seem to be on the right track. In their proposals, adverbial quantifiers quantify over situations. Situations in Kratzer's theory are defined as parts of worlds, and they are flexible enough to cover various entities over which adverbial quantifiers quantify. My proposal differs from the previous situation-based proposals (e.g., von Fintel (1994)) in that I do not appeal to the notion of minimal situations, nor do I permit extending a quantifier-domain situation to find a nuclear-scope situation. For the purpose of this article, I shall merely show how my proposal would deal with some of the examples discussed above to demonstrate that this type of approach is worth pursuing.

First, as for examples that deal with temporal adverbial clauses, we can simply say that a set of relevant situations is pragmatically selected in such a way that both the adverbial clause eventuality and the (potential) matrix eventuality are included in each situation.[10] For example, (15) , repeated here as (30a), is predicted to have the truth conditions given in (30b). *C* is the set of pragmatically-induced set of situations, and τ is a temporal trace function that applies to a situation and yields its temporal extension.

(30) a. Before John makes a phone call, he always lights up a cigarette.

b. $\{s \mid \exists s_1 \exists x[s_1 \leq s$ & x is a phone call in s_1 & John makes x in $s_1]$ and $s \in C\} \subseteq \{s \mid \exists s_1 \exists y[s_1 \leq s$ & y is a cigarette in s_1 & John lights up y in s_1 & $\neg \exists s_2 \exists x[x$ is a phone call in s_2 & John makes x in s_2 & $\tau(s_2) < \tau(s_1)]]$ and $s \in C\}$

The idea is that some elements of *C* contain multiple phone calls and others only contain one phone call each. The semantics of *before* is due to Anscombe (1966),

and this analysis also draws on Rooth's (1985) domain selection theory. This allows us to state the right truth conditions for (15). A similar mechanism accounts for (24) and (29).

Let us now consider (19b), repeated here as (31a), which exemplifies the proportion problem in the nominal domain. I shall propose the truth conditions given in (31b).

(31) a. If a farmer owns a donkey, he is usually rich.

b. A majority of the elements of $\{s \mid \exists s_1 \exists x \exists y[s_1 \leq s \ \& \ x \text{ is a farmer in } s_1 \ \& \ y \text{ is a donkey } \& \ x \text{ owns } y \text{ in } s_1] \ \& \ s \in C\}$ are also elements of $\{s \mid \exists s_1 \exists x[s_1 \leq s \ \& \ x \text{ is a farmer in } s_1 \ \& \ x \text{ is rich in } s_1] \ \& \ s \in C\}$

In (31b), *C* is selected in such a way that the resulting domain of quantification is the set of situations in which exactly one farmer and all the donkeys he owns are found. This is equivalent to letting *usually* quantify over donkey-owning farmers.

Schubert and Pelletier's example (23) (= (32a)) is analyzed in the present proposal as in (32b).

(32) a. If a man has a quarter in his pocket, he always puts it in the parking meter.

b. $\{s \mid \exists s_1 \exists x \exists y[s_1 \leq s \ \& \ x \text{ is a man in } s_1 \ \& \ y \text{ is a quarter in } s_1 \ \& \ x \text{ has } y \text{ in } s_1] \ \& \ s \in C\} \subseteq \{s \mid \exists s_1 \exists x \exists y[s_1 \leq s \ \& \ x \text{ is a man in } s_1 \ \& \ y \text{ is a quarter in } s_1 \ \& \ x \text{ puts } y \text{ in the parking meter in } s_1] \ \& \ s \in C\}$

Just as in the earlier examples, I depend heavily upon *C* for deriving the right interpretation for (32a). I assume that *C* is chosen in such a way that each relevant situation will include exactly one man and all the quarters he has. Assuming the

semantic mechanism of Schubert and Pelletier that accounts for the indefinite lazy reading of the "E-type pronoun" *it*, we can derive the right interpretation for (32a).[11]

7. Closing Remarks

In this article, it is suggested that there are many problems with the idea that the frequency adverbs can be analyzed as unselective quantifiers. However, making the adverbial quantifiers selective does not seem to solve these problems. Intuitively, quantificational adverbs quantify over a set of relevant SITUATIONS, which cannot be easily derived from the syntactic and/or semantic information available at the surface sentence level. Drawing on Kratzer's work on situation semantics, I have sketched my analysis of the problematic data.

Notes

* This is a revised version of DYANA (Dynamic Interpretation of Natural Language) deliverable R2.3.B. I thank Hans Kamp, Walter Kasper, and Marc Moens for discussion and/or valuable suggestions. I also wish to acknowledge the following three talks on temporal semantics given during the European Summer School held in Leuven, Belgium in Summer 1990: those by Hans Kamp, Henriëtte de Swart, and Alex Lascarides. Those talks motivated me to work on this paper. I also thank Gina Christine Taranto for her help with proofreading. Of course, I alone am responsible for any errors.

[1] In this article, the "first argument" of a quantificational adverb will be referred to as RESTRICTIVE CLAUSE or ANTECEDENT, and the "second argument" as CONSEQUENT.

[2] When a new variable is introduced in the consequent as in (i), (3a) predicts that (i) translates as in (ii), which makes the wrong predictions.

(i) It is always the case that when a man is lonely, he keeps a cat.

(ii) always [*x* is a man & *x* is lonely, *x* keeps *y* & *y* is a cat]

(ii) is true if there is no lonely man. If there is some lonely man, (ii) is true only if some pragmatically implausible conditions are satisfied. At any rate, (ii) does not have the truth conditions that (i) has.

[3] I leave the name *John* unanalyzed here.

[4] Stump (1985:155) also provides an example in which the *when*-clause situation appears to precede the main-clause situation.

(i) When Lindbergh crossed the Atlantic, he chose Long Island as his starting point.

[5] Lascarides (1990) claims that this is the right generalization about English and proposes a formal framework which accounts for the actual order of the events by incorporating some information about pragmatics.

[6] See also Schubert and Pelletier (1989).

[7] Strictly speaking, translating the main clause as 'I go to the cinema at t' is problematic because the time of an aunt's coming and my going to the cinema are not simultaneous.

[8] They also suggest that indefinite NPs should perhaps be analyzed as existential quantifiers, at least in some cases.

[9] Schubert and Pelletier accounts for what they call the INDEFINITE LAZY READING of the pronoun *it* by exploiting the difference between TRUE-IN-A-CONTEXT, versus TRUE-IN-ENGLISH.

[10] The term eventuality (Bach 1986) is used as a cover term for both events and states.

[11] This informal presentation does not show how the pronoun *it* in (32a) should be analyzed. I merely paraphrase the right interpretation of *it* in terms of an existential quantifier in (32b). The same caveat applies to other occurrences of pronouns such as *he* in (31a) and *he* in (32a), which receive regular E-type interpretations.

REFERENCES

Anscombe, Gertrude Elizabeth Margaret (1964) "Before and After," *The Philosophical Review* 73, 3–24.

Bach, Emmon (1986) "The Algebra of Events," *Linguistics and Philosophy* 9, 5–16.

Bäuerle, Rainer and Urs Egli (1985) *Anapher, Nominalphrase und Eselssätze*, Arbeitspapier105 des Sonderforschungsbereichs 99, University of Konstanz.

Bennett, Michael and Barbara Partee (1972) *Toward the Logic of Tense and Aspect in English*, distributed by the Indiana University Linguistics Club.

Berman, Steve (1987) "Situation-Based Semantics for Adverbs of Quantification," University of Massachusetts Occasional Papers 12, ed. by J. Blevins and A. Vainikka.

Dowty, David R. (1979) *Word Meaning and Montague Grammar: The Semantics of Verbs and Times in Generative Semantics and in Montague's PTQ*, Reidel, Dordrecht.

von Fintel, Kai (1994) *Restrictions on Quantifier Domains*, Doctoral dissertation, University of Massachusetts, Amherst.

Heim, Irene (1982) *The Semantics of Definite and Indefinite Noun Phrases*, Doctoral dissertation, University of Massachusetts, Amherst.

Heim, Irene (1990) "E-type Pronouns and Donkey Anaphora," *Linguistics and Philosophy* 13, 137–177.

Hinrichs, Erhard (1981) *Temporale Anaphora im Englischen*, Staatsexamen thesis, University of Tübingen .

Hinrichs, Erhard (1986) "Temporal anaphora in discourses of English," *Linguistics and Philosophy* 9, 63–82.

Kadmon, Nirit (1987) *On Unique and Non-Unique Reference and Asymmetric Quantification*, Doctoral Dissertation, University of Massachusetts, Amherst.

Kamp, Hans (1979) "Events, Instants and Temporal Reference," *Semantics from Different Points of View*, ed. by Rainer Bäuerle, Urs Egli, and Arnim von Stechow, 376–418, Springer, Berlin.

Kamp, Hans (1981a) "Evénements, répresentations discursives et référence temporalle," *Langages* 64, 39–64.

Kamp, Hans (1981b) "A Theory of Truth and Semantic Representation," *Formal Methods in the Study of Language*, ed. by Jeroen Groenendijk, Theo Janssen, and Martin Stokhof, 277–322, Mathematisch Centrum, Amsterdam.

Kamp, Hans (1990) A talk on temporal semantics given at the Second European Summer School, Leuven, Belgium.

Kratzer, Angelika (1989) "An Investigation of the Lumps of Thought," *Linguistics and Philosophy* 12, 607–653.

Lascarides, Alex (1990) “Knowledge, Causality and Temporal Representation,” Research Paper HCRC/RP-8, University of Edinburgh.

Lewis, David (1975) “Adverbs of Quantification,” *Formal Semantics of Natural Language*, ed. by Edward L. Keenan, 3–15, Cambridge University Press, Cambridge.

Ogihara, Toshiyuki (1995) “Non-factual Before and Adverbs of Quantification,” *Proceedings from Semantics and Linguistic Theory V*, ed. by Teresa Galloway and Mandy Simons, 273–291, DMLL Publications, Cornell University, Ithaca, NY.

Partee, Barbara H. (1984) “Nominal and Temporal Anaphora,” *Linguistics and Philosophy* 7, 243–286.

Rooth, Mats (1985) *Association with Focus*, Doctoral dissertation, University of Massachusetts, Amherst.

Schubert, Lenhart K. and Francis J. Pelletier (1989) “Generically Speaking, or, Using Discourse Representation Theory to Interpret Generics,” *Properties, Types and Meaning*, Volume II: *Semantic Issues*, ed. by Gennaro Chierchia, Barbara H. Partee, and Raymond Turner, 193–268, Kluwer, Dordrecht.

Stump, Gregory (1985) *The Semantic Variability of Absolute Constructions*, Reidel, Dordrecht.

Swart, Henriëtte de (1989) “A Temporal Analysis of Quantifying Adverbs,” *Papers from the 25th Regional Meeting*, vol. 1, 68–82, Chicago Linguistic Society.

_____ (1990) “Quantified Sentences Introduced by a Temporal Connective,” paper presented at the Second European Summer School, Leuven, Belgium.

Vendler, Zeno (1967) *Linguistics in Philosophy*, Cornell University Press, Ithaca, NY.