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Situation theory and the semantics of propositional expressions

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University of Massachusetts, 1992

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SITUATION THEORY AND THE SEMANTICS OF PROPOSITIONAL EXPRESSIONS

A Dissertation Presented

by

PAUL HOWARD PORTNER

Submitted to the Graduate School of the University of Massachusetts in partial fulfillment of the requirements for the degree of

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Department of Linguistics
SITUATION THEORY AND THE SEMANTICS OF PROPOSITIONAL EXPRESSIONS

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This paper discusses the variety of propositional expressions in English: gerunds, infinitives, and indicative and subjunctive clauses. It is proposed that, by using a variety of situation semantics developed by Kratzer (1991a), one can assign different characteristic sorts of propositions to each class of expressions. On this theory, propositions are sets of possible situations, where situations are parts of worlds; a possible world is simply a maximal possible situation. A uniform analysis of subordination is also given. When these types of phrases are subordinated, they always denote functions from reference situations to propositions.

Gerunds may be considered to denote sets of minimal situations. This allows an analysis which does not postulate an ambiguity of the idea that sometimes they denote sets of events but that other times they denote propositions (Vendler (1967)). The reference situation is used in giving a semantics for imperfectivity that allows gerunds, the progressive, and free adjuncts to be treated uniformly. For infinitives, in contrast, are
argued to denote sets of situations which extend into the future from the reference situation, thus providing an understanding of the idea that they are future-oriented and irrealis (Bresnan (1972)). There are at least two kinds of subjunctive in English. Given a reference situation, one type denotes a set of situations incompatible with it. The other type requires its reference situation to be one in which something is obliged. Finally, with indicative clauses the reference situation is used as part of the analysis of sequence of tense phenomena. The proposition they result in is always persistent: it includes a supersituation of any situation in it. The characteristic propositions each type of phrase denotes lets us understand the selectional restrictions that a variety of propositional attitude verbs have.
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CHAPTER 1
GENERAL INTRODUCTION

This dissertation addresses the question of what semantic theory of propositions can best be used to analyze the variety of syntactically distinct propositional expressions. The standard view within formal semantics is that propositions are sets of possible worlds, with a possible world being a total way a universe-history could be. Up until now this approach has been applied in detail to indicative clauses, but little attention has been paid to the semantic similarities and differences among the members of a wider group of phrases, all of which, it has been suggested, denote propositions. In this work I will investigate the semantics of gerunds, infinitives, subjunctives, and indicatives in English. Each of these types of expressions has its own characteristic semantic properties while evidently still being propositional.

A brief examination of gerunds, infinitives, and subjunctives shows that each differs semantically from indicative clauses in a particular way. Gerunds, which since the work of Vendler (1967) have been seen to have at least a propositional use, as in (1), in other cases seem to denote something like a set of events, as in (2).

(1) John denied eating the apple.
   John denied that he ate the apple.
(2) Eating that apple was fun.
If the proposition that the gerund in (1) denotes must be the set of possible worlds in which John eats the apple—as, let us assume, is the case for the indicative complement—it seems unlikely that the gerund in (2) should be analyzed in the same way.

On the basis of examples like (3), infinitives are another type of expression that one might well want to analyze as propositional.

(3) Joan hopes for Mary to come.

Joan hopes that Mary will come.

As has been pointed out by Bresnan (1972), however, infinitives have aspects to their meaning that are distinctive. Infinitives with the complementizer for have a future orientation that is apparent in (3). Furthermore, they seem to occur exclusively in intensional contexts. It is difficult to see how to give an account of these points within possible worlds semantics, and there is been virtually no formal semantic discussion of them.

Subjunctive clauses also have semantic properties that distinguish them from indicatives. While there are several kinds of subjunctives in English (cf. Chapter 4), by way of illustration the variety in (4) seems to only occur in contexts where it is presupposed that it is contrary to fact or that someone believes it to be contrary to fact.¹

(4) Mary wishes that Bill were here.

If Bill were here, Mary would be happy.

¹Karttunen and Peters (1979) dispute this characterization. See Chapter IV for discussion.
Farkas (1990) has studied the semantics of the subjunctive in Romance; while she has made progress in understanding the contexts which select for the subjunctive, up until now no one has come up with a formal interpretation for this form that explains its distribution and semantic properties.

The task of Chapters 3-5 is to examine the semantic differences among these syntactically distinct kinds of proposition-denoting expressions in light of a modified view of the nature of propositions. The central idea, which has emerged in a number of places in recent years, is that propositions are not sets of possible worlds but rather sets of possible situations (Barwise and Perry (1983), Landman (1986), Kratzer (1989a))\(^2\). The particular form of this idea that I will use here is Kratzer's; it is a fairly conservative extension of possible worlds semantics, replacing the set of possible worlds in classical systems with a set of possible situations. Having situations instead of worlds makes for much more flexibility in distinguishing kinds of propositions in linguistically relevant ways. By utilizing this framework, I hope to explain the kinds of facts represented by (1)-(4) above.

Modern linguists were not the first to realize that there are some important and puzzling connections between situations and

\(^2\)Lewis (1981, 1983) holds a similar view: that sentence meanings, at a context, are functions from world-time-speaker (plus possibly some additional components) tuples to truth values. However, the world, time and speaker need not be such that the speaker exists in the world at the time or even such that the world exists at the time, and in this way these tuples are not interchangeable with situations. Lewis' arguments that world, time, and speaker need to be independent parameters in this way translate into situation semantics as arguments that propositions should be treated as functions from situation-time-speaker tuples to truth values.
propositions. As they have thought about the relations among propositions, situations, states of affairs, and events, linguists and philosophers have long struggled to reconcile the intuition that a true sentence describes some part of the world with the realization, to use Wittgenstein's metaphor (1922, §3.144), that the meaning of a sentence must be more like an arrow than a point. The traditional approach, which originated with the work of Carnap (1947) and has been developed by, among others, Hintikka (1961), Kanger (1957), Kripke (1959, 1963), Montague (1960b), is that the meaning of a sentence is a set of possible worlds. If a sentence describes a part of the actual world, it is because every possible world in the sentence's meaning contains a part similar to that actual part.

The idea of 'event' natural within this system is that an event is a property of times (Montague (1960a)) or a property of space-time points (Cresswell (1973, 1985), Lewis (1986b)). These formulations take an event to be a class of parts of worlds. A sentence can be said to describe a given event if the event is realized--e.g. if some of its times or space-time points exist--in every world in the sentence's denotation. Events of this kind can be more or less specific. A nominal like the rising of the sun can denote both the property of times at which the sun rises--billions of individual new days in this world alone--or a property of times corresponding to this morning's sunrise only. Intuitively, this notion of event is very close to that of proposition; an event is a class of parts of worlds instead of a class of whole worlds. However, despite the intuitive similarity, on these approaches
there is very little formal similarity; while events are functions from worlds to sets of times, propositions are functions from worlds to truth values.

A second approach to the semantics of sentences is to take the idea that sentences name parts of the world as basic, and then try to extend this view in a way that lets a sentence denote in a way sufficiently different from names. The most explicit approach along these lines is Situation Semantics (Barwise and Perry (1983)). (Henceforth I will refer to Barwise and Perry's theory as SA, for Situations and Attitudes, their 1983 book, in order to distinguish it from Kratzer's theory.) The basic idea of SA is that the meanings of parts of sentences--individuals, properties, etc.--are linguistically primitive, and that sentences put together these meanings in a way that can correctly or incorrectly classify actual parts of the world, otherwise known as actual situations. Besides assembling sentence meanings out of the semantic primitives, it is also possible to create a variety of other set-theoretic objects. Some of these have a different kind of linguistic significance: they are a second variety of situation, the abstract situations. An abstract situation is a group of individuals and a relation along with a specification of whether the individuals stand in the relation. Technically, it is the abstract situations that are classified by propositions, but some of the abstract situations stand in a special relation to real parts of the world--they may be said to represent actual situations. When a sentence classifies as true or false an abstract situation which represents an actual situation, it may be said to have classified the actual situation as
well. It is the introduction of abstract situations which allows SA to avoid making sentences simply be names for parts of the world.

Possible worlds semantics provides a direct analysis of what a proposition is, and then, on the basis of this, can give us a way of understanding the intuition that a sentences may describe a part of the world or an event. SA, in contrast, begins by formulating an analysis of how sentences describe parts of the world, and then moves to a more abstract notion of situation in order to model what, for the possible worlds semanticist, is the fundamental notion of proposition. There is a third approach to the semantics of sentences which gives a direct analysis both of how sentences describe parts of the world and of how they denote a realm of possibilities. This is the variety of situation semantics introduced by Kratzer (1989a) and for which I will reserve the term 'situation semantics'. As mentioned above, this theory is like ordinary possible worlds semantics except that it replaces the set of possible worlds with a set of possible situation. Possible situations are primitive objects which are intuitively ways that part of the world could be. According to this theory, sentences denote sets of possible situations. In this way they are immediately intensional, as with possible worlds semantics, but the way in which they can describe a situation is also directly analyzed. A proposition p describes a situation s iff s ∈ p. In this way Kratzer's theory results in a very simple and elegant representation of two fundamental intuitions about how sentences mean.
In this dissertation I will explore some aspects of the semantics of gerunds, infinitives, subjunctives and indicatives by using some of the resources afforded by situation semantics. We have seen that possible worlds semantics and SA can model both the idea that sentences denote propositions and that they describe situations. For this reason, I don't believe that any analysis I will give could not be translated into either of those frameworks. Indeed, given the apparatus of set theory that all the approaches have at their disposal, I doubt any reasonable analysis in one of these theories is untranslatable, in some sense, into the others. However, in what follows the fact that the situation semantics makes sentence meanings be at the same time both sets of alternative possibilities and descriptions of actual events will be very important. For instance, the fact that gerunds sometimes seem to have meanings like common nouns, denoting sets of events, but at other times appear to have the semantics of sentences, can be explained on this approach. For this reason this dissertation can be seen partially as an extended argument for Kratzer's theory. More importantly, however, I hope to use the added flexibility that this aspect of the situation semantics provides to improve our understanding of the similarities and differences among the various kinds of propositional expressions in natural language.

Within situation semantics, there are at least three potentially interesting ways that propositions could differ formally from each other. First, a proposition could be distinctive in that all the situations in it have a certain kind of internal
structure. For example, it might be a characteristic of a certain syntactically definable class of propositional expressions that all the situations in their denotations are internally homogeneous—that is, that no subpart is relevantly different from any other. This could be the case for entities that we say denote states or processes:

(5) He is running.
(6) She is tall.

Thus this first type of variation among propositions has to do with aspect and aspectual classes (aktionsarten).

A variety of proposition could also be distinctive in that someone holds a particular attitude towards situations in the propositions' denotations. For instance, it might be a matter of the semantics of an example like (7)

(7) Would that she were here!

that the speaker holds the situations in the denotation of she were here to be desirable. The kind of variation on the meanings of propositions goes by the traditional name 'mood'.

Finally, situation semantics will also suggest a third parameter of variation for propositions. The situations in a proposition may have various 'structural' properties; in what follows we will make use of two sorts of structural properties. First, a type of proposition may be such that, if some given situation s is in it, this will entail that some other s' is also in it. (8) presents an example:

(8) presents an example:
A proposition $p$ is **persistent** iff, for all situations $s$ and $s'$, if $s \subseteq p$ and $s$ is a part of $s'$, then $s' \subseteq p$.\(^3\)

(8) makes use of the idea that one situation may be a part of another; this will be discussed further in Chapter 2, but the concept is pretty intuitive. If one thinks of the situation $s$ consisting of everything that goes on in Amherst, Massachusetts on 3/8/92 and the situation $s'$ consisting of everything that goes on in all of Massachusetts on that same day, it is intuitively clear what it means to say that $s$ is a part of $s'$. (The part-of relation will be discussed in more detail in the next chapter.) We can then see what (8) says: that a persistent proposition contains every supersituation of a situation in it.

The second kind of structural property that will become relevant is that a given class of propositions may have their situations built up out of simpler situations in a particular grammatically defined way. An example that will be elaborated on in Chapter 4 has to do with the infinitives that Bresnan (1972) has argued to be futurate and irrealis.

(9) John wants for you to go to the store.

We can build the future orientation of this infinitive into its meaning by saying that *for you to go to the store* denotes possible situations that extend from the present (the time at which John wants) into the future until they include a situation in which you go to the store. Once we have moved to the situation semantics, this move may seem to be an almost obvious representation of

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\(^3\)For discussion of persistence see Barwise and Perry (1983), Landman (1986), and Kratzer (1989a).
our intuitions about what the infinitive means. However, before looking at the infinitive with an idea that it could have a characteristic semantics because of the structure of the situations in its denotation, it would have been quite hard to see how the future orientation could be modelled in a way different from a future tense. Since the infinitive is not tensed, and furthermore since it has other semantic properties which distinguish it from tensed clauses--a variety of which will be explained in Chapter 4 on the basis of the nature of the situations in its denotation--such an approach would be problematical. Instead the situation-based approach avoids these problems.

At this point I will go over, in an informal way, some of the background theory for this dissertation. Later on, in Chapter 2, these ideas will be integrated into a more formally rigorous framework. First I will discuss the ontology that will be needed, comparing it to what arises from other ideas about what situations or events are. Then I will discuss the syntax/semantics interface. After presenting this background material, I will give an overview of the rest of the chapters.

As noted above, the leading idea of the situation theory that I will be using, based on that of Kratzer, is that the semantic values of sentences are sets of parts of worlds, objects also known as situations. If we take as basic a set S of possible situations, this set has the following properties: S is partitioned into mutually disjoint subsets. The subsets are disjoint both because I follow the counterpart theory of Lewis (1968, 1971, 1986a) and for some reasons (to be discussed in Chapter 2) specific to the analyses.
presented in this dissertation. Each subset can be considered the situations in some possible world. Among the situations in one of these subsets, there is a maximal situation of which every other situation is a part, the world itself. Furthermore, for any two situations s and s' in one of the subsets of S, there is a third situation s" in S which is intuitively the result of joining together s and s'. For example, if one joins together the situation in the actual world called 'World War I' with the situation in the actual world called 'World War II', one ends up with another actual situation, which might be called 'the two World Wars'. When s" is the result of joining together s and s', s and s' are parts of s", and we write s<s" to say that s is a part of s". The world in which a situation s exists, w_s, is simply the result of joining together all the situations in the same subset of S as s. The part-of relation is also reflexive and transitive, so that a situation is always part of itself and if we have s<s' and s'<s"", then s<s". I am not making any assumptions about whether the world is based on a level of atomic situations, or whether some situations can be subdivided forever.

What has just been described is the mereological structure of the set of situations. Before going on to other introductory points, I would like to discuss briefly how the present version of situation semantics contrasts with three other views of the nature of situations or events. I will come back to each of these in later chapters, but at this point we can get an initial sketch of how the points of view differ. First of all let us look again at Barwise and Perry's theory; I will return to discussion of SA in the concluding
chapter, when it will be possible to be more concrete about how it could approach the problems we will have looked at in the meantime. However, it can now be seen clearly how the situation semantics used here is different from SA. In SA, the class of abstract situations—the kind of situation which can represent a variety of different actual situations and can be the semantic value of a sentence—is defined on the basis of individuals, relations, and truth values. For instance, the following is a situation: \(<\text{runs, John}, \text{true}>\). Let us consider the following three situations:

\[
\begin{align*}
\text{s1: } & \langle\text{runs, John}, \text{true}> \\
\text{s2: } & \langle\text{runs, John and Mary}, \text{true}> \\
\text{s3: } & \langle\text{dead, John}, \text{true}> 
\end{align*}
\]

Barwise and Perry would say that the structure of the world imposes some constraints on these three abstract situations, viz. that \(s_2\) involves \(s_1\) and that \(s_3\) is incompatible with \(s_1\) and \(s_2\). The relations among abstract situations are not due to anything in their structure, but rather with another 'level' of situations like \(s_4\): a situation in which someone \(x\) and Mary run always has as a part a situation in which \(x\) runs. Since we know that \(s_4\) represents an actual (non-abstract) situation, we know that we can't have an actual situation represented by \(s_2\) without having one represented by \(s_1\) too.

The contrast between the ways of capturing the intuitive part-whole relations among situations points out, I believe, the most significant differences between SA and the situation semantics used here. Recall that in the present theory, these
relations were located directly in the mereological structure of the set of situations. While the set of actual situations of Barwise and Perry's theory of course has a similar structure, the abstract situations, which provide the semantic values for sentences, are merely set-theoretic objects whose part-whole relation (subset) does not adequately represent the idea of one situation being part of another. Instead, a set of constraints, using the involves relation, are part of the definition of the structure of abstract situations that is used to model reality. An appropriate modelling structure of situations must respect all constraints, like that represented by $s_4$ above.

Barwise and Perry give some more examples of constraints that the structure of situations must respect: kissing involves touching; eating involves eating something; having a wife involves being a married man; two individuals being president involves them being identical; and tossing a coin involves it landing heads or tails. In order to impose on the set of abstract situations all the part-whole structure that reality has, it will be necessary to consider all the factual involves relations. Though it may not be necessary to represent reality's full mereological structure in the structure of abstract situations, we must be certain that any aspects of the part-whole relation that are used by the semantics are modelled. For example, the meaning proposed informally above for infinitives entails that the one in (11) should denote situations which begin with the present situation in which I am happy and end up with me giving you the award.
(11) I am happy to give you this award. 
In SA this proposal would amount to the claim that the abstract situation denoted by the infinitive involves at its initiation the situation in which I am happy and also involves a situation in which I give you the award. In order for it to denote at all, then, constraints must have been imposed which result in such a situation existing. In subsequent chapters a variety of different uses will be made of the part-of relation, and it is not clear what set of constraints would have to be constructed to give sufficient structure to the set of abstract situations.

The second alternative view of what events or situations are is represented by the ideas of Vendler (1967), Davidson (1967), Higginbotham (1983), and Parsons (1990); it essentially says that there is no direct relation between events and propositions. Events, according to these theorists, are a kind of individual, and they may be an argument of the function denoted by a predicate just as other individuals may be. They are not elements of a propositions: the nature of propositions and that of events are independent. Parsons, whose approach is the most explicit, accepts a 'broadly Fregean' view of propositions (p. 31), and it would be possible to continue to construe propositions as sets of possible worlds.

According to this Davidsonian approach, example (12), which has two event-denoting expressions in it, might have a semantic structure like (13).

(12) The assassination caused the war.
(13) past(cause(the assassination, the war))
(12) is not relevantly different from (14).

(14) The cat ate the bird.
(15) past(eat(the cat, the bird))

On this view, events are just a particular kind of individual.

One of the most interesting uses to which this conception of what events are has been put is presented by Davidson (1967) and taken up by Parsons (1990). They suggest that all action sentences (and perhaps some other sentences as well) have a hidden event argument. Thus (16) might have the semantics given in (17).

(16) John ran.
(17) \exists e [\text{past}(e) \land \text{runs(John, e)}]

The formula (17) says that John participates in some past running event. This theory is able to give a nice analysis of certain cases of adverbial modification; many adverbs and PP's can be seen as denoting properties of events, allowing (18) to get the translation (19):

(18) John ran quickly.
(19) \exists e [\text{past}(e) \land \text{runs(John, e)} \land \text{quick(e)}]

(19) makes it clear why (18) entails (16), and this is one of Davidson's primary arguments in favor of his approach.

The Davidsonian semantics appears to be easily able to give a semantics for event-denoting expressions derived from verbs (Parsons (1990)). The meaning of the gerund in (20) could apparently be given as in (21), which is derived by abstracting over run's event argument.

(20) John's running.
However, in Chapter 3 I will argue that a Davidsonian semantics of the kind advocated by Parsons will not work adequately for certain gerunds (cf. also Portner (1991a)). The argument is based on cases in which the verb's event argument has apparently been bound off by some other quantifier internal to the gerund, as in (22).

(22) During the periods when he was unemployed and depressed, he always called his mother when he got sick. His calling his mother whenever he got sick really bothered his girlfriend.

The gerund in (22) apparently refers to a set of situations--situations which consist of a period in which he calls his mother whenever he gets sick. The actual calling situations or events, the events which could be introduced by call, are not those that make up the set; rather, those events are quantified over: any event in which he gets sick is immediately followed by an event of him calling his mother. Therefore there needs to be some other source for the events/situations that the gerund denotes. As we will see in much more detail in Chapter 3, in situation semantics the existence of this situation argument is automatic, as the gerund will be propositional and all propositions are sets of situations.

A final competing view of the connection between situations and events in semantics comes from the work of Kim (1969, 1980) and, in more explicit detail, Chierchia (1984). According to Chierchia, events are sets of tuples consisting of an n-place
property and n individuals. For instance, John's running could be represented as (23).

(23) \{<\text{runs, John}>\}

The connection between events and propositions on this view is fairly direct. Each event corresponds naturally to a proposition, namely the conjunction of the results of applying the property of each tuple to the individuals of each tuple. The event in (24) corresponds to the proposition in (25).

(24) \{<\text{runs, John}>, <\text{collapses, John}>\}

(25) \{w : \text{John runs in } w \text{ and John collapses in } w\}

Chierchia's approach is essentially to graft a version of SA onto possible worlds semantics. It works well for the purposes he puts it to, but--like Montague's approach as well--it will have difficulty with any facts which suggest that an element should be able to be both event-denoting and propositional at the same time. This is so because events do not typically play any role in the semantics of propositional expressions nor do propositions figure in determining the meaning of any event-denoting form. Davidson's analysis of adverbial modification is one proposal that requires that a clause, i.e. something that should denote a proposition, have an event or situation argument available, and here Chapters 3 is essentially concerned with exploiting the fact that propositions may denote sets of situations that one would intuitively call events. Hence part of this dissertation can be seen as an argument against as radical a dissociation of events and propositions as Chierchia proposes.
Now I will briefly discuss the conception of the syntax-semantics interface to be used here. As with the ontology discussed above, in Chapter 2 there will be a much more formally rigorous account of some of the ideas I am about to present. I will be assuming the T-model of the organization of the syntax proposed by Chomsky and Lasnik (1977) along with a system of compositional interpretation of Logical Forms (LFs); this kind of general setup has been discussed in the most detail by Rooth (1985). I will also argue that the semantics can serve as a filter on syntactic representations, in that in certain cases an LF which is syntactically well-formed will still be ungrammatical because it is not interpretable. One area in which this idea is clearly relevant concerns the application of Quantifier Raising (QR), a transformation that moves an NP from its surface position at LF, adjoining to some higher projection. Let us consider by way of example (26) and (27), which might receive the LF's (28) and (29) respectively:

(26) John seeks a unicorn.
(27) John sees a unicorn.

(28)

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( S (NP John) (VP (pres (V seek) (NP a unicorn))) )
```
We are considering the status of the object NP's. Because *seek* is an intensional verb, the LF (28), in which the NP has not undergone QR, is appropriate. *Seek* needs to take an NP meaning of type <e,t> as its argument. As argued by Kamp (1981a) and Heim (1982), and indefinite is just this type. In contrast, *see*, which is an extensional verb, is of type <e,<e,<s,t>>>. It is a function from individuals to intransitive verb meanings. Because of this, assuming that indefinites have no individual-denoting meaning, (29) is uninterpretable. There is no semantic combination operation available to the grammar that combines the verb with its sister. Therefore the LF (29), which must be syntactically well-formed since it is syntactically indistinguishable from (28), is ungrammatical due to the filtering effect of the semantic component. Instead, (29) must be transformed via QR in (30) in order for it to be grammatical.

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(30) is interpretable because the trace of *a unicorn* is translated as an individual variable, which is of the type that *see* needs as its object argument.

Another proposal about how semantic interpretation works also follows from this kind of reasoning. It is the idea of coercion. If we introduce into the grammar certain freely applying operations which change the semantic type of expressions, they may be counted upon to 'fix-up' otherwise uninterpretable LF's. Consider (31).

(31) The cat is a wonderful beast.

*Be a wonderful beast,* let us assume, denotes a function from individuals to propositions; it is of type <e, <s, t>>. For this reason, *the cat*, which is basically of type <e, t> (Kamp (1981a), Heim (1982)), cannot straightforwardly be interpreted in its S-structure position. One option is for it to undergo QR, as *a unicorn* did in

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5 This idea is very closely related to that of Partee (1987), for whom type-shifting operations can shift the meaning of NPs among types e, <e, t>, and <<e, t>, t>. Klein and Sag (1985) have a system in which the semantic combination operation used for a given structure is determined on the basis of the types of the component constituents.
(30), but another is for it to be changed into a kind-denoting expression. As originally discussed by Carlson (1977), a definite NP may have as its meaning a certain sort of abstract object, a kind of individuals. In the case of (31), the definite may denote the natural kind of cats. I will introduce a semantic operation, whose semantics is taken from Chierchia (1984), which may freely convert any expression into one that denotes such an abstract individual (though in some cases, such as with a quantified NP like every book, this abstract individual may not be anything that natural language ever talks about). If this raising to kind level applies to the cat in (31), the sentence will be interpretable, since the subject will then denote an individual. This option is available in the present case, but not for (27), because the meaning of be a wonderful beast has kinds in its domain, while see does not.

This preliminary discussion of the syntax/semantics interface is merely intended to be illustrative of the type of approach I will pursue. In Chapter 2 more detailed discussion will be given. Now I come to a summary of the contents of the dissertation.

In the next chapter, there is a much more detailed discussion of the semantic system and the syntax-semantics interface that I will be assuming. First I will look at the structure of the model, in particular at the ontology, that underlies the situation-based semantics. Then I will give a compositional mechanism for translating Logical Forms into expressions of an intensional logic. This latter task involves making explicit a number of points about the syntax-semantics interface. In
particular, the nature of the syntactic category/semantic type correspondence plays a crucial role in arriving at a working model of the interpretation mechanism. This is so because the translation procedure that will be developed is type-driven, in that the translation operations make nearly exclusive reference to the semantic types associated with phrases and aims to be as little stipulative as possible. The system translates every non-terminal node of a tree on the basis of its immediate daughters, thus yielding a bottom-up procedure for translating whole sentences.

After discussing the nature of the model and the translation mechanism, Chapter 2 gives an account of the logical language into which sentences have been translated. This task involves both semantic and pragmatic aspects. In addition to deriving model-theoretic interpretations for phrases, the system implements a compositional version of Heim's (1982) theory of presupposition. Having a working theory of presupposition will be crucial in the ensuing chapters, as a number of distributional and semantic facts about gerunds, infinitives, and subjunctives are based on their presuppositional properties.

In Chapter 3, I examine the English verbal gerund (i.e. ACC-ing and POSS-ing gerunds). In the past, on the basis of the work of Vendler (1967), these constructions have been assumed to be ambiguous between a propositional (or fact) reading and an event-denoting reading. Utilizing the situation-based framework, I will present an analysis which treats all of these gerunds uniformly, as denoting propositions. The propositions they denote
are sets of minimal situations, and these situations can
individually play the role of events.

In addition to showing how the situation-based theory can
give an account of the semantic variability of gerunds, in Chapter
3 I will make two additional points. First, I will present an
argument based on sentences like (22) that situation semantics is
preferable to a Davidsonian theory of the relation between events
and propositions. And second, I will reexamine the contrast
between POSS-ing and ACC-ing gerunds. POSS-ing gerunds, as in
(32), have been considered to be syntactically distinct from ACC-
ing gerunds like that in (33):

(32) His leaving bothered me.
(33) Him leaving bothered me.

However, I will argue that the real contrast between (32) and (33)
is one of presupposition. The gerund in (32), I claim, is definite,
while that in (33) is indefinite. This idea will allow an account of
the semantic contrasts between the two forms.

Chapter 4 studies the semantics and pragmatics of English
for infinitives and subjunctives. Bresnan (1972) argues that there
is a semantically coherent class of infinitives which may be called
the for infinitives. These often have an explicit for
complementizer and generally occur in contexts in which a for is
possible when the infinitive as an explicit subject. As was noted
above, I will propose that a central characteristic of the meaning
of for infinitives can be captured if they denote sets of situations
which extend forward in time from some reference situation to
another situation in which the to infinitive (the infinitive minus
the *for* is satisfied. Besides giving an account of the future-orientation of these forms, this idea has further consequences. As with gerunds, the situations in the denotation of an infinitive are smaller than whole worlds\(^6\). For this reason, I will argue, they are forced to show up in certain kinds of contexts; not only will it be impossible to use them assertively when unembedded, but using them in the complement position of such verbs as *believe* or *claim* will also result in semantic anomaly. This sort of reasoning will capture the intuition that *for* infinitives are necessarily irrealis.

The crucial characteristic of subjunctive clauses is that they are only possible when interpreted with respect to a situation towards which someone bears an attitude. Subjunctives in English may be divided into several classes each of which requires a particular attitude. Consider (34) and (35):

(34) Shelby demands that we be there at 9:00.

(35) *Shelby hopes that we be there at 9:00.

The type of subjunctive in (34) is only possible when it is interpreted with respect to some situation in which it is deemed obligatory. In general, embedded clauses are interpreted with respect to the situation introduced by the embedding verb—another way of putting this is to say that in (34) the reference situation for the subjunctive is the situation associated with *demands*. Example (34) is possible, then, because a demanding situation is one in which something is obliged. In contrast, a

\(^6\)Except for some extremely odd worlds that cover only a spatially and temporally small stretch of a more ordinary possible world.
sentence like (35) is impossible because hoping situations are not situations in which anything is claimed to be obligatory.

Another kind of subjunctive is seen in (36):

(36) Shelby wishes that we were there.

This kind of subjunctive is only possible when it is interpreted with respect to a situation that it is considered to be incompatible with. In (36), that we were there is interpreted with respect to the wishing situation. The sentence is possible because Shelby believes this wishing situation to be incompatible with our being there; since the wishing situation is clearly actual, what Shelby essentially believes is that we are not there. This prediction about the interpretation of the subordinate clause in (36) seems correct.

Chapter 4 first explores a wide variety of constructions in which infinitives and subjunctives are found, sketching how the analyses proposed can be used with them. Then a detailed account is given of the selectional restrictions of certain attitude verbs: believe, claim, hope, wish, want, and desire. After that, I investigate how the interpretations of infinitives and the type of subjunctive in (36) can be integrated into Kratzer's (1989a) theory of conditionals with would and might. Both infinitives and subjunctives can occur with these modals:

(37) For him to win would be great.

(38) If he were to win, it would be great.

I will argue that the contrast between infinitive and subjunctive does have semantic consequences: (37) and (38) are not equivalent, in that (38) presupposes that he has not won while
(37) does not. By using the meanings proposed for infinitives and subjunctives, we will in this way be able to get a better understanding of both the compositional semantics of conditionals with would or might and their presuppositional and conversational force.

Chapter 5 presents a case study of how the situation semantics can address questions concerning aspect and the nature of aspectual classes. There I examine the semantics of English VP-<i>ing</i> constructions, trying to come up with a general account of the imperfectivity that these forms show. (39) gives a few different types of <i>-ing</i> forms, and they are all interpreted in such a way that there is no implication that Mary climbed all the way up the mountain.

(39) Mary was climbing the mountain.
Mary enjoyed climbing the mountain.
Climbing the mountain, Mary hurt herself.
Before climbing the mountain, Mary called her mother.

Sometimes and <i>-ing</i> form is interpreted perfectively, as in (40).

(40) Mary celebrated climbing the mountain.
After climbing the mountain, Mary called her mother.

Attempting to understand how changing enjoy to celebrate or before to after shifts the <i>-ing</i> form from an imperfective to a perfective reading is one of the main tasks of Chapter 5. The

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7The presupposition of (38) must be satisfied when the sentence is interpreted, but it can be overturned afterwards. This fact will let us deal with examples like Karttunen and Peters' (1979)
If Mary were allergic to penicillin, she would be showing exactly the symptoms she is in fact showing.

26
explanation makes crucial use of the idea that the contrast between a perfective and imperfective interpretation is based on a difference between an external and an internal view of a situation. In (40), there is some sense of looking back on the mountain-climbing after it is over, while in (39) the point of view on the event is contemporaneous with it. Formally this idea is encoded by means of the relation between the situation introduced by the verb of the main clause and that associated with the -ing form itself. This idea is exactly parallel to the one used with infinitives and subjunctives; there too the matrix verb provided a situation with respect to which the embedded verb was interpreted.

After developing a theory of perfectivity along these lines, I will try to give a semantically unified theory of the constructions in (39)-(40). Despite syntactic differences among them, and corresponding differences in how the meaning of the VP-ing is connected with the rest of the sentence, I believe that a uniform meaning for the -ing forms themselves is possible. As this is worked out, I will extend and develop in various ways the ideas of Stump (1985) on free adjuncts, of Partee (1984) on phrases introduced by before and after, and of various authors (Dowty (1979), Parsons (1990), Landman (1991), Vlach (1981), and ter Meulen (1985)) on the progressive. Finally, I will conclude by investigating aspectual verbs like start, stop, continue, etc. Some of these verbs select for either gerunds or infinitives, while others take only gerunds. The ideas about the meanings of infinitives and gerunds that we will have in hand at that point allow a formal
and explanatory account, based on some ideas from ter Meulen (1990), of the selectional properties of these verbs.

Chapter 6 summarizes the main conclusions reached in the dissertation. There I will also come back to comparisons of situation semantics with other theories of the relation between propositions and situations or events.

Finally, a note about organization: The initial sections of each of the content Chapters 3-5 present the ideas and argumentation in a semi-formal way. Irrelevant details of the semantic mechanism are suppressed; when possible characteristic functions of sets are represented as the sets themselves, and so forth. Then, the last section of each chapter formalizes the claims of the preceding parts. One who is only interested in the big picture, and not in the details of how all of the ideas fit together compositionally, can skip these formalization sections. Conversely, one who has doubts about the semiformal presentation should look to these sections to find detailed argument that the system behaves as advertised. The formalization sections also present full analyses of crucial examples drawn from the text. I hope to have presented these in a way that both clarifies the structure and significance of the examples and shows how the formal mechanisms introduced work for a variety of real sentences. Finally, some further distinctions and questions are explored in the formalization sections as well.
CHAPTER 2
INTRODUCTION TO THE FORMAL SYSTEM

2.1 Introduction

In this chapter I will present the basics of the formal system to be used in this dissertation. There are three main topics to be explicated. First, the model, especially the nature of the set of situations, contains some aspects that may be unfamiliar. In particular, certain situations both play a role analogous to the one that possible worlds usually do in formal semantics and are members of the domain of individuals. Second, the translation procedure operates in a compositional way on Logical Forms to yield expressions of a logical language. The third topic is to explain this logical language, which both deals with the dual nature of situations and provides a compositional implementation of Heim's (1982) theory of presupposition. Having a working theory of presupposition will be crucial in the ensuing discussions of gerunds, infinitives, and subjunctives.

As the discussion of this chapter progresses, it will sometimes be necessary to allude to arguments that will be made in more detail in later chapters. This generally occurs so that an example can be given of how a certain device works. The reader can consult the sections where the relevant argument is spelled out to see the precise use that the formal claim is put to. However, this chapter is intended to be self-contained in that one should be able to both understand the system and see to what
uses in the study of natural language its novel elements could be put, even though the specifically linguistic arguments for such treatments follow.

This remainder of chapter is divided into three sections: (§2.2) Ontology, (§2.3) Translation, and (§2.4) Logic. In each of the following chapters, claims about the semantics of a given construction will first be made semiformally, and then will be incorporated into the system given here.

2.2 Ontology

This section focuses on the question: what is the representation in the model of individuals and situations? Drawing on the work of many previous scholars, the following claims will be made:

(i) Individuals are world-bound, i.e. they exist in only one world.

(ii) There are counterpart relations among individuals. (i) and (ii) are derived from Lewis (1968; 1971; 1986).

(iii) The situations form a subset of the individuals.

(iv) Certain situations are distinguished as WORLDS.

(v) There is a mereological summation structure on the situations, with each world being the maximal element of a complete join semilattice, and every situation being part of a world (Bach (1986), Kratzer (1989a)).

(vi) A subset of the individuals, which I will call the CONCRETE INDIVIDUALS, is the domain from which nouns and adjectives take their values and over which
determiners can quantify. All ordinary individuals plus some situations are concrete individuals.

(vii) There is a temporal ordering among situations (Hinrichs (1982), Kamp (1979), Kamp and Rohrer (1983), Partee (1984)).

It is impossible to go into all of the philosophical reasons for preferring a counterpart theoretic semantics. See the cited works by Lewis for discussion.

It is important to the analysis of gerunds in Chapter 3 that the situations be individuals. Gerunds have uses in which they seem to denote ordinary propositions as well as uses in which they seem to denote sets of events:

1) Jeff denied stealing an extra piece of the pie.

2) Stealing an extra piece of the pie invariably got Jeff in a lot of trouble.

(1) seems perfectly paraphrasable by (3), making it appear that the gerund in it denotes a proposition (Vendler (1967)).

3) Jeff denied that he stole an extra piece of pie.

(2) involves quantification over episodes of Jeff stealing an extra piece of pie. These episodes could also be called 'occasions', 'events', or 'situations' of Jeff stealing an extra piece of pie. Each such episode got Jeff in a lot of trouble. It is because a verb like get takes an episode as an argument that I assume that the episodes are individuals. The reason for identifying episodes with situations, the elements that make up propositions, is to avoid postulating an ambiguity for gerunds. According to the analysis to be developed, in both (1) and (2) the gerund denotes a set of
situations. In (1) this set as a whole is the argument of deny.\(^1\) In (2), the elements of the set are quantified over. Thus the gerunds in (1)-(2) can be treated uniformly.

The claim (iv) above is straightforward. Worlds are simply maximal situation. Point (v) tells us what 'maximal' means: The situations are partitioned into sets. Each set forms a complete mereological summation structure, with a world as its supremum. The situations in the set are therefore all the situations in that world. The symbol '<' will be used to indicate that a situation is part of another. 'r < s' means that r is a mereological part of s.

The part-of relation is reflexive, transitive, and antisymmetric.

The most intuitive case of a situation s being part of another s' is when s is just the goings-on of s' limited to a spatio-temporal region that is a subpart of that occupied by s'. For instance, if s' is everything going on in Massachusetts on July 10, 1992, then it is clear what it means to say that s, everything occurring in Amherst, Mass., on that same day, is a part of s'. It is equally obvious why the situation in the real world denoted by World War I is a part of the situation denoted by the two World Wars. However, in the more general case, s is part of s' if s' is a more fully specified version of s. The situation of everything going on in Amherst on July 10, 1992, specifies only part of what is going on in all of Massachusetts on that day. The more subtle

\(^1\) I would like to leave open for now whether the proposition itself or its individual correlate (Chierchia (1984)) is really the argument of the verb. According to Chierchia, each possible interpretation for a phrase has a correlate among the domain of individuals. He hypothesizes that only individuals are arguments of non-function words. This results in a greatly simplified type structure.
explication of the part of relation also allows for the following kind of case: the situation in the actual world denoted by *America*³'s winning the race is only part of that denoted by *America*³'s narrowly winning the race with a run of good luck. The former situation is more abstract than the latter in that it is in itself neither a narrow, lucky victory nor a convincing one, although it is part of only a narrow, lucky victory. This situation of narrowly winning with good luck is a more fully specified version of the mere winning situation.

This sense of the part-whole relation can be directly put to linguistic use. The statement (vi) above claims that only a subclass of the individuals are able to be in the denotations of nouns and adjectives and to be quantified over by determiners. They are called the CONCRETE INDIVIDUALS, and I give them this name in order to suggest that they are more fleshed-out and fully object-like than other individuals. Certain situations are concrete individuals, and these are called the CONCRETE SITUATIONS; the concrete situations are maximally specified in the following sense: they are not part of any situation which occupies the same spatiotemporal region. Thus, they are those situations which are everything that is going on in a certain region. The idea of concrete situations is motivated by the following type of examples:

(4a) Eating that apple quickly made me sick.
(4b) The quick eating of that apple made me sick.
(5a) Eating that apple quickly took four minutes.
(5b) The quick eating of that apple took four minutes.
(6a) *Eating that apple quickly took place on July 16.
(6b) The quick eating of that apple took place on July 16.
(7a) *Eating that apple quickly took place in the library.
(7b) The quick eating of that apple took place in the library.
(8a) *Eating that apple quickly was joyful.
(8b) The quick eating of that apple was joyful.

All of the predicates in (4)-(8) intuitively apply to situations rather than propositions. (4) and (5) show that some properties can be said to hold of the situations in a gerund's denotation (the (a) cases) as well as those in an action nominal's (the (b) cases). So, in (4a) for example, an event of eating that apple quickly can be said to make me sick. (6)-(8) demonstrate that in other cases, a VP which is compatible with an action nominal is incompatible with a verbal gerund.

Given the notion of a concrete situation, this contrast can be explained as follows. (6a)-(8a) indicate that certain situations—here, those in the denotation of eating that apple quickly—cannot be claimed to take place on July 16, take place in the library, or be joyful. The gerunds' events are simply not in the domain of those properties. The situation is different with action nominals. Action nominals, as in (4b)-(8b), also appear to denote situations. (6b)-(8b) are acceptable, showing that the situations that they denote can be said to take place on July 16, take place in the library, or be joyful. These situations are in the domain of a wider variety of VP meanings than the gerunds' situations. Syntactically, action nominals are completely NP like, both internally and externally.
While gerunds are modified by adverbs, take arguments without an intervening preposition, and are incompatible with determiners, action nominals cooccur with adjectives and determiners, and take their arguments in PP's. This suggests that the $V+ing$ form in them is an N, not a V (Vendler (1967), Abney (1987)). Thus the events that are in the denotations of action nominals are like ordinary individuals in that they can be an element in the denotation of an adjective or noun, or be in the domain of quantification of a determiner. As we have seen, they are also distinguished semantically from the situations in a gerund's denotation. (4)-(8) indicate that they can be claimed to have more properties, in the sense that a larger variety of predicates can sensibly be applied to them; any predicate of events that can be applied to a gerund can be applied to an action nominal, but not vice versa. I hypothesize that the events in the denotation of the action nominal are maximally specified situations based on those in the corresponding gerund's meaning, and that the fact that they are more fully specified enables more predicates sensibly to be applied to them. In a given world, the *quick eating of the apple* denoted the maximally specified, concrete situation that takes place in the same spatiotemporal region as that in the denotation of *eating the apple quickly* in the world. It is this variety of concreteness, I would like to suggest, that makes an element of the domain of individuals suitable for taking part in the semantics of the nominal system—for being in the denotation of a noun or adjective or in the domain of quantification of a determiner.
One may wonder about the following question: are some ordinary individuals identical with certain concrete situations? Imagine the concrete situation spatiotemporally located exactly where some object, say Klee's 'Dune Flora', is. Is this situation distinct from 'Dune Flora' itself? The question is complicated by the fact, discussed by Link (1983), that the object 'Dune Flora' must be distinguished from the matter that makes it up. They must be distinguished because, for instance, the matter is quite old, while the painting came into existence in 1923. If the situation only begins in 1923, then it cannot be identical to the matter that makes up 'Dune Flora'. Is it 'Dune Flora'? It is impossible to tell by linguistic means, because action nominals cannot be formed from statives, and we would need a name for a concrete situation like *the being of 'Dune Flora'.2 If this nominal were grammatical, it would presumably name the concrete situation spatiotemporally located exactly where 'Dune Flora' is. One might consider this evidence that the situation and the individual are identical, and say that we don't say *the being of 'Dune Flora' simply because we already have the name Dune Flora. In general we do not have action nominals of statives, one would then say, because the entities that would be named are the kinds of things that should be named with ordinary nouns. This view seems plausible to me, but as noted there is no direct linguistic evidence on the question.

2*Being Dune Flora* will not do, because it is a gerund, and so doesn't denote a set of concrete situations.
I will also assume that there is a temporal ordering on the situations such that, for any two situations \( r \) and \( s \) in the same world, (i) \( r \) (wholly) precedes \( s \), (ii) \( s \) (wholly) precedes \( r \), or (iii) \( r \) and \( s \) partially or totally overlap. Using the part of relation we can define 'partially precedes': \( r \) partially precedes \( s \) iff \( r \) overlaps \( s \) and some part of \( r \) wholly precedes \( s \). In this dissertation I do not make separate use of times, and so take no position on whether there is an independent set of times or times are constructed out of the ordering of events (cf. Bach (1977) and Kamp (1979, 1981b)). There are constraints relating the 'part of' relation and the temporal ordering; for discussion of the complete set of axioms needed, see Carnap (1958). I am not assuming that situations must be spatiotemporally continuous, but Chapter 5 contains discussion of whether noncontinuous situations are ever in the denotations of natural language expressions.

### 2.3 Translation

I will be assuming a view of the relation between syntax and semantic interpretation according to which the output of a syntactic derivation is a phrase structure tree known as a 'Logical Form' (LF). The LF is then compositionally interpreted in a model-theoretic semantics by translating it into a logical language to which we in turn provide an interpretation. This approach is most clearly stated in Rooth (1985). Because the rules that translate the LFs are general enough to apply to a variety of syntactic categories, and make reference to the types of the translations of the syntactic categories, the system can be said to follow a
strategy of 'type-driven translation'. For example, rule 2 below, that of functional application, looks like this:

2. FUNCTIONAL APPLICATION

\[
\begin{array}{c}
\Psi \\
\Phi \\
X
\end{array}
\]

\[\Psi' \text{ type } \langle \rho, x \rangle \text{ and } X' \text{ of type } \rho, \]
\[\Phi' = \Psi'(X').\]

The conditions for applying the rule have variables over types. Thus the rule can be used to translate any binary branching node such that (the translation of) one of its daughters has a functional type that takes as argument elements of the type of (the translation of) the other daughter. The linear order of \(\Psi\) and \(X\) is not relevant.

This brings us to the question of what types different syntactic categories may have, since the possible category-type correspondences will determine which semantic operations can ultimately apply to a given category. There are some principles that guide the assignment of types to elements of a given category, though I do not have a general theory of the relation.

The reason that some theory about the category-type correspondence will be necessary is to explain instances of syntactic or semantic "coercion". As discussed in Chapter 1, in some circumstances an element is forced to undergo Quantifier Raising in the derivation of LF because, at S-structure, it is in a position of the wrong type. For example, if a quantified NP is in

\[\text{3 The proposal is in the general spirit of Klein and Sag (1985), though the implementation is quite different.}\]
an entity-type argument position at S-structure, within the the system presented here it will not be interpretable unless something special happens. One special thing that could happen is for it to undergo QR, leaving behind a type e trace. This we can call 'syntactic coercion'. The other special thing that could happen is that the NP itself could be type-shifted to type e. There will be a procedure below that allows this to happen. Performing this type shift has semantic consequences; in particular it results in a kind-denoting term, and so we may want to use this 'semantic coercion' to force kind readings of NP's in certain positions.

Another reason that thinking about the category-type relation is important is to try to prevent puzzles like the following: Within a system like Montague's (1973), both common nouns and VP's are of type \(<<s,e>,t>\). While meaning postulates make it turn out that, for the most part, noun meanings and VP meanings are disjoint, there are difficulties. For example, cat and be a cat are predicted to be synonymous. While by itself this result may not seem too awful, within Chierchia's (1984) system, it entails that cats and being a cat are also synonymous. They both should denote the natural kind of cats. However, these two phrases clearly do not have the same meaning.

What is crucial for the rest of this dissertation is that some general view of the relationship between syntactic categories and semantic types be available to meet the needs just mentioned.

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4 Thanks to B. Partee for discussion of these points.
5 There are other well-known systems, like that of Lewis (1970), that do not have this difficulty.
What I am about to present does more than that, since all that is really necessary is (i) to stipulate that the argument positions in which I will want coercion to apply in later chapters (e.g. the direct object of *enjoy*) are of the desired types (for *enjoy*'s object, e), and (ii) to assign disjoint sets of possible types to common nouns and VP's. Nevertheless I have tried to sketch a coherent general view. Additionally, in the following discussion I will sometimes state that some particular category must be able to be of a given type in order to analyze some construction; for example, I say that general semantic rules must be able to turn NP's into expressions of type <s,t> in order to analyze adverbial quantification. These particular claims are also crucial, but they are justified independently as the relevant construction is discussed.

In general, verbs are elements whose types end in <s,t>. <s,t> is the type of propositions, sets of possible situations, and so verbs are the elements that, in some sense, semantically 'head' propositional expressions. One may protest that any verb-modifier will also come out as a verb; for instance, a PP of type <e,<s,t>> (a VP modifier) has a type that ends in <s,t>. A possible conclusion would be that, though every verb has a type ending in <s,t>, not everything whose type ends in <s,t> is a verb. However, I think we can do better; one way of trying to get rid of such a worry is by placing limits on what kinds of arguments verbs may take. The PP in question couldn't be a verb, one might argue, because verbs cannot take arguments of type <e,<s,t>>. A
problem with this answer is that one might want to assign just the
type \( \langle e, \langle s, t \rangle \rangle, \langle e, \langle s, t \rangle \rangle \) to a verb like \textit{seems} in

(9) John seems to be happy.

However, it is not clear whether this is the right analysis of \textit{seems}. Many theories would say that the complement of \textit{seems} is of type \( \langle s, t \rangle \). Another approach is that of Chierchia, who has argued that VP meanings are never the arguments of verbs, but that such arguments are always nominalized. According to this, \textit{to be happy} in (9) has been nominalized, and so is of type \( e \). \textit{To be happy} refers to a particular individual that is correlated with the function that is the ordinary denotation of \textit{to be happy}. How it can come to denote this \textit{INDIVIDUAL CORRELATE} is discussed in the next section. He makes the same proposal for other arguments of verbs, essentially suggesting that every argument of a verb is of type \( e \). Following Chierchia's approach in this kind of case, verbs are defined as elements whose types are of the form \( \langle e, ..., \langle e, \langle s, t \rangle \rangle, ..., \rangle \). \footnote{The "event argument" of Davidsonian theories like those of Davidson (1967), Parsons (1990), Kratzer (1988), Higginbotham (1985) corresponds to the 's' in these types.} Next we will go on to see how, on this view, verbs compare to nouns.

Nominal categories may have a variety of types: \( e \), \( \langle e, t \rangle \), and \( \langle e, t \rangle, t \) are possible for nouns that do not take arguments and for NP's. The basic type for common nouns (N's and N-bar's) is \( \langle e, t \rangle \), and some NP's have this type as well. These nouns and NP's therefore simply denote sets. There is not a problem with getting sufficient intensionality into these meanings because I assume
that the sets are sets of possible individuals. For instance *cat*
denotes the set of all possible cats. (How this assures that we can
give appropriate meanings to intensional adjectives like *alleged*
will be discussed in §2.4.4.) If we consider a sentence like (10),
we may then wonder why it doesn't mean that every possible
linguistics student walked into the house.

(10) Every linguistics student walked into the house.

I will assume that *every* only quantifies over the individuals of a
given world. That is, *every linguistics student* denotes the
following function:

(11) \{every linguistics student\} = that \( f \in D^{<e,<s,t>>,<s,t>>} \) : for
\( \forall d \in D^{e,<s,t>>} \), \( f(d) = \) that function \( g \in D^{<s,t>} \), for any
situation \( s \), \( g(s) = 1 \) iff for every linguistics student \( a \) in the world of \( s \), \( d(a)(s) = 1 \).

Some nouns, derived from verbs like *eating* or inherently
relational like *sister*, may take an argument. They would be of
type \(<e,<e,t>>\). The noun's argument must be saturated, either with
an of phrase or implicitly (Zucchi (1989)), making it of the
ordinary common noun type \(<e,t>\), in order to combine it with a
determiner or otherwise use it as other nouns are used.

Given what has been said in the last two paragraphs, we
may generalize and claim that nouns are elements whose type
ends in \(<e,t>\). The only exceptional cases are names, which denote
individuals, and primitive NP's like *nobody*, which denote
generalized quantifiers. The notion 'noun' therefore does not have
as neat a definition as that of 'verb'. However, there is no type
that can be assigned to both a noun and a verb. In this way the
category-type correspondence is more constrained than certain others, such as that of Montague (1973).

It should be noted here that some NP’s may be of type t or <s,t>. Type t occurs when an NP or type <e,t> is applied to a variable, and when it is then intensionalized, to yield a quantifier restriction (cf. Heim (1982)), it is of type <s,t>. These cases do not have to do with the lexical assignment of meanings, but rather only arise through the application of general semantic rules. They will be discussed extensively in §2.4.4.

If a category β is of type <α,α>, it is a modifier category; if α’s type ends in <s,t>, β is a verbal modifier, i.e. an adverbial.

The following chart summarizes some of the assignments of types to categories that will come up in the chapters that follow.
<table>
<thead>
<tr>
<th>Category</th>
<th>Type</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>N, N'</td>
<td>(&lt;e,t&gt;; e; \langle e,d,d\rangle); (&lt;e,e,d,d\rangle);</td>
<td>the second two for names only</td>
</tr>
<tr>
<td>NP</td>
<td>(&lt;e,e,d,d\rangle; \langle e,s,d,d\rangle; t; \langle s,d\rangle)</td>
<td></td>
</tr>
<tr>
<td>Det</td>
<td>(&lt;e,d,\langle e,s,d,d\rangle, \langle s,d,d\rangle\rangle)</td>
<td>except <em>a</em> and <em>the</em>³</td>
</tr>
<tr>
<td>A</td>
<td>(&lt;e,e,d,d\rangle)</td>
<td>intransitive verbs</td>
</tr>
<tr>
<td>V&lt;INTRANS&gt;</td>
<td>(&lt;e,e,d,d\rangle)</td>
<td>transitive verbs</td>
</tr>
<tr>
<td>V&lt;TRANS&gt;</td>
<td>(&lt;e,e,d,d\rangle)</td>
<td>propositional attitude V's</td>
</tr>
<tr>
<td>VPROP</td>
<td>(&lt;e,e,d,d\rangle)</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>(&lt;e,\langle e,s,d,d\rangle, \langle e,s,d,d\rangle\rangle)</td>
<td></td>
</tr>
<tr>
<td>Not</td>
<td>(&lt;e,s,d,d\rangle)</td>
<td>complementizers</td>
</tr>
<tr>
<td>C</td>
<td>(&lt;e,s,d,d\rangle)</td>
<td>adverb of quantification</td>
</tr>
<tr>
<td>AdvQ</td>
<td>(&lt;e,s,d,d\rangle)</td>
<td>intrans. verb modifiers</td>
</tr>
<tr>
<td>AdvV</td>
<td>(&lt;e,s,d,d\rangle)</td>
<td>tense</td>
</tr>
<tr>
<td>T</td>
<td>(&lt;e,s,d,d\rangle)</td>
<td></td>
</tr>
</tbody>
</table>

The noun and verb meanings have already been discussed. Remember that with the propositional attitude verbs, the first 'e' is the individual correlate of a proposition. Determiners take N/N' meanings (of type \(<e,t>\)) into functions from properties⁸ to propositions. Adjectives are modifiers of N/N' meanings. The preposition meaning type given is a function from individuals to intransitive verb modifier meanings. *Not*, in its basic type, modifies propositions.

Complementizers denote functions that take propositions and return properties. This is not a standard kind of view. Let us take (12) as an example.

(12) that Richard is writing the book

---

³*A* and *the* are in most cases typeless markers of definiteness. However, I leave open the possibility that sometimes they are true quantificational determiners.

⁸Properties here will be functions of type \(<e,<s,t>\rangle\).
Richard is writing the book denotes a proposition, roughly the set of situations in which Richard or a counterpart of him is writing the book or a counterpart of it. (12) denotes a propositional function (which in this framework is equivalent to a property), a function from situations to propositions. These situations will play a role that I will call that of the reference situation. The reference situation crucially provides the time, and sometimes the place, with respect to which the embedded proposition is interpreted. In this way it functions like a reference time in theories of tense (e.g. DRT theories, as in Kamp (1979), Kamp and Rohrer (1983), and Partee (1984); also Reichenbach (1947)). It differs from a reference time in these theories, however, in that its functioning is fully grammaticized and determined by compositional semantics.

For purposes of explanation, take (13) as the denotation of (12). (14) provides a simplified version.

(13) \[\text{[that Richard is writing the book]} = f \in D_{<s,\langle s,t \rangle>} : \text{for any } s \in S, f(s) = \text{that } g \in D_{<s,t>} : \text{for any } s' \in D_e, g(s') = 1 \iff \text{[Richard is writing the book]}(s') = 1 \text{ and } s' \text{ doesn't precede } s \text{ (or its counterpart in } w_s) \text{ and } s \text{ (or its counterpart in } w_s) \text{ doesn't precede } s'.\]

(14) \[\text{[that Richard is writing the book]} = f \in D_{<s,\langle s,t \rangle>} : \text{for any } s \in S, f(s) = \{s' : s' \in \text{[Richard is writing the book]} \text{ and } s' \text{ and } s \text{ have the same time}\}.

According to this meaning for a that clause, the evaluation situation of an embedded clause must temporally overlap the reference situation. This is an extreme oversimplification, but for
purposes of discussion here it is sufficient. In Chapter 4 we will
discuss in much more detail the role of the reference situation.
When (12) is embedded, as in (15), the reference situation—here,
s—is associated with the situation of the higher verb. This will
yield a meaning for (15) like that given in (16).

(15) Mary hopes that Richard is writing the book.

(16) \{s : for all situations s" such that s" is what Mary hopes
in s, there exists an s' such that s'\in [Richard is writing
the book] and s' and s have the same time and s"\}

This meaning does not take account of the tense in the higher
clause. It is a set of hoping situations. While the semantics of
propositional attitude verbs will be discussed more fully in
Chapter 4, intuitively the situations in (16) are the possible states
of mary hoping that Richard is writing the book. They are the
(possible) parts of the world that would make it true that she
hopes that. Her mental state in these situations projects a set of
situations which represent the content of her hope. A hoping
situation s is in (16) iff every one of these situations which
represent what is hoped for by Mary in s has as a part a situation,
simultaneous with s, of Richard writing the book.

Adverbs of quantification, such as always, never, or usually,
are functions from pairs of propositions to propositions. IV
Adverbs are simply functions from properties to properties.
Tense morphemes denote proposition-modifiers. (17) puts the
matrix tense morpheme's meaning into (16). (The embedded
tense is hidden inside the unanalyzed Richard is writing the
The meaning for the present tense is somewhat simplified here; the analysis of tense will be elaborated on in §2.4.2.

(17) \( s: s \) is present and for all situations \( s'' \) such that \( s'' \) is what Mary hopes in \( s \), there exists an \( s''' \in \{ s': s'' \in [\text{Richard is writing the book}] \text{ and } s' \text{ and } s \text{ have the same time} \} \text{ and } s'''' < s'' \)

The designation 's is present' is defined with respect to the utterance time. It is an indexical. In the next subsection, the meanings of more tenses will be discussed.

Following the general assumptions about the syntax discussed in Chapter 1, now I will discuss one by one the translation rules. In what follows, \( \Phi' \) indicates the translation of \( \Phi \). In the trees below, precedence relations are irrelevant.

1. **TRANSLATION OF LEXICAL ITEMS**

(a) *John* translates as 'John'. *he* \( n \) translates as 'male|+def|n' or \( x_n \). *run* translates as 'run', *be* translates as *be* etc.

(b) \([\text{NP}_n \ t] \) translates as 'v\( z_n \)' or 'v\( \langle e, i, t, n \rangle \)' or 'v\( \langle e, \langle s, i, t, n \rangle \rangle, n \)', \([\text{VP}_n \ t] \) translates as 'v\( \langle e, \langle s, i, t \rangle \rangle, n \)',\(^9\) etc.

This rule simply gives the basic meanings of each terminal of the syntactic tree. NP traces are translated as as a variable of one of the potential types for NP's. Which type is chosen is determined by the argument position that the trace finds itself in; if, for example, it is the direct object of an intensional verb, the

---

\(^9\) \( v z_n \) is the \( n \)th variable of type \( e \) and sort \( z \); more on the sorts later. \( v_{\tau, n} \) is the \( n \)th variable of type \( \tau \).
trace is translated as $v^{<e,<s,t>,<s,t>,n>}$, in a predicative position as $v^{<e,t>,n}$ and in an extensional argument position as $v_n$. If the trace is translated by a variable of an improper type, the result will be filtered out as ungrammatical. A VP gap, as might arise from VP deletion, is translated as a variable of the VP type.

2. **FUNCTIONAL APPLICATION**

With $\Phi$

$$\Psi \xrightarrow{X} \Psi'$$

$\Psi'$ type $<p,r>$ and $X'$ of type $p$, $\Phi' = \Psi'(X').$

We have already discussed this rule. It says that, whenever a node dominates two nodes, one of which is translated as a functional type and the other of which is translated as the argument type for that function, the translation of the mother is the translation of the function applied to that of the argument.

The usual Montague Grammar functional application rule applies $\Psi'$ to $\forall X'$. Here we have a general raising operation, translation rule 8 below, which can intensionalize $X$ when necessary.

3. **DYADIC FUNCTIONAL APPLICATION**

With $\Phi$

$$\Psi \xrightarrow{X,\Pi}$$

$\Psi'$ type $<p,<\pi,\tau>>$, $X'$ of type $p$, and $\Pi'$ of type $\pi$, $\Phi' = \Psi'(X')(\Pi').$

The rule is the two-argument case of ordinary functional application. Because in general with these translation rules order is irrelevant, one may fear that sometimes $\Psi'$ would take its arguments in the wrong order. However, I believe that the
determination of what is the first and what is the second argument of such a function should be left to an independent theory. The relevant two-place functions are the denotations of modals and adverbs of quantification. As has been discussed by Partee (1991), the selection of the first and second arguments for such operators is heavily dependent on such factors as Topic-Focus structure. Therefore I will assume that an appropriate theory of these matters will determine the proper use of rule 3.

4. CONJUNCTION OF PROPOSITIONS

\[
\begin{array}{c}
\Psi \\
(\text{and}) \\
X
\end{array}
\]

\(\Psi'\) of type \(<s,t>\) and \(X'\) is of type \(<s,t>\), \(\Phi' = [\Psi' \& X']\).

This rule simply conjoins propositions. It can operate even when two propositional expressions are not joined by an explicit conjunction. It will be used in cases when an indefinite or definite NP is adjoined to an S. Though the rule seems innocent enough, below '& &' will be given a somewhat nonstandard interpretation in order to account for the presupposition projection properties of conjunctions.

5. QUANTIFYING IN

\[
\begin{array}{c}
\Psi_k \\
X
\end{array}
\]

\(\Psi'\) of type \(<<e, <s,t>>, <s,t>>\) and \(X'\) of type \(<s,t>\), \(\Phi' = [\Psi'(\lambda x_k [X'])]\).

This rule quantifies an NP into a propositional expression. It abstracts over the variable of the same index of the NP, and gives
the result to the NP's translation as its argument. The variable $x_k$
will typically be present in $X'$ as the translation of the trace $\Psi_k$
left when it underwent Quantifier Raising in the derivation of LF.
It may also be the translation of a pronoun or part of the
translation of some definite NP.

Now we will look at several rules for non-branching
structures. The three meaning-changing rules for non-branching
structures, 6, 8, and 9, can apply through coercion to fix up
otherwise uninterpretable sentences. Note that, in order for this
to be possible, Logical Forms must be allowed to differ from the S-
structures they are derived from in replacing a node $\Phi$ with:

$$
\Phi
$$

6. INDIVIDUAL CORRELATE
with $\Phi$

$$
\Psi'
$$

$\Psi'$ of type $\tau$, $\Phi' = +\Psi'$

('+' is my typography for Chierchia's (1984) 'up' operator.)

This operation has been discussed in Chapter 1 and
previously in this chapter. For any expression $\Psi'$, $+\Psi'$ denotes
some individual, the individual correlate of what $\Psi'$ denotes. The
'+-' operation is discussed in depth by Chierchia (1984). The
individual correlate of a set like that denoted by cat or mud will
be a natural kind. The individual correlate of a property like that
denoted by run or be a cat will be something similar, which we
can call an ACTION KIND. The individual correlate of a proposition,
i.e. a set of situations such as that denoted by *he climbs*, can be called in what follows a **SITUATION KIND** or **EVENT KIND**. The correlates of other sets, like the meaning of *refrigerators with a can of tuna on top*, will not be natural kinds, but will still be called '(non-natural) kinds'.

The category-type correspondence places a restriction on the application of this rule. Since in this system NP's are the only category that can be of type e, only NP's will be able to denote the individual correlates of anything.

7. **IDENTITY**
   with $\Phi$
   
   $\Psi$
   $\Psi'$ of type $\tau$, $\Phi' = \Psi'$

   This rule simply states that in a nonbranching subtree, the mother node may denote just what the daughter denotes.

8. **RAISING**
   with $\Phi$
   
   $\Psi$
   $\Psi'$ of any type, $\Phi' = ^a\Psi'$

   This rule freely gives the intension of any expression.

9. **MEANING SHIFT FOR INDEXED ELEMENTS**
   with $\Phi$
   
   $\Psi_i$
   (a) $\Psi'$ of type <$e,t$>, $\Phi' = \Psi'(x_i)$.
   (b) $\Psi'$ of type $\tau$, $\Phi' = \Psi'[x_i]$.
   (i is the index of $\Psi$.)
The first clause allows a certain kind of type-shift. \( \Psi \) is turned into an expression of type \( t \) by applying its translation to a type \( e \) variable. The variable it is applied to has the same index as \( \Psi \). This rule will be used, for example, when an NP \( _1 \) of type \( <e,t> \) is to be the first argument of an adverb of quantification (cf. §2.4.3 below). By applying the NP's meaning to \( x_1 \), we will get an expression of type \( t \). Then, the expression will be made intensional, into type \( <s,t> \), through the use of rule 8 above.

The second clause is used when a propositional element has an index. A gerund, for example, denotes a proposition, a set of situations, and it is an NP and has an index. With a propositional expression \( p \) and an individual variable \( x \), \( [p[x]] \) denotes the set of all possible situations if the denotation of \( x \) is a situation in the denotation of \( p \), and denotes the empty set otherwise. By this clause it will be possible to quantify over the situations in a gerund's denotation. The meaning of the square brackets will be discussed more in §2.4.

The last rule is

8. LIFTING
   with \( \Phi \)
   \[
   \begin{array}{c}
   \Psi \\
   \end{array}
   \]
   \( \Psi' \) of type \( e \), \( \Phi' = L(\Psi') \).

\( L(\Psi') \) will denote the type-lifted version of \( \Psi' \). It is of type \( <<e,<s,t>>, <s,t>> \). This rule is used to convert an entity-denoting expression to one whose meaning is a generalized quantifier.

The rules for non-branching structures that have been given seriously overgenerate. For example, they allow an NP of type
<e,t> to be interpreted as \( L(+[\wedge x][+[\wedge NP'(x)][x]]) \). What is needed is a better understanding of when rules 6, 8, and 9 can apply. However, for purposes of this study the right results will be obtained if the operations are limited to cases of coercion—that is, if they do not apply except to the extent that it is necessary to create an interpretable LF from a given S-structure. An alternative type of approach lies in selectional restrictions; the examples \( L(+[\wedge x][+[\wedge NP'(x)][x]]) \) is a very strange kind of abstract individual, and it may be that it is not in the domain of any function that is a natural language meaning. Whatever may be the best approach, however, these concerns can be suppressed as we consider the topics discussed in this dissertation.

2.4 Logic

This section presents the syntax and semantics of the logical language into which expressions of natural language are translated. There are four subsections. In §2.4.1, the syntax of the logical language is given; §2.4.2 presents the semantics. The mechanisms for handling intersentential anaphora are discussed in §2.4.3. This section presents a theory of common ground and definiteness based on that of Heim (1982); however, in the present system the sentence meanings that form the input to the pragmatic rules that combine sentence meanings will have been compositionally derived. §2.4.4 works through several example sentences and brief discourses, illustrating how the various elements from §§2.4.1-2.4.3 work, and work together.
2.4.1 Syntax

The form of our logical language is almost completely ordinary. First of all, there is the usual stock of types:

**Types:** e and t are types.
if ρ, τ are types, <ρ,τ> is a type.
if ρ is a type, <s,ρ> is a type.
nothing else is a type

As will be discussed in the next subsection, e is the type of entities while t is the type of truth values. Types of the form <s,ρ> are intensional, and types of the form <ρ,τ> are functional.

Now we provide ourselves with a stock of variables. What a 'sort' is will be discussed next:

**Variables**

For each sort z and natural number n, there is a variable vzn of type e and sort z. (The sort parameter is suppressed when irrelevant or clear from context.)

For all other types τ, for every natural number n, there is a variable vn,τ of type τ.

The domain of individuals is divided into a variety of sorts of entities. Every denotation of whatever type has an individual correlate among the individuals, with the individual correlates of denotations of each type coming among a different sort. We will simply name these sorts by the symbol '+' plus the type that they are individual correlates of. So, denotations of type <e,τ>,τ> have individual correlates of sort +<e,τ>,τ>.
Sorts: for every type $\tau$, there is a sort $+\tau$ such that
expressions of type $e$ and sort $+\tau$ take their values
from among the individual correlates of the elements
of $D_\tau$. There is also a sort $u$ of individuals that are not
the individual correlates of anything.

There may be other sorts, the sort of count or mass elements of
the domain of individuals, and in general sorts may cross-classify
a domain; however, the sorts mentioned above are the ones that
will concern us here.

The language also contains a stock of constants of each type.
I will typically write these as bold-face English words, indicating
the words they are translations of.

Based on the primitives introduced so far, the following
combination rules yield new expressions of the logic:

Combination Rules

1. if $\alpha$ is of type $<p,\tau>$ and $\beta$ is of type $p$, $\alpha(\beta)$ is of type $\tau$.

2. if $\alpha$ is of type $\tau$ and $\omega$ is any tuple of indices, $\exists\omega[\alpha]$ is of
type $\tau$.

3. if $\alpha$ is of type $<s,\tau>$, $\neg\alpha$ is of type $<s,\tau>$. (alternatively,
'Not($\alpha$)')

4. if $\alpha$ is of type $\tau$ and $v$ is any variable of type $p$, $\lambda v[\alpha]$ is
of type $<p,\tau>$.

5. if $\alpha$ and $\beta$ are of type $<s,\tau>$, $(\alpha \& \beta)$ is of type $<s,\tau>$.

6. if $\alpha$ is of type $\tau$, $^\wedge\alpha$ is of type $<s,\tau>$.

7. if $\alpha$ is of type $<s,\tau>$, $^\vee\alpha$ is of type $\tau$.

8. if $\alpha$ is of type $<s,\tau>$ and $x$ is a variable of type $e$ and
sort $u$ or $+<s,\tau>$, $\alpha[x]$ is of type $<s,\tau>$.
9. if \( \alpha \) is of type \( \tau \), \(+\alpha\) is of type \( e \) and sort \(+\tau\), where \(+\tau\) is the sort associated with type \( \tau \).
10. if \( \alpha \) is of type \( e \) and sort \(+\tau\), \(-\alpha\) is of type \( \tau \), where \( \tau \) is the type associated with sort \(+\tau\).
11. if \( \alpha \) is of type \( e \), \( L(\alpha) \) is of type \( <<e,\langle s,t\rangle,\langle s,t\rangle>\). 

Rule 8 is novel; its function will be to use a proposition to restrict an individual variable. It will be discussed in detail shortly.

2.4.2 Semantics

This subsection gives the interpretation of sentences of the logical language. The next subsection will discuss how sequences of sentences are dealt with. A model will be a 5-tuple \(< I, S, <, \text{precedes}, \text{counterpart}>\). \( I \) is a set ("the individuals"). \( S \) ("the situations") is a subset of \( I \). \( I \) will call the elements of \( I \) not in \( S \) the ORDINARY INDIVIDUALS. (The ordinary individuals include the individual correlates and are different from the concrete individuals, since the concrete individuals include some situations.) 'Precedes' is a relation on \( S \) and 'counterpart' and '<' ("part of") are relations on \( I \). 'a < b' intuitively means (i) if \( b \) is a situation and \( a \) is an ordinary individual, that \( a \) is in \( b \), (ii) if \( a \) and \( b \) are ordinary individuals, that \( a \) is a (material) part of \( b \), and (iii) if \( a \) and \( b \) are situations, that \( a \) is part of \( b \).

Now we will define the possible denotations of expressions of various types.
Domains

$D_\tau$, the set of possible denotations for expressions of type $\tau$, is defined by:

$D_0 = 1$

$D_\tau = \{0, 1\}$

For all types $\rho$ and $\tau$, $D_{<\rho, \tau>} = D_\tau D_\rho$

For any type $\tau$, $D_{<s, \tau>} = D_\tau S$

Intensional types are functions from a situation to a meaning of the appropriate variety.

Expressions of our logical language are interpreted with respect to a model $M$, a situation of utterance $u$, a context of utterance $C$, a variable assignment $g \in G$, and a situation $s \in S$.\(^\text{10}\) The situation of utterance $u$ includes several things: a time of utterance, a specification of speaker and addressee, and possibly more. $C$ is a set of assignment-situation pairs. This $C$ is a context in Heim's (1982) sense, and the way it is used to keep track of discourse anaphora is discussed in §2.4.3. However, in several cases this $C$ is used in the semantics proper, in giving the interpretations of individual sentences. It is used in the semantics when a semantic rule has an effect on presupposition projection.

The general picture of how contexts are used is the following: Every phrase is interpreted with respect to a context; after each matrix sentence is interpreted, the context with respect to which it was interpreted is updated for the meaning of that sentence. This gives a new context $C'$ which is the set of

\(^{10}\)In Chapter IV an additional parameter of interpretation, the reference situation, will be introduced.
assignment/world pairs used in calculating the meaning of the next sentence. So, for example, with a sequence of sentences 'S1 S2', S1 is interpreted with respect to C and S2 is interpreted with respect to C', where C=C ⊕ [S1] and '⊕' represents the update function. I will not discuss in detail how the update function works until the next subsection, so when it comes up in this section I will simply give an informal description of what happens.

The following are the semantic combination rules:

**Semantic Rules**

1. if v,τ is a variable of type τ, \([v,τ]^{M,u,C,g,s} = g(v,τ)\).

2. if α is of type <ρ,τ> and β is of type ρ,
   \([α(β)]^{M,u,C,g,s} = [α]^{M,u,C,g,s}(β)\).

3. if α is of type <s,t>, \([¬α]^{M,u,C,g,s}\) that function f∈D<s,t> such that for any s∈S, f(s)=1 iff \([α]^{M,u,C,g,s}(s')=0\).

4. if α is of type τ and v is a variable of type ρ,
   \([λv[α]]^{M,u,C,g,s} = \text{that } f∈D<ρ,τ> \text{ such that for any } d∈D_ρ, f(d) = [α]^{M,u,C,g,d/v},s\).

\(g(d/v)\) is the assignment function in G just like g except possibly in that it assigns d to v.

5. for any tuple of variables ω and α of type t,
   \([∃ω[α]]^{M,u,C,g,s} = 1 \text{ iff there is a } g' <ω> g \text{ such that } [α]^{M,u,C,g',s} = 1\).

\(g' <ω> g\) means that g' is an assignment function that agrees with g on what is assigned to every variable except possibly those in ω.

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6. if \( \alpha \) and \( \beta \) are of type \(<s, t>\), \([(\alpha \& \beta)]^{M_u.C.g.s} = \) that function \( f \) such that for any \( s' \in S \), \( f(s') = 1 \) iff \([\alpha]^{M_u.C.g.s}(s') = 1 \) and \([\beta]^{M_u.C.g.s}[C[\alpha]M_u.C.g.s]g.s(s') = 1 \).

Note that the context with respect to which \( \beta \) is interpreted is \( C[\alpha]^{M_u.C.g.s} \), i.e. the context that results from updating \( C \) for \( \alpha \). This will allow \( \alpha \) to satisfy \( \beta \)'s presuppositions. How this works can be seen in the discussion of (32) in §2.4.4.

7. if \( \alpha \) is of type \( t \), \([\alpha]^{M_u.C.g.s} = \) that function \( f \in D_{<s,t>} \) such that, for all \( s' \in S \), \( f(s') = [\alpha]^{M_u.C.g.s} \).

This rule gives the intension of an expression.

8. if \( \alpha \) is of type \(<s, t>\), \([\alpha]^{M_u.C.g.s} = [\alpha]^{M_u.C.g.s}(s) \).

This rule gives the extension, with respect to the current situation, of an intensional expression.

9. \([\alpha[x^u]]^{M_u.C.g.s} = \) that function \( f \in D_{<s, t>} : \) for any \( s' \in S \), \( f(s') = 1 \) iff \([\alpha]^{M_u.C.g.s}(g(x^u)) = 1 \), and \( f(s') = 0 \) otherwise.

Essentially, the rule says that \( x^u \) denotes a situation that makes \( \alpha \) true. \( u \) is the sort of individuals that are not the individual correlates of any other possible denotation. Rule 9 will be very important in the following chapters. It uses a propositional expression to restrict an individual variable. \( \alpha \) is of type \(<s, t>\), a set of situations. \([\alpha[x^u]]^{M_u.C.g.s} \) will denote the set of all situations if the denotation of \( x^u \) is a situation \( \sigma \) such that \( \sigma \) is in \([\alpha]^{M_u.C.g.s} \). Otherwise, it denotes the empty set. This rule will be further refined in Chapter 5.

10. \([\alpha[x+<s, t>]]^{M_u.C.g.s} = \) that function \( f \in D_{<s, t>} : \) for any \( s' \in S \), \( f(s') = 1 \) iff \([x+<s, t>]^{M_u.C.g.s} = [\alpha]^{M_u.C.g.s} \); and \( f(s') = 0 \) otherwise.
This rule uses a proposition to restrict a variable of sort \( +<s, t> \), the sort of individual correlates of propositions. If the variable denotes the individual correlate of the proposition denoted by \( \alpha \), \( [\alpha[x++s,t>]_{M,u,C,g,s} \) will denote the set of all situations; otherwise it denotes the empty set. In effect, \( \alpha[x++s,t>] \) says that \( x++s,t> \) denotes the individual correlate of \( \alpha \).

11. \( [+\alpha]_{M,u,C,g,s} = \{ d \in I \mid d \text{ is the individual correlate of } \alpha \} \)

12. if \( \alpha \) is of type \( e \), \( \{L(\alpha)\}_{M,u,C,g,s} \) denotes that function

\[ f \in D_{<e, <s,t>, <s,t>} \text{ such that for any } P \in D_{<e, <s,t>}, \text{ and } s' \in S, f(P)(s') = 1 \text{ iff } P([\alpha]_{M,u,C,g,s})(s') = 1. \]

Rule 12 is used to convert an individual-denoting expression into one that denotes a generalized quantifier.

Next we will look at the meanings of some words. In §2.4.4 these meanings will figure in example sentences and discourses.

First is a meaning for run.

For any \( c \in I \),

\( [\text{run}]_{M,u,C,g,s}(c) = \{ f \in D_{<s,t>} \mid \text{for any } s' \in S, f(s') = 1 \text{ iff } s' \text{ is a minimal situation in which } c \text{ or a counterpart of } c \text{ runs.} \}

This simply says that run denotes the function that, for any individual \( c \), has as its value the set of minimal situations in which \( c \) runs. A situation is a minimal situation in which \( c \) runs iff it contains nothing irrelevant to the truth of \( c \) runs, in the sense that if any part of it were taken away, we would say that we no longer had the whole of \( c \)'s run anymore. It will therefore be a rather abstract situation. Many situations in which \( c \) runs will not be in this proposition—for instance, no normal-sized
world is a minimal situation in which someone runs. It is one of the functions of tense, as discussed shortly, to cause non-minimal situations to be included in a sentence's proposition.

The next word to be looked at is always. I assume, following Heim (1982), that always receives a tuple of indices \( \omega \) at Logical Form.

For any \( \alpha, \beta \) of type \( <s,I> \),

\[
[\text{always}_\omega(\alpha)(\beta)]^{M,u,C}_{g,s} = \text{that } f \in D_{<s,I>}: \text{for any } s' \in S, \]
\[
f(s') = 1 \text{ iff for all } g' \text{ such that } <g',s'> \in C \text{ and } g' <\omega> g, \]
\[
\text{if there exists a } g'' <\text{N}> g' \text{ such that } <g'',s'> \in C \& \]
\[
[\alpha]^{M,u,C}_{g'',s} = 1. \text{ then for some } g''' \text{ such that } <g''',s'> \in C \& g''' <\text{N}> g', \]
\[
[\beta]^{M,u,C,C(\alpha)}_{g''',s} = 1. \]

\( N \) is some set of indices; the variables with indices in \( N \) are existentially closed within \( \alpha \) or \( \beta \). The variables whose indices are not in \( N \) may be bound by higher operators, such as the always, or they may introduce a new discourse referent. I assume that the indices in \( \omega \) are never in \( N \) so that always will have access to the variables it is intended to bind. Other variables may be in \( N \) or not, as either choice represents a possible reading, subject to pragmatic constraints such as the need for definite NP's to have their presuppositions satisfied.

Note that \( \beta \) is not interpreted with respect to the context \( C \), but with respect to \( C \) updated for \( \alpha \); this will allow \( \alpha \) to satisfy the presuppositions of elements in \( \beta \). Furthermore, the meaning given interprets all indefinites in \( \alpha \) and \( \beta \) whose indices are not in
ω existentially. Choosing the set of indices ω is analogous to Chierchia's (1991) Topic Selection, in that it picks out a group of indefinites that will not be interpreted existentially, but instead will be quantified over. Example (42) in §2.4.4 demonstrates how this meaning for always works.

Above I have treated always syncategorematically. Though I believe that, for my purposes, this is the most clear and straightforward way to analyze it, it is possible to assign it a meaning directly. However, this requires complicating the logic somewhat; before going on to look at the meanings of more lexical items, I will show how this can be done. (The reader can skip ahead to the discussion of every if he or she wishes.) First of all, we need to add a type $<g, \tau>$ to the logic; expressions of this type denote functions from infinite tuples of individuals to truth values. In general, we can add the following to the definition of the set of types:

If $\tau$ is a type, $<g, \tau>$ is a type.

And we need to add the following to the definition of the domains of semantic values for the various types:

For all types $<g, \tau>$, $D_{<g, \tau>} = D_\tau(\{1\\times1\times\ldots\})$

The possible meanings for expressions of type $<g, \tau>$ is functions from infinite tuples of individuals to possible denotations for expressions of type $\tau$. Now we will add the symbol $\uparrow$ to the logic. 12 below is a new syntactic rule, and 13 the corresponding semantic rule.

12. If $\alpha$ is of type $\tau$, $\uparrow\alpha$ is of type $<g, \tau>$. 

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13. \([\hat{\imath}\alpha]M.u.C.g.s = \text{that } f \in D<g,\tau> \text{ such that, for any infinite tuple of individuals } \omega = <a_1, a_2, a_3, \ldots>, f(\omega) = \]
\([\alpha]M.u.C.g(a_1/x_1, a_2/x_2, a_3/x_3, \ldots), s.\]
\(\hat{\imath}\) simultaneously abstracts over all individual variables in \(\alpha\).

Finally, we can give the following revised meaning for \textit{always}.

Here \textit{always} has arguments of type \(<g,<s,\omega>>\).

For any \(p, q \in D<g,<s,\omega>>\),
\[\text{[always}\omega]M.u.C.g.s(p)(q) = \text{that } f \in D<s,\omega>: \text{for any } s' \in S, \]
\[f(s') = 1 \iff \]
for all \(g'\) such that \(<g', s'> \in C\) and \(g' <\omega> g,\)
if there exists a \(g'' <N> g'\) such that \(<g'', s'> \in C \& \]
\[\text{[\alpha]M.u.C.g.s(<g''(x_1), g''(x_2), g''(x_3), \ldots>)(s') = 1, then} \]
for some \(g'''\) such that \(<g''', s'> \in C \& g'' <N> g'\),
\[\text{[\beta]M.u.(C\otimes[\alpha]M.u.C.g''''(\cdot), s, i).g.s(<g''''(x_1), g''''(x_2), g''''(x_3), \ldots>)(s') = 1.} \]

When \textit{always} occurs in a sentence \textit{always} \(\Phi\ \Psi\), both \(\Phi\) and \(\Psi\) will first be raised by the \(\hat{\imath}\) operator, so we get a translation like \(\text{always}(\hat{\imath}\Phi)(\hat{\imath}\Psi)\). The \(\hat{\imath}\) operator will need to be added via a translation rule like 6-9. Just as \(^\wedge\) or \(+\) can be added freely to the translation of a phrase, so can \(\hat{\imath}\).

This method of abstracting over all individual variables simultaneously is based on the approach to intensional types in Groenendijk and Stokhof's (1990) Dynamic Montague Grammar. In that system, phrases of a type of the form \(<s,\tau>\) denote functions from pairs of an assignment (to type \(e\) variables) and a world to denotations in the domain of type \(\tau\). I think that the present system is justified in keeping abstraction over worlds with \(^\wedge\) separate from unselective abstraction over variables with
Across constructions, the need to use unselective abstraction over variables in the treatment of anaphoric phenomena does not in general go along with intensionality, nor does intensionality tend to imply the need for unselective abstraction over variables. The core anaphoric phenomena are intersentential and donkey anaphora, while core intensional phenomena involve the argument positions of certain operators, including verbs like *seek* and modals. Though there is overlap, as in the case of generic quantifiers, by keeping the two things separate, the system better reflects this fact about the semantics of natural language.

The preceding discussion has shown that it is possible to assign an independent meaning to *always* within this framework, at the cost of complicating the logic to introduce unselective abstraction over individual variables. This potentiality, and the operator ⌜, will not be used in what follows, because it is possible to treat the phenomena under consideration without the extra complications.

Next, we will look at the meaning for *every*.

For any \( b \in D_{<e,1>} \), \( c \in D_{<e,<s,1>}> \),

\[
[\text{every}] M_u C_\varphi S(b)(c) = \text{that } f \in D_{<s,1>} : \text{for any } s' \in S, f(s')=1 \text{ iff for all } d \in I, \text{ if } b(d)=1 \text{ & } d < \text{ the world of } s', \text{ then } c(d)(s')=1. 
\]

The rule follows that of Kratzer (1989a) in claiming that *every* \( \alpha \beta \) is true in a situation \( s \) iff everything that is an \( \alpha \) in the world of \( s \) has the property \( \beta \) in \( s \). Thus, in the ordinary case, *every* \( \alpha \beta \) will
not be true in s unless every α in the world of s is in s.\textsuperscript{11} I adopt this definition to avoid problems with the interaction with tense, discussed below.

I have not tried to write this meaning for every so that the proper readings for donkey sentences will come out. Doing so would bring in complications that are irrelevant to this dissertation. The complications that would be brought in would tend to make the meaning for every more like that of always. However, in contrast what is predicted by the treatments of Kamp (1981a), Heim (1982), and Groenendijk and Stokhof (1990), I agree with Chierchia's (1991) claim that we should not create a meaning for every that gives the following two sentences the same meaning:

(18a) Every farmer who owns a donkey beats it.

(18b) If a farmer owns a donkey, he always beats it.

In (18a) we cannot have universal quantification over donkeys, in contrast to (18b). However, I believe that what is said in subsequent chapters is independent of any particular approach to the contrast in (18) and the many issues that surround it.

Here is an interpretation for man.

For any c ∈ I,

\[ \{\text{man}\}^{M,u,C.g.s(c)=1} \text{ iff c is a man.} \]

Recall that common nouns are of type <e,t>.

\textsuperscript{11}As Kratzer discusses, there are cases when every has different properties. These will be brought up in the discussion of counterfactuals.
Finally, here is a sample meaning for the past tense.
For any \( p \in D_{<s,t>} \),

\[
[\text{Past}]M\cdot u\cdot C\cdot g\cdot s(p) = \text{that } f \in D_{<s,t>} \text{ such that for any } s' \in S, \ f(s') = 1
\]

iff for some \( s'' < s' \), \( p(s'') = 1 \) and \( s'' \) precedes \( u \).

Note that the past tense will create a persistent proposition. A proposition \( p \) is persistent iff, for any \( s \in p \) and \( s' \) such that \( s < s' \), \( s' \in p \). Recall that a sentence like \( \alpha \text{ runs} \) only denotes the set of minimal situations in which \( \alpha \) runs; this is not a persistent proposition. However, the tensed \( \alpha \text{ ran} \) will denote a persistent proposition. For instance, a world \( w \) in which \( \alpha \text{ ran} \), uttered at \( u \), will be a situation where there exists an \( s'' < w \) such that \( s'' \) is a minimal situation in which \( \alpha \text{ runs} \) and \( s'' \) precedes \( u \).

Now we can see why the meaning for \( \text{every} \) needs to be as it is. If in \( w \) there is some situation \( s \) such that every man in \( s \) ran, but there is another \( s' \) such that not every man in \( s' \) ran, the interpretations we have will assure us that no situation in \( w \) (including \( w \) itself) is a situation in the denotation of \( \text{every man ran} \). With a simpler meaning for \( \text{every} \), however, on which \( \text{every man ran} \) is true in \( s \) but false in \( s' \), \( w \) would be in the denotation of both \( \text{every man ran} \) and \( \text{every man didn't run} \).

2.4.3 Pragmatics

Now we move on to how sequences of sentences are interpreted. The intent at this point is to be able to incorporate Heim's (1982) theory of presupposition into the present framework. In later chapters, some novel aspects of presupposition will be discussed.
A context is a set of pairs of a variable assignment and a situation. Each matrix sentence updates the context, if the context is defined for that sentence. The result of updating the context for a matrix sentence provides the context with respect to which the next sentence is interpreted.

As seen above, contexts and the update function figure in semantic rules as well. This is how elements inside sentences can have their presuppositions checked. With a matrix conjunction, as described by semantic combination rule 6 above, the update proceeds first with the first conjunct, followed by the second. (M) shows this schematically.

(M) **MATRIX SENTENCE CONJUNCTION**

\[
\begin{array}{c}
\Phi \\
\Psi \text{ (and)} \ X \\
\end{array}
\]

\[
[\Phi']^{M.u.C.g.s} = \text{that } f \text{ such that for any } s' \in S, f(s') = 1 \text{ iff } \\
[\Psi']^{M.u.C.g.s}(s') = 1 \text{ and } \{X'\}^{M.u.C.g.s}(s) = 1.
\]

(M) is not an independent rule, but rather simply an illustration of the combined effect of translation rule 4 and semantic rule 6. However, it lets us see the presuppositional effect of the syntactic form of conjunction.

When an NP of type <e,t> undergoes raising, the result is interpreted as a conjunction. Thus, the LF of (19a),

(19a) The man came in.
shown in (19b), causes an update of the context according to (M).
The outcome is shown in (20).

(19b) [s [NPI The man] [VP ti came in] ]

(20) [(18)] M,u,C.g.s = f ∈ D,<s,i> : for any s' ∈ S, f(s')=1 iff

[^man(xi)]M,u,C.g.s(s')=1 and

[[came.in(xi)]]M,.u.[C®[^man(xi)]]M,u,C.g.s.g.s(s')=1

This is the kind of case in which (M), i.e. the combination of
semantic rule 6 and translation rule 4, is used. ‘^[man(xi)]’ is the
translation of '[NPI The man]' and 'came-in(xi)' is the translation
of '[VP ti came in]'. Example (32) in §2.4.4 provides a detailed
explanation of how these translation of the part of (19a) are
arrived at as well as discussion of what the interpretation given in
(20) means.

I will give several formulations of the update function, so
that the reader can find the one that he or she finds most
perspicuous. Intuitively what they all express is this: A context C
updated for a sentence Φ is the set of assignment-situation pairs
<g',s'> such that <g',s'> is in C and the extension of Φ is 'true' with
respect to g' and s'. The first definition is as follows, where Φ is of
type <s,i>:

(Θ)(a) C ⊕ [Φ] M,u,C.g.s =

{<g',s'> : <g',s'>∈ C & [∀Φ]M,u,C.g'.s'=1}

This formulation says <g',s'> is in the new context if it is in the old
context and ∀Φ is true with respect to g' and s'. Another way of
putting this is:

(Θ)(b) C ⊕ [Φ] M,u,C.g.s =

{<g',s'> : <g',s'>∈ C & [Φ]M,u,C.g'.s(s')=1}
This operation gives the set of assignment-situation <g',s'> pairs such that s' is in the denotation, with respect to g', of Φ.

We can also give a formulation that uses the operator $⇑$ discussed briefly in connection with always. This formulation only works on the assumption that only individual variables are relevant to the context--that is, that there is no higher order intersentential or donkey anaphora.

$$(\Theta)(c) C \oplus [\Phi]M.u.C.g.s = \{<g',s'> : <g',s'> \in C \& \\
[\hat{\Phi}]M.u.C.g.s(<g'(x_1).g'(x_2).g'(x_3)...>) (s') = 1 \}$$

Recall that $[\hat{\Phi}]M.u.C.g.s(<g'(x_1).g'(x_2).g'(x_3)...>) = [\Phi]M.u.C.g(<g'(x_1)/x_1.g'(x_2)/x_2.g'(x_3)/x_3...>).s$. Along the lines of the formulation of the update function in (b), of course we can also have

$$(\Theta)(d) C \oplus [\Phi]M.u.C.g.s = \{<g',s'> : <g',s'> \in C \& \\
[\hat{\Phi}]M.u.C.g.s'(<g'(x_1).g'(x_2).g'(x_3)...>) = 1 \}.$$ 

Given the definition of $⇑$, (d) is also equivalent to the following:

$$(\Theta)(e) C \oplus [\Phi]M.u.C.g.s = \{<g',s'> : <g',s'> \in C \& \\
[\Phi]M.u.C.g(<g'(x_1)/x_1.g'(x_2)/x_2.g'(x_3)/x_3...>).s' = 1 \}.$$

(e) shows most directly, though perhaps not most clearly, the force of the update function. It says that <g',s'> is in the new context if it is in the old context and Φ is true in s' when $x_1$ refers to $g'(x_1)$, $x_2$ refers to $g'(x_2)$, $x_3$ refers to $g'(x_3)$, etc. (d) and (e) also rely on the assumption that the kinds of anaphora relevant to the context all take place at the level of individuals. If we make this assumption, it probably makes sense to define a context not as a set of pairs of an ordinary assignment and a situation, but of an assignment restricted to the individual variables and a situation.
It should be noted that the restrictiveness of this assumption is lessened by that fact that every denotation of whatever type has its individual correlate in the domain of individuals. However, for greater generality I will use the update function defined in (a)/(b).

When there is a sequence of sentences in a discourse, in the usual case each sentence is used to update the context. Thus if we come to the pair of sentence $\Phi \Psi$ in discourse with the context $C$, first we interpret $\Phi$ to get $[\Phi]^{M,u,C<g,s>}$. Then, if $\Phi$ has been taken to be an assertion that is sincere, justified, nonmetaphorical, nonconditional, etc., we update $C$ for this meaning: $C \oplus [\Phi]^{M,u,C,g,s}$. We can call this process ACCEPTANCE.12

Acceptance

To accept $\Phi$ in context $C$, update $C$ to $C \oplus [\Phi]^{M,u,C,g,s}$. Let this new context be $C'$. Then we interpret $\Psi$ with respect to $C'$: $[\Psi]^{M,u,C',g,s}$. To accept $\Psi$ we calculate $C''=C' \oplus [\Psi]^{M,u,C',g,s}$. $C''$ is the context with respect to which the next sentence would be interpreted. If we reduce $C''$ to $C$, we get: $(C \oplus [\Phi]^{M,u,C,g,s}) \oplus [\Psi]^{M,u,[C \oplus [\Phi]^{M,u,C,g,s}],g,s}$. This formulation makes it clear how $\Phi$ can satisfy presuppositions of $\Psi$.

There are many aspects of presupposition that this fragment has nothing to say about, for example how presuppositions are modified by certain sentence embedding predicates such as attitude verbs.13

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12B. Partee suggested this term.
Now we can examine how the presuppositions of definite NP's work.

(21) If \( \alpha \) is a [+def] NP, \([\alpha']^{M,u,c,g,s}\) is only defined if, for all \(<g',s'> \in C, [\alpha'(x_i)]^{M,u,c,g',s}(s')=1\).

This states that the update of \( C \) is only defined for a definite NP if the context already entails the content of the NP. Another way of putting this is to say that updating the context for the definite has no effect on the context.

In order to accommodate an analysis of the presuppositions of indefinite NP's, the notion of context must be augmented with information about which variables have been used. This can be done with the notion of the domain of a context. We can recover the set of indices on type e variables which have been used so far in the discourse with the function \( D \):

(22) The function \( D \) is a function from contexts to sets of indices, where for any context \( C, D(C) = \) the set of indices \( i \) such that it is not the case that, for all \( a \in I \), there is a \( <g,s> \in C \) such that \( g(x_i)=a \).

An index \( i \) will be in \( D(C) \) if \( C \) places some restrictions on what \( x_i \) might refer to. If an index has been used, say in an NP like a dogi, then it will not be able to refer to just anything: in this case every assignment in \( C \) will have it referring to a dog. Therefore it will be in \( D(C) \).

One question about this approach to novelty is whether there are sentences that introduce a discourse referent but do not
place any restriction on what it might be. A potential example is

(23) If something exists, it is self-identical.
The 'something' of the antecedent could apparently be anything at all, yet the reference is picked up by a definite, it, and not by an indefinite. However, I doubt that any felicitous utterance ever introduces a discourse referent on which no restrictions at all have been placed. In (23) exists means something like 'exists in the real world', and thus we feel that it is possible to continue (23) with but some things that don't exist aren't. However, if the present semantic approach to keeping track of which indices have been used fails, it is possible to take a syntactic approach, like that of Heim (1982).

Given the method in (22) of deciding whether an index is novel in the discourse, (24) gives the presupposition of an indefinite NP.

(24) if $\alpha$ is a [-def] NP$_i$, $^{(\alpha'_{1M.u.C.g.s}}$ is only defined if $i \in D(C)$. An indefinite is only felicitous if its index is novel with respect to C.

We may also revise (21), the presupposition of definites, in the following way.

---

14 Pointed out by B. Partee.
15 Also compare (i) and (ii):

(i) Everything that exists is self-identical.
(ii) Everything is self-identical.

It seems to me that (i), but not (ii), is only about actual objects.
(21') If $\alpha$ is a [+def] NP, $[\alpha']^{M.u.C.g.s}$ is only defined if,

(i) if $\alpha'$ is of type $<e,t>$, for all $<g',s'> \in C$,

$[\alpha'(x_i)]^{M.u.C.g'.s} = 1$, and

(ii) $i \in D(C)$.

(ii) adds to (21) the claim that the index of a definite must already have been used. This revision of the presupposition of definites would make a difference in a language that had a pronoun or other anaphoric device that could refer to anything—i.e., a combination of he, she, it, and they. Clause (i) of (21') would always be satisfied for such a pronoun, since it would have no descriptive content whatsoever. However, the index would still be in D(C).

I have also added to (21') the requirement that $\alpha'$ be of type $<e,t>$. This is necessary because, due to translation rules (6)-(9), an NP's meaning may shift from its basic one through the application of various operators. The statement of the presupposition is only coherent when the NP is of type $<e,t>$.

In §2.4.3 I have attempted to use the meanings compositionally derived by the rules of §§2.4.1-2.4.2 in a theory of pragmatic presupposition. This is an improvement on Heim's theory, which does not give a semantics for elements smaller than a clause or NP. However, the basic ideas for the presuppositions of definites and indefinites come from her work.
2.4.4 Examples

In this section I will work through a number of sentences and short discourses showing how the system outlined above works. The first example is the simple (25), which I assume has the S-structure shown:

(25) John ran.

The tense has lowered from \( I \) onto the untensed verb in order to form the past-tense form \( \text{ran} \). The subject \( \text{John} \) has raised from VP-internal position to the surface subject position under IP. Since there is only one NP, I am ignoring its index. I will assume that, at LF, \( \text{PAST} \) is located in its underlying position, dominated by \( I \). (26) gives a translation tree for (25); each node is a pair of, first, syntactic category and, second, a translation into the logical language discussed in §2.4.3. This tree is not an actual level of representation, though removing all the translations would yield the LF.
(27) gives the denotation of the VP with respect to M, u, C, and \(<g,s>\).

(27) that function \(f \in D_{<s,t>}\), such that for any \(s' \in S\), \(f(s')=1\) iff

- \(s'\) is a minimal situation in which \(g(x)\) or a counterpart of \(g(x)\) runs.

Next, (28) gives the denotation of the I'.

(28) that function \(h \in D_{<s,t>}\), such that for any \(s' \in S\), \(h(s')=1\) iff

- for some \(s''<s'\), \((s'')\) is a minimal situation in which \(g(x)\) or a counterpart of \(g(x)\) runs) and \(s''\) precedes \(u\).

The part of (28) in parentheses says that \(f(s'')=1\), where \(f\) is, as shown in (27), the denotation of the VP. Finally, with (29) giving the meaning for \(L(john)\), (30) gives the interpretation of the whole sentence.
(29) \[ [L(john)]^{M.u.C.g.s} = \text{that } j \in D_{<e, <s, i>}, <s, i> \text{ such that, for any } P \in D_{<e, <s, i>}, j(P) = i \in D_{<s, i>} \text{ such that, for any } s' \in S, f(s') = 1 \text{ iff } P(John)(s') = 1. \]

(30) \text{that function } k \in D_{<s, i>}, \text{ such that for any } s' \in S, k(s') = 1 \text{ iff for some } s'' < s', s'' \text{ is a minimal situation in which John or a counterpart of John runs and } s'' \text{ precedes } u. \text{ Now we are ready to update the context for the proposition (30).}

(31) shows the result of updating the context \( C \).

(31) \( C' = \{ <g, s> : <g, s> \in C \text{ & for some } s' < s, s' \text{ is a minimal situation in which John or a counterpart of John runs and } s' \text{ precedes } u \} \).

\( C' \) is the set of assignment/situation pairs in \( C \) such that the situation is one that contains a minimal situation which precedes \( u \) and in which John or a counterpart of John runs. In discussing this example, I have left out aspects of the meaning that would allow \textit{John} to bind pronouns later in the discourse. This is only for explanatory simplicity with the first example, and we will now move on to a case of intersentential anaphora.

The next example is the sequence of sentences (32).

(32) A man ran. He smiled.

(33) gives the translation tree for the first sentence of (32):
The subject NP has three meanings in (33). Its basic meaning, the one of the most deeply embedded NP\[-def\] 1, is just the characteristic function of the set of possible men. Then, by translation rule 9, that meaning is applied to the variable x_1. Finally, by rule 8, an expression that denotes a proposition is created. The I', meanwhile, is just like in the preceding example (except that the subject has index 1 in this case). The IP's meaning is gotten by conjoining the subject and the predicate, using translation rule 6.

The interpretation of the subject in (33), with respect to M, u, C, g, and s, is given in (34):

(34) that function f ∈ D_{<s,1>} such that, for any s' ∈ S, f(s') = 1 iff g(x_1) is a man.
The interpretation of the I' is as in the preceding example. We get the interpretation of (33) by semantic rule 6.

\[(35)\] \[ ((33))^{M.u.C.g.s} \text{that } f \in D_{<s,t>} \text{ such that, for any } s' \in S, f(s')=1 \text{ iff } [\mathbf{^\text{man}(x_1)}]^{M.u.C.g.s(s')}=1 \text{ and } [\mathbf{past(run(x_1))}]^{M.u.[C@[\mathbf{^\text{man}(x_1)}]^{M.u.C.g.s}.g.s(s')}=1.\]

(36) is a simpler statement of (35):

\[(36)\] \[ \text{that } f \in D_{<s,t>} \text{ such that, for any } s' \in S, f(s')=1 \text{ iff } g(x_1) \text{ is a man and for some } s''<s', s'' \text{ is a minimal situation in which } g(x_1) \text{ or a counterpart of } g(x_1) \text{ runs and } s'' \text{ precedes } u.\]

(36) is only defined if the presupposition of a man is met. It is met if C places no restriction on what \(x_1\) can refer to.

Now we can update the context for the meaning (36). This yields the following:

\[(37)\] \[ \{<g,s'> : <g,s'> \in C \land [\mathbf{^\text{man}(x_1)}]^{M.u.C.g.s(s')} \text{ and } [\mathbf{past(run(x_1))}]^{M.u.[C@[\mathbf{^\text{man}(x_1)}]^{M.u.C.g.s}.g'.s(s')}\}

(38) provides a simpler version of (37).

\[(38)\] \[ \{<g,s> : <g,s> \in C \land g(x_1) \text{ is a man and for some } s'<s, s' \text{ is a minimal situation in which } g(x_1) \text{ or a counterpart of } g(x_1) \text{ runs and } s' \text{ precedes } u.\]

Let us call the context (38) \(C'\).

There is nothing new to be learned from the analysis tree for the second sentence of (32). It is interpreted with respect to \(C'\). The subject is definite, and has index 1, so the update is only felicitous if both \(1 \in D(C')\) and \(C'\) entails that \(x_1\) is male. Both of these conditions are met, as is clear from (36). (39) gives the meaning for the second sentence:
(39) \( f \in D_{<\text{s,t}>} \) such that, for any \( s' \in S \), \( f(s') = 1 \) iff
\[
[^{\text{male}}(x_1)]M.u.C.g.s(s') \quad \text{and} \quad 
[past(smiles(x_1))]M.u.[C@[^{\text{male}}(x_1)]M.u.C.g.s].g.s(s')
\]

Updating the context for (39) gives (40).

(40) \( C'' = \{<g,s> : <g,s> \in C' \& \text{for some } s' < s, s' \text{ is a minimal situation in which } g(x_1) \text{ or a counterpart of } g(x_1) \text{ smiles and } s' \text{ precedes } u \} \)

In (41), \( C' \) is expanded so \( C'' \) is defined in terms of the original context \( C \).

(41) \( C'' = \{<g,s> : (<g,s> \in C \text{ and } g(x_1) \text{ is a man and for some } s' < s, s' \text{ is a minimal situation in which } g(x_1) \text{ or a counterpart of } g(x_1) \text{ runs and } s' \text{ precedes } u) \text{ and for some } s'' < s, s'' \text{ is a minimal situation in which } g(x_1) \text{ or a counterpart of } g(x_1) \text{ smiles and } s'' \text{ precedes } u \} \)

The part of (41) in parentheses comes from the first sentence.

(41) is the set of assignment/situation pairs \( <g,s> \) in \( C \) such that (a) \( g(x_1) \) is a man, (b) \( s \) contains a minimal situation before \( u \) in which that man (or a counterpart) runs and (c) \( s \) contains a minimal situation before \( u \) in which that man (or a counterpart) smiles.

This meaning does not say anything about the relative order of the running and the smiling, even though it intuitively seems that the smiling must follow the running. One way to account for this would be to add another parameter to the interpretation, a reference time or situation that moves forward during a discourse (cf. for example Kamp (1979), Hinrichs (1982), Kamp and Rohrer (1983), Partee (1984)); in fact, we will add a reference situation in Chapter 4 for independent reasons. Another point to notice
about (41) is that it assumes that the utterance time \( u \) for the two sentences is identical. This simplification would cause problems in certain cases, such as during a description of ongoing events; however, it is clearly possible to remove this idealization within the present system, just by letting different sentences have different contexts of utterance \( u_1, u_2, \ldots \).

The next example I would like to discuss involves an adverb of quantification.

(42) When a donkey wept, it always ran.
In order to avoid for the present having to consider quantification over situations, we will be looking at the reading of (42) which only involves quantification over donkeys. On this reading \textit{wept} and \textit{ran} are generic; it says that any donkey which in the past was a weeper was also in the past a runner. We will not go into how \textit{weep}s and \textit{run}s might become generic, but cf. Carlson (1977).

(43) gives a partial translation tree for (42).

(43)

\[
\begin{align*}
\text{IP: always} & (\wedge (\text{donkey}(x_1)) \& \text{past}(\text{weep}(x_1))) (\wedge \text{it}(x_1) \& \text{past}(\text{run}(x_1))) \\
\text{always}_1; \text{always}_2 & \quad \text{IP: } \wedge (\text{donkey}(x_1)) \& \text{past}(\text{weep}(x_1)) \\
\text{when} & \quad \text{IP: } \wedge (\text{donkey}(x_1)) \& \text{past}(\text{weep}(x_1))
\end{align*}
\]

\textit{when a donkey wept \ldots it ran}
I am assuming that *when* has no semantic effect. The assumption, taken from Heim (1982), that the adverb of quantification raises onto the S at LF will be challenged in Chapter 5. While this assumption is probably wrong, it is easier to illustrate how the quantification works by making it. The interpretation of the IP in (43), with respect to M, u, C, and <g,s>, is given in (44).

$$\text{(44) } f \in D_{<s,t>} \text{ such that, for any } s' \in S, f(s') = 1 \text{ iff}
\begin{align*}
&\text{for all } g' \text{ such that } <g',s'> \in C \text{ and } g'<\omega>g,
&\text{if there exists a } g''<\eta>g' \text{ such that } <g'',s'> \in C \text{ and}
&[\neg \text{[donkey}(x_1) \& \text{past}(\text{weeps}(x_1))]M.u.C.g',s(s') = 1,
&\text{then}
&\text{for some } g''' \text{ such that } <g''',s'> \in C \text{ and } g'''<\eta>g',
&[\neg \text{it}(x_1) \& \text{past}(\text{runs}(x_1))]M.u.C.\neg \neg [\neg \text{[donkey}(x_1) \& \text{past}(\text{weeps}(x_1))]M.u.C.g,s].g''''<\eta>s(s') = 1.
\end{align*}$$

Since index 1 is not in N, $g''<\eta>g'$ means that $g''$ agrees with $g'$ on what it assigns $x_1$. Notice that *it ran* is not interpreted with respect to C, but rather with respect to $C \ominus [\neg \text{[donkey}(x_1) \& \text{past}(\text{weeps}(x_1))]$. This will allow a donkey to satisfy the presupposition of *it*: The presupposition amounts to the following: (44) will only be defined if the assignment of every assignment/situation pair in $C \ominus [\neg \text{[donkey}(x_1) \& \text{past}(\text{weeps}(x_1))]$ assigns an 'it' to $x_1$. $C \ominus [\neg \text{[donkey}(x_1) \& \text{past}(\text{weeps}(x_1))]$ is the set

$$\text{(45) } \{<g,s>: <g,s> \in C \text{ and } g(x_1) \text{ is a donkey and for some } s'<s,}
\text{s' is a minimal situation in which } g(x_1) \text{ weeps and } s' \text{ precedes } u\}.\)
The assignment of each assignment/situation pair in this set assigns a donkey to $x_1$, so the presupposition is satisfied. The other presupposition of (42) is that of the indefinite *a donkey*. This presupposition is that $C$ places no restrictions on what $x_1$ can refer to, and this will be the case if index 1 has not yet been used in the discourse.

Assuming that *a donkey*'s presupposition is met, (44) is equivalent to (46):

(46) $f \in D_{S,1}$ such that, for any $s' \in S$, $f(s')=1$ iff

for all $g'$ such that $<g',s'> \in C$ and $g'<\omega>g$, if there exists a $g''<N>g'$ such that $<g'',s'> \in C$ & $g'(<x_1>)$ is a donkey and for some $s''<s'$, $s''$ is a minimal situation in which $g''(<x_1>)$ weeps and $s''$ precedes $u$,

then for some $g'''<N>g'$, $<g''',s'> \in C$ & $g'''(<x_1>)$ is an 'it' and for some $s'''<s'$, $s'''$ is a minimal situation in which $g'''<x_1>$ runs and $s'''$ precedes $u$.

(46) is equivalent to the following: the whole sentence is true of a situation $s'$ iff all assignments $g'$ such that that (i) the pair $<g',s'> < g'<\omega>g$ is in $C$, (ii) $g'$ differs from $g$ only in what it assigns to $x_1$, and (iii) $g'$ assigns a donkey that weeps in $s'$ to $x_1$ are such that in $s'$ the donkey runs. More explicitly, (46) is true of a situation $s'$ iff all assignments $g'$ such that that (i) the pair $<g',s'> < g'<\omega>g$ is in $C$, (ii) $g'$ differs from $g$ only in what it assigns to $x_1$, and (iii) some $g''$ (such that $<g'',s'> < g'<\omega>g$ is in $C$) which assigns the same thing to $x_1$ as $g'$ assigns a donkey that weeps in $s'$ to $x_1$ can be adjusted to another
assignment $g''$, where (i) again $<g'', s'>$ is in $C$, (ii) $g''$ assigns the same donkey to $x_1$, and (iii) in $s'$ the donkey runs.

What if, in the place of *it ran* in (43), we had an IP with a new indefinite? An example of this is (47).

(47) When a donkey wept, it always bit a farmer.

(48) gives a partial translation tree for (47).

(48)

\[
\text{IP; always} \quad (^{\text{donkey}(x_1)} \& \text{past(weep}$x_1$))) \quad (^{\text{it}(x_1)} \& ^{\text{farmer}(x_2)} \& \text{past(bite(x_1x_2))})
\]

Now, in (49) we have the meaning of (48); this meaning comes about through the same process as with the preceding example.
For any $f \in D_{<s,\ell>}$ such that, for any $s' \in S$, $f(s') = 1$ iff
for all $g'$ such that $<g', s'> \in C$ and $g' <\omega> g$,
if there exists a $g'' <N> g'$ such that $<g'', s'> \in C$ & $g''(x_1)$ is a
donkey & for some $s'' <s'$, $s''$ is a minimal situation
in which $g''(x_1)$ weeps and $s''$ precedes $u$,
then for some $g''' <N> g''$ such that $<g''', s'> \in C$ & $g'''<N> g'$,
$g'''(x_1)$ is an 'it' and $g'''(x_2)$ is a farmer and for some
$s'''' <s'$, $s''''$ is a minimal situation in which $g'''(x_1)$
bites $g'''(x_2)$ and $s''''$ precedes $u$.

If index 2 is in $N$, a farmer is interpreted with narrow scope
existential force. If it is not, it establishes a new discourse
referent which may be picked up in subsequent discourse. Either
possibility seems available.

It was asserted above, in §2.3, that treating common nouns
as denoting sets of possible individuals does not cause difficulty
with usual Montague Grammar analyses of intensional
constructions. This point can be made in general by showing that
there exists a function $R$ which converts sets of possible
individuals to usual Montague Grammar intensions for common
nouns, of type $<s,<e,\ell>>$. Recall that the individuals in the present
system exist in only one world. (50) defines $R$.

For any $f \in D_{<c,\ell>}$, $R(f) = g \in D_{<s,<e,\ell>>}$ : for any $s \in S$, $g(s) =$
that $h \in D_{<c,\ell>}$ : for any $c \in I$, $h(c) = 1$ iff $c$ exists in $s$ and
$f(c) = 1$.

\[16\] This type incorporates Bennett's (1974) simplification of Montague's
system. Montague's type would be $<s,<s,c>,\ell>>$.
Here I would like to illustrate the treatment of the intensional adjective *alleged*. Recall that a noun like *crime* is of type $<$e,t$>$, and the adjective *alleged* is of type $<(e,t),<e,t>$. Now let us investigate the semantics of the subject NP of example (51).

(51) The alleged crime was horrible.

Consider the following meaning for *alleged*.

(52) $[\text{alleged}]^{M,u,C,g,s} = f \in D^{<e,t>,<e,t>} : \text{for any } P \in D^{<e,t>}$

$$f(P) = \text{that } h \text{ such that for any } b \in I, h(b) = 1 \text{ iff for some world } w, \text{ for all worlds } w' \text{ compatible with what is alleged in } w \text{ there exists a counterpart } c \text{ of } b \text{ in } w' \text{ and } P(c).$$

*Alleged crime* will denote the set of possible individuals that are alleged to be crimes; something is alleged to be a crime iff, in every world compatible with what is alleged about it, it or its counterpart is a crime.

The final preliminary semantic topic I would like to discuss is the word *be*. *Be*, when it takes a predicate nominal, must convert noun meanings into properties, i.e. VP meanings: it must be of type $<e,t>,<e,<s,t>>$. Let us take as an example the untensed predicate (53).

(53) be a cat.

A *cat* denotes the set of possible cats. *Be a cat* should denote the property of being a cat. This is the function from individuals to the set of situations such that the individual, or a counterpart, is a cat in that situation. So *be* will have the following meaning.
(54) \[ \text{be}^M \cdot u \cdot C \cdot g \cdot s = f \in D_{<e,t>,<e,<s,t>_1>} : \text{for any } P \in D_{<e,t>_1}, f(P)= \]
\begin{align*}
&\text{that } g \in D_{<e,<s,t>_1>} : \text{for any } \alpha \in I, g(\alpha)= \text{that } h \in D_{<s,t>_1}: \text{for any } s' \in S, h(s')=1 \text{ iff there is a counterpart } \beta \text{ of } \alpha \text{ such that } \beta \text{ exists in } s' \text{ and } P(\beta).^17 
\end{align*}

In order to combine a predicate adjective with be, I assume that it must be shifted to type \(<e,t>\). In the usual case, the shifted meaning is obtained by applying the adjective meaning to the set of all things. Thus, if \textit{smart} usually denotes \(\lambda P[\lambda x[\text{smart}(x) \& P(x)]]\), as a predicate adjective it will denote the set of smart things. This type of shift must not be able to apply with \textit{alleged}, since (55) is impossible.

(55) *That crime is alleged.

The present analysis of be has the advantage that the meanings of (for example) \textit{cat} and \textit{be a cat}, as well as \textit{cats} and \textit{being a cat}, are different from each other. As noted in §2.3, on certain other theories the members of these pairs are predicted to be synonymous.

In this subsection I have tried to demonstrate how the semantic system developed throughout the chapter is able to analyze a variety of English sentences. Of particular interest is that fact that we were able to give a compositional semantics for sentences involving donkey anaphora and intersentential anaphora. These analyses followed those of Kamp (1981a) and Heim (1982), treating definites and indefinites as open sentences which restrict a variable. The system also incorporates Heim's

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17 The counterpart relation is reflexive, so \(\alpha\) is a counterpart of itself.
(1982) theory of presupposition, and in this respect it is an improvement on Groenendijk and Stokhof's (1990) theory of Dynamic Montague Grammar, which does not deal with definiteness. However, I believe that all of the analysis of infinitives, subjunctives, and gerunds given in this dissertation could be reproduced in Dynamic Montague Grammar. Therefore, one can prefer their approach to donkey anaphora while still accepting my conclusions about the semantics of propositional expressions.

Some of the aspects of the logic developed in §§2.4.1-2.4.2 have not been discussed very much yet. These, for example semantic rules 9 and 10, will be used extensively in the following chapters. It has been the purpose of this chapter to make the reader comfortable enough with the general semantic framework and the approach to the syntax-semantics interface that he or she can approach specific questions in the semantics of propositional expressions.

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18 Chierchia (1991) outlines a theory of the presuppositions of indefinites in that framework, but does not discuss the presuppositions of definites.
CHAPTER 3
GERUNDS

3.1 Introduction

In this chapter I will discuss the semantics of verbal gerunds like those in (1)-(3).

(1) John's eating the apple bothered me.
(2) I imagined John eating the apple quickly.
(3) Mary denied having eaten the apple.

These forms are referred to as verbal gerunds because they show the internal structure of VP's: They may be modified by adverbs; direct objects occur without any preposition; and they may occur with the auxiliary have.

Though they are all verbal in this sense, the gerunds in (1)-(3) have frequently been considered not to form a unified class. It has been proposed that the gerund in (1), with its subject in the genitive, is syntactically different from that in (2), with an objective case subject (Rosenbaum (1967), Roeper and Wasow (1972), Horn (1975), Chierchia (1984), Abney (1987)). The POSS-ing gerund of (1) is considered to contain a nominalization of a VP, while the ACC-ing in (2) is claimed to be a nominalization of an S. We will come back to these claims in §3.3. There it will be argued that the facts which have been used to motivate this syntactic distinction should rather be explained on the basis of a presuppositional difference. It will be suggested that the gerunds in (1) and (2) differ syntactically only in that the former contains
a POSS morpheme; the interpretation of this POSS morpheme is similar to that of the definite marker the. Until then, I will regard all the gerunds above as nominalizations of VP’s. This syntactic analysis is discussed in some detail at the end of this section.

Early discussions of the meaning of verbal gerunds are given by Lees (1963) and Vendler (1967). Vendler focuses in more detail on the aspects of meaning that we are interested in here; he argues that the gerunds in (1)-(3) have as their meanings a proposition or 'fact'. This idea has been translated into a situation semantics framework by Zucchi (1989). The main argument for this semantics is the near paraphrasability of (1)-(3) by (4)-(6):

(4) That John ate the apple bothered me.
(5) I imagined that John ate the apple quickly.
(6) Mary denied that she had eaten the apple.

While I believe that (1)-(3) each have some reading that is close to (4)-(6), it seems that (1) and (2) also have interpretations on which the gerunds, informally speaking, denote events rather than propositions. The most prominent reading of (2), for instance, requires that I actually bring to mind an image of John eating the apple quickly, while (5) may be true if I merely contemplate the kind of state of affairs that would result. The possibility of verbal gerunds denoting events may be seen more clearly in other contexts, such as (7)-(8):

(7) John’s eating an apple usually bothers me.
(8) I seldom minded Mary using the telephone.

These cases seem to involve quantification over events and are not paraphrasable by replacing the gerunds with that clauses.
seems to mean that most events of John eating an apple bother me; (8) says that few events of Mary using the telephone are such that I minded them. These verbal gerunds therefore appear to be distinctly non-propositional.

As an aside, I'd like to mention a second argument Vendler has for considering verbal gerunds to uniformly denote facts or propositions. So-called perfect nominals like those underlined in (9) show up in contexts which intuitively are clearly eventive.

(9) Janet's call to Mary occurred on the tenth.
    John's singing of the Marseillaise was slow.
Verbal gerunds are not possible in these contexts:

(10) *Janet's calling Mary occurred on the tenth.
    *John's singing the Marseillaise was slow.
Vendler and Zucchi explain this contrast by hypothesizing that occur on the tenth and be slow select for events. Thus, according to this explanation, the examples in (10) are unacceptable because the gerund does not denote the right type of entity for these predicates to apply to. However, recall that in §2.2 of Chapter 2 it was proposed that nominals like those in (9) denote situations of a special sub-type: concrete situations. Thus we can explain the difference between (9) and (10) while still allowing verbal gerunds to occur in positions that select for an event/situation. The problem with the examples in (10) is that occur on the tenth and be slow can only be true of concrete situations, and the verbal gerunds in (10) denote less fully specified situations that are merely part of those denoted by the nominals in (9).
It is the main goal of this chapter to provide a uniform semantics for the gerunds in (1)-(3) and (7)-(8). I propose that a verbal gerund always denotes a proposition--i.e. a set of possible situations--but that within situation semantics such a meaning can also function to pick out an individual situation or event. The situations in a gerund's proposition are all minimal situations of the relevant sort, and because they are minimal they are able to play the role of events. (1) asserts not that the set of situations of John eating that apple bothered me, but rather that one situation in that set did. Thus the gerund acts rather like an ordinary definite or indefinite NP. (3) in contrast asserts that Mary stands in the deny-relation to the set of situations in which she has eaten the apple. It is a case of a true propositional attitude.

A final introductory point concerns the syntactic analysis of verbal gerunds. As mentioned above, previously it has been argued that ACC-ing gerunds are nominalizations of S's, as in (11a), while POSS-ing gerunds contain nominalizations of VP's, as in (11b).

(11a)
These trees do not take into account a variety of variations that have been proposed for the basic analyses. The treatment of negation as an adjunct rather than as a functional head is not crucial to what follows. The questions that the considerations below will allow us to answer are (i) whether gerunds contain a functional projection dominating sentential not to whose head verbs may move, and (ii) whether the gerunds' subjects are inside or outside the nominalized constituent. Thus, with a 'split INFL' proposal like that of Pollock (1989), the distinction could be cast as one between (12a) and (12b).

\[(12a)\]
I will argue--speaking in terms of the structures in (11)---that there is no functional projection higher than negation in gerunds and that the subject of the gerund, whether an ACC-ing or a POSS-ing, is in the ordinary NP possessor position. I have avoided incorporating the refinements in (12) or the DP analysis (Abney (1987)) into the discussion not because there are arguments against them, but because the complications added seem not to bear on the topics treated here.

There are two arguments which motivate accepting an analysis along the lines of (11b) for both ACC-ing and POSS-ing gerunds. First is the lack of semantic parallelism between (13) and the gerund in (14).

(13) John is \([\text{VP not } \text{t}] \text{AP happy}\) for five minutes each day.

(14) John's \([\text{VP being } \text{AP not happy}] \text{for five minutes each day}\) is a cause for concern.

There is a scope ambiguity between \text{not} and \text{for five minutes each day} in (13). However, in (14) there is no reading on which \text{not} has higher scope than the temporal modifier. In the derivation of
(13), *be* raises from within its VP projection into I. Assuming that both *not* and *for five minutes each day* are adjoined to VP, this will result in the word order seen in (13) as well a scope ambiguity--based on which is adjoined c-commanding the other--between the negation and the temporal. If the gerund in (14) had the internal structure of clauses, as claimed by (11a), there is no reason why its *be* should not be able to undergo the same operation.\(^1\) Thus (14) should show the same scope properties as (13). However, if (11b) is the correct analysis of (14)'s gerund, there is no way we can have a wide scope negation to the right of *be*. There is no place for *be* to raise to, so it must be within its VP. This indicates that *not* has attached directly to the adjective or AP, giving it obligatory narrow scope.

The other argument for the structure in (11b) also involves scope. Consider (15):

(15) Everyone('s) not smiling bothered her.

Here, in either the POSS-ing or the ACC-ing case, *everyone* obligatorily has wide scope over *not*. This fact is in contrast to the state of affairs with a clause.

(16) Everyone did not smile.

If (15) contains a clausal structure like (16) as a subpart, it is quite difficult to see how to prevent all the scope relations possible in (16) from being available in (15). However, if (11b) is the correct structure for (15), wide scope for *everyone* seems almost inevitable. There are two ways one might seek to derive

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\(^1\)Pollock (1989) proposes that such raising does occur in gerunds.
wide scope for not in (16). Either not is able to raise at LF, adjoining to S, or everyone lowers at LF to some position below negation. The former possibility is clearly unavailable with (11b). Using the latter with (16) depends on treating subjects as being base-generated within the VP and raising to spec of IP (S) at S-structure. According to such an analysis, subsequent lowering of the subject back into the VP is a case of reconstruction. However, if (11b) is the correct structure for (15), the subject has not raised from anywhere and therefore no scope reconstruction can occur.

I will now go on to discuss the structure of gerunds in more detail. Because of these scope facts, I believe that it is worthwhile to pursue the idea that POSS-ing and ACC-ing gerunds uniformly involve the nominalization of a VP. The proposal that both types of gerunds contain nominalized VP's receives further support in §3.3, where I give a reanalysis in terms of presuppositional differences of facts that have been used to motivate treating ACC-ing gerunds as S-nominalizations and POSS-ing's as containing VP-nominalizations. Thus, even if the arguments just outlined are not conclusive, in the end the most simple analysis of the contrast between ACC-ing's and POSS-ing's will not involve the kind of structural difference in (11a)-(11b).
In (17) I illustrate the structure I assume for gerunds.

(17)

I treat the nominalizing element as a phonetically null head, represented here as *ing* which heads an NP projection. This head selects for a VP complement, which it obliges to carry a [+ing] feature. This feature percolates onto the V and is realized as the *-ing* form of the verb. *ing* also sets up a control relation between its specifier position and the VP-internal subject PRO; this proposal is reminiscent of Diesing's (1989) treatment of INFL with individual-level predicates.2

The rest of this chapter is structured in the following way: In §3.2 I will first show in more detail how the basic analysis of gerunds works. Then I will illustrate how the proposal can handle

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2As pointed out to me by F.R. Higgins, sentences like (i) suggest a need to allow raising in gerunds:

(i) There being another guest in the kitchen bothered us.

The status of *there* in this sentence is parallel to that in (ii).

(ii) We prevented there from being too many people in the kitchen.

Here too we have a problematical case of apparent raising. Crucially, such cases do not allow scope reconstruction either:

(iii) We dissuaded everyone from not calling their mother.

Thus, either we have a type of raising that does not allow reconstruction or control is possible in some cases with *there.*
the more complicated quantificational cases in (7)-(8). Next, in §3.3, I will return to the contrast between POSS-ing and ACC-ing gerunds mentioned above. I argue that the differences between them should be attributed to a difference of definiteness. §3.4 presents an argument for the situation-based framework over a Davidsonian semantics, one of its major rivals. As mentioned in Chapter 1, a Davidsonian theory claims that events enter the semantics of sentences as arguments of predicates. Finally, §3.5 offers a formalization of the ideas of §§3.2-3.4 within the framework given in Chapter 2. In order to let me highlight the crucial aspects of the proposals, until §3.5 the discussion will proceed in an only semi-formal fashion.

3.2 Propositional and Eventive Gerunds

In this section I will discuss how the situation semantics framework lets us give a unified analysis of the semantics of gerunds. (Much of this material is a refinement of Portner (1990; 1991b).) The gerunds in (18)-(20) will all have the same meaning.

(18) Mary denied climbing Savoy Mountain.
(19) Mary regretted climbing Savoy Mountain.
(20) Mary always enjoyed climbing Savoy Mountain.

In all three cases the gerund denotes the following proposition:

(21) \[ \text{ing(climb(Mary)(Savoy Mountain))} = \{s : s \text{ is a minimal situation of Mary climbing Savoy Mountain}\} \]

(In this chapter I will ignore the aspectual effect of \(-ing\). It is discussed in detail in Chapter 5.) In (18) this proposition is
directly the argument of the matrix verb; \textit{deny} denotes a propositional attitude. In (19), in contrast, the verb denotes a relation not towards a proposition, but rather towards a single situation. The Logical Form of (19) therefore involves Quantifier Raising of the gerund, since the gerund denotes the wrong kind of entity to be interpreted in place. The trace of the gerund is translated as a variable, and the gerund itself is used to restrict the denotation of that variable to situations in the gerund's denotation. This restricting is quite parallel to the way in which definite and indefinite NPs are interpreted within a Kamp/Heim framework; however, because the gerund is propositional, and not of type \textit{<e,t>}, there will have to be some technical differences in how the restriction comes about. Through this kind of process, (19) ends up expressing a relation of regretting towards a situation of Mary climbing Savoy Mountain. Finally, (20) is similar to (19) except that there is quantification over situations in the gerund's denotation. Rather than there being a relation towards a single situation of climbing Savoy Mountain, Mary is said to stand in the enjoy relation towards every such minimal situation.

All of the analyses given in this chapter will be revised somewhat in Chapter 5, where the aspectual properties of gerunds are taken into account. Despite the fact that some of the changes will be fairly significant, the main points of the analysis of the semantic variability seen in (18)-(20) will be unaffected.
3.2.1 Propositional Gerunds

In this section I will discuss in more detail the interpretation of (18), repeated here:

(18) Mary denied climbing Savoy Mountain.

The translation of (18) is given in (22).

(22) past(deny(Mary)(ing(climb(Mary)(Savoy Mountain))))

Assuming the meaning in (23) for deny, (24) is the interpretation of (18):

(23) deny denotes that function $f \in D_{<s,i>} <e,s,i>>$ such that, for any $p \in D_{<s,i>}$, $f(p) = that \in D_{<e,s,i>>}$ such that, for any $a \in I$, $h(a) = \{s : \text{for all } s' \text{ which } a \text{ denies in } s, s' \in p\}$

(24) $\{s : \text{for some } s', s' < s \text{ and } s' \text{ is past and for all } s'' \text{ which Mary denies in } s', s'' \text{ is a minimal situation of Mary climbing Savoy Mountain}\}$

The meaning (23) uses the set of situations 'which a denies in s'. This set of situations are those that represent the content of Mary's denial. Thus, (24) is the set of situations s such that the set of situations which represent the content of Mary's denial in s contains only situations of her climbing Savoy Mountain.

The accessibility relation set up by this meaning for deny is somewhat different from what would be assumed in traditional possible worlds semantics. Ordinarily, one would take deny to give the set of worlds compatible with what is denied--the set of worlds that Mary could consider and say "no! I'm not in that world" to. Since only minimal climbing situations can be accessible if (24) is to be true, we do not have this kind or set.
Instead, we have the set of situations which would be the basis for Mary's saying "no!" to any world containing one of them. They are the situations which make a given world incompatible with what Mary is claiming to be the case. As we will see in the next chapter, it is possible to explain the selectional properties of verbs like believe that take that clauses but not gerunds or infinitives by arguing that they never set up an accessibility relation that makes minimal situations accessible.

The meaning in (23) would be equally compatible with a that clause. (25), for instance, gets the interpretation (26):

(25) Mary denied that she climbed Savoy Mountain.
(26) \(s: \text{for some } s', s'<s \text{ and } s' \text{ is past and for all } s'' \text{ which Mary denies in } s', \text{ for some } s'''', s''''<s'' \text{ and } s'''' \text{ is past and } s'''' \text{ is a minimal situation of Mary climbing Savoy Mountain}\)

Though (26) is not identical to (24), the two are similar enough to account for the fact that the sentences are fairly accurate paraphrases of each other in most circumstances. The crucial difference is that the that clause denotes a persistent proposition, and so the content of Mary's denial may be represented by somewhat larger situations than the minimal ones in the gerund's denotation. Aspectual matters aside, in (24) Mary must stand in the deny-relation to a set of situations all of which are minimal situations of her climbing Savoy Mountain, while with (26) she is asserted to stand in the deny-relation to the set of situations which contain a situation of her climbing Savoy Mountain. Thus, though (24) entails (26), (26) will not entail (24) without
additional assumptions. Example (25) would be true of a situation in which Mary's denial is of situations in which she both climbs Savoy Mountain and discusses semantics with Allen. In contrast, (18) would not obviously be true in such a situation--though it might be. It would be if that situation contained as a part a situation in which she only denied the climbing. It is a difficulty question whether in general situations of doing both A and B should have as parts situations of doing A and doing B alone. In the present case, I will leave the matter open, as I am unsure whether (25) does entail (18).

It should be noted that the difference between (24) and (26) follows from independent arguments. In Chapter 4, we will see why that clauses should be considered to be persistent. In the next subsections we will see the benefits of analyzing gerunds as sets of minimal situations. Because the meaning difference between gerunds and that clauses is needed elsewhere, having a distinction between (24) and (26) should not be found objectionable.

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3 Another issue that arises with the treatment of gerunds as denoting sets of minimal situations is how to analyze conjoined gerunds like (i):

(i) Mary denied climbing Savoy Mountain and eating the apple. Since no minimal situations of Mary climbing Savoy Mountain are minimal situations of her eating the apple, the conjunction's meaning should apparently be the empty set. This type of example will be examined in §4. The solution lies in the fact that, officially, the gerunds do not denote propositions but rather the individual correlates of propositions. Thus, their meanings can be lifted to generalized quantifier type, conjoined, and quantified in.
3.2.2 Non-Quantified Eventive Gerunds

Now we will consider the semantics of gerunds which seem to denote events, such as that in (19).

(19) Mary regretted climbing Savoy Mountain.

As discussed above, this example involves QR of the gerund. For the moment I will assume that QR adjoins the gerund to the S, though this proposal will be revised in §3.3. (27) is an LF for (19).

(27)

The NPj-over-NPj structure in (27) arises from translation rule 9 of Chapter 2. It occurs so that the content of the NP can be used to restrict a variable. The lower NPj receives the translation (28), and then the higher one gets the translation (29):

(28) ing(climb(Mary)(Savoy Mountain))

(29) ing(climb(Mary)(Savoy Mountain))(xj)

With respect to an assignment function g, (29) denotes the set of all situations if g(xj) is a situation in the denotation of (28), and it denotes the empty set otherwise. Thus, (29) effectively says 'g(xj)
is a minimal situation of Mary climbing Savoy Mountain. The whole of (19) gets the translation (30).

(30) \( \text{ing(climb(Mary)(Savoy Mountain))(x_j) \& past(regret(Mary)(x_j))} \)

With respect to an assignment \( g \), (30) has the meaning given in (31).

(31) \{ s : s \in \{ s' : g(x_j) \text{ is a minimal situation of Mary climbing Savoy Mountain} \} \text{ and } s' \in \{ s'' : \text{for some } s'<s'', s'' \text{ is past and } s'' \text{ is a minimal situation of Mary regretting } g(x_j) \} \}

= \{ s : g(x_j) \text{ is a minimal situation of Mary climbing Savoy Mountain and for some } s'<s, s' \text{ is past and } s' \text{ is a minimal situation of Mary regretting } g(x_j) \}

If \( g(x_j) \) is not a situation of Mary climbing Savoy Mountain, (31) will be the empty set. Context must assure that \( g \) does assign an appropriate situation to \( x_j \), and in this way \( x_j \) acts like a discourse pronoun. We will discuss the presuppositions of gerunds in §3.3.

So long as \( x_j \) does refer to an appropriate situation, however, (31) simply says that Mary regrets it.

### 3.2.3 Quantified Eventive Gerunds

Finally we will consider how quantification over the situations in a gerund's denotation comes about in this framework. (20), repeated here, is the appropriate kind of example.

(20) Mary always enjoyed climbing Savoy Mountain.

(20) gets the LF shown in (32).
This structure gets the translation shown in (33).

(33) \textit{always}j(ing(climb(Mary)(Savoy Mountain))\[xj])

\hspace{1cm} (past(enjoy(Mary)(xj)))

I repeat in (34) the meaning for \textit{always} discussed in Chapter 2.

(35) then gives a meaning for (33) with respect to an assignment \(g\) and ignoring parts of (34) having to do with the context.

(34)

For any \(\alpha, \beta\) of type \(<s,t>\),

\[\{\text{always}_\omega(\alpha)(\beta)\}^{\text{M.u.C.g.s}} = \text{that } f \in D_{<s,t>}: \text{for any } s' \in S,\]

\[f(s') = 1 \text{ iff }\]

for all \(g'\) such that \(<g',s'> \in C\) and \(g' < \omega > g\),

if there exists a \(g'' < N > g'\) such that \(<g'',s'> \in C \& \]

\[\{\alpha\}^{\text{M.u.C.g''}}.s(s') = 1, \text{ then }\]

for some \(g''''\) such that \(<g'''',s'> \in C \& g'''' < N > g'\),

\[\{\beta\}^{\text{M.u.C.}[\alpha]^{\text{M.u.C.g''''}}.s} .g''''.s(s') = 1.\]
(35) \( \{ s : \text{for all } g' \text{ differing from } g, \text{ if at all, in what it assigns to } x_j, \text{ if for some } g'' \text{ agreeing with } g \text{ on what it assigns to } x_j, g''(x_j) \text{ is a situation of Mary climbing Savoy Mountain, then for some } s' < s, s' \text{ is past and for some } g'' \text{ agreeing with } g' \text{ on what it assigns to } x_j, s' \text{ is a situation of Mary enjoying } g''(x_j) \} \)

\( \{ s : \text{for all } g' \text{ differing from } g, \text{ if at all, in what it assigns to } x_j, \text{ if } g'(x_j) \text{ is a situation of Mary climbing Savoy Mountain, then for some } s' < s, s' \text{ is past and } s' \text{ is a situation of Mary enjoying } g'(x_j) \} \)

(35) simply asserts that every situation in the denotation of the gerund was enjoyed by Mary. There will have to be a contextual limitation on the set of climblings of Savoy Mountain quantified over; we only want to consider her past climblings. However, this limiting is no different from what ordinarily goes on with quantification. For example, (36) is only about past presidents.

(36) Mary liked every president.

With the right kind of context, (36) may even be about some smaller set of past presidents—for example those of the 1920's. This is also the case for (20).

So far we have seen the most direct benefits of treating gerunds as denoting sets of minimal situations. This kind of interpretation lets gerunds show up both in propositional and eventive contexts. When the gerund is the complement of a propositional attitude verb, such as deny, it stays in place at LF and is treated almost precisely like a that clause. In contrast,
when a gerund shows up in an event-argument position, it undergoes LF Quantifier Raising like a definite or indefinite NP in the Kamp/Heim framework. These two different ways that a gerund's meaning can be incorporated into the overall sentence meaning are based on a single interpretation for the gerund, and it is a primary advantage of this system that we need not postulate ambiguity for gerunds. In parallel to its syntactic form which is both nominal and verbal, the meaning proposed allows the gerund to have semantic properties of both clauses and NPs.

In the next section we will see that the present analysis also allows a new way of understanding the difference between POSS-ing and ACC-ing gerunds. It proposes that POSS-ing's are definite but that ACC-ing's are indefinite. This idea will let us give an account of some further, previously unnoticed, semantic distinctions within the set of eventive gerunds. Additionally, we will explain many facts which have previously been used to argue that ACC-ing's and POSS-ing's are structurally different.

3.3 POSS-ing vs. ACC-ing Gerunds

3.3.1 Quantificational Readings

The type of reading discussed in the last subsection is not always available for complement gerunds. When an ACC-ing gerund is the object of a nonfactive verb, it cannot have a quantificational reading. The case is different with POSS-ing gerunds, which may receive a quantified reading in this circumstance.

(37) Joyce usually dreams about Mary shouting at her.
(38) Joyce usually dreams about Mary's shouting at her.

(38) may, but (37) may not, have the reading indicated in (39):

(39) Most of the time, when Mary shouts at her, Joyce
dreams about it (e.g. that night).

The same difference shows up in the contrast in (40)-(41).

(40) Joyce usually dreams the next night about Mary
shouting at her.

(41) Joyce usually dreams the next night about Mary's
shouting at her.

In (41), the next night quite naturally anchors to events of Mary
shouting at Joyce; the sentence can mean: for most events e of
Mary shouting at her, Joyce dreams on the night after e about e.

In (40), in contrast, the next night must be interpreted with
respect to the events in some contextually given set; for example,
(40) could mean: for most events e of Mary getting mad at her,
Joyce dreams the night after e about Mary shouting at her. In
each case, the events that are quantified over are the ones that
the next night anchors to, and this fact lets us see that in (41), but
not in (40), events of Mary shouting at her may undergo
quantification.

3.3.2 The Presuppositions of POSS-ing and ACC-ing

Gerunds

We have just seen that, while POSS-ing gerunds may always
be quantified over, ACC-ing complements of nonfactives may not
be. In the rest of this section I will attempt to explain this
difference by claiming that all and only definite gerunds may
undergo quantification. Gerunds in subject position and gerunds which are the complements of factive verbs are interpreted factively. I will argue, and factivity is a species of definiteness. For this reason, these gerunds may be quantified over. I will also suggest that POSS-ing gerunds are inherently definite while ACC-ing gerunds are indefinite. Given all these factors, the only indefinite gerunds will be the ACC-ing complements of nonfactive verbs.

Before going on to argue that POSS-ing gerunds are definite and ACC-ing gerunds are indefinite, I would like to discuss why this difference should be relevant for the availability of a quantificational reading. Berman (1988) shows a similar contrast in the interpretation of indirect questions. Berman argues that it is the presence of the factive verb know that makes quantification possible. Because know presupposes the content of its complement, the theory goes, a process of presupposition accommodation will make the open sentence x won a prize available to serve as the restrictive clause of the quantifier always. This process may either be thought of syntactically, as an LF copying of the indirect question into a position (say, adjoined to S) where always may have access to it, or semantically, as an instance of a general tendency for adverbial
quantifiers to quantify over some presupposed set. That the latter possibility is preferable is at least indicated by cases, such as Schubert and Pelletier's (1987) example (44), in which the presupposed set does not occur explicitly at all but can still be quantified over.

(44) Cats always land on their feet.
Landing presupposes falling, and (44) is most naturally read as saying that whenever cats fall, they land on their feet.

I hope to extend Berman's explanation to account for when quantified readings are possible with gerunds. Therefore I need to show that subject gerunds, gerunds that are complements of factives, and POSS-ing gerunds in general, but not ACC-ing gerunds which are complements of nonfactive, are presupposed. (45)-(47) present the relevant data.

(45) **Subject Gerunds**

John's coming to visit her didn't bother him. 

John coming to visit her didn't bother him.

If John's coming to visit her made him cry, I wouldn't tell you.

If John coming to visit her made him cry, I wouldn't tell you.

It's unlikely that John's coming to visit her suprised him.

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4Obviously, the presence of another operator with higher scope can destroy the factivity:

(i) John's coming to visit her wouldn't bother him.
It's unlikely that John coming to visit her suprised him.

(46) **Gerunds which are Complements of a Factive**
Mary didn't enjoy John's coming to visit her.
Mary didn't enjoy John coming to visit her.
If Mary regretted John's coming to visit her, she didn't tell me.
If Mary regretted John coming to visit her, she didn't tell me.
It's unlikely that Mary enjoyed John's coming to visit her.
It's unlikely that Mary enjoyed John coming to visit her.

(47) **Gerunds which are Complements of a Nonfactive**
Mary didn't discuss John's coming to visit her.
Mary didn't discuss John coming to visit her.
If Mary contemplated John's coming to visit her, she didn't tell me.
If Mary contemplated John coming to visit her, she didn't tell me.
It's unlikely that Mary discussed John's coming to visit her.
It's unlikely that Mary discussed John coming to visit her.

In (45)-(46) all the gerunds are presupposed material--some event of John coming to visit her must have been introduced into the conversation. Indeed, in these examples, there is the even
stronger presupposition of factivity. It is presupposed that some actual situation of John coming to visit her is familiar. In (47), in contrast, only the POSS-ing's have a familiarity presupposition at all, and it is not necessary that the familiar situation of John coming to visit her be actual (though for me the strong tendency is to strengthen the presupposition to full-blown factivity). The presupposition that the POSS-ing's in (27) bear is that there is an entity, perhaps only hypothetical, under discussion; outside the domain of gerunds, similar kinds of examples can be found with NP's like the next chairman or the person who keeps hiding all my papers. In contrast, the ACC-ing gerunds are completely indefinite, lacking even this type of familiarity presupposition. Thus it seems that exactly the gerunds which are definite in (45)-(47) can receive a quantified reading when an adverb of quantification is present.

That ACC-ing gerunds are indefinite but POSS-ing gerunds definite may also be argued on the basis of facts previously used, to motivate different syntactic analyses for the two classes of gerunds. Indeed, I believe it is possible to relate all such facts to a difference of definiteness, and so to undercut the arguments that ACC-ing's and POSS-ing's are not syntactically uniform. I will discuss nine arguments from the literature which are intended to show that ACC-ing gerunds involve the nominalization of an S but that POSS-ing gerunds contain a nominalized VP. I believe that the first six are based on invalid generalizations and that the rest

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5Thanks to B. Partee for pointing out this example.
can be explained on the basis of definiteness. If this is correct, the decision above to treat all gerunds as nominalizations of VP's will be supported.

First, Horn (1975) claims that ACC-ing gerunds take singular agreement when they conjoin, while POSS-ing's take plural agreement.

(48) John coming and Mary leaving bothers me.
(49) John's coming and Mary's leaving bother me.

I do not find that reversing the singular and plural agreement in (48)-(49) results in ungrammaticality, but it does seem that the pattern shown is the more natural. However, these facts seem to be based on a tendency to interpret conjoined ACC-ing's as describing a single event but to consider conjoined POSS-ing's to describe different events. Such a tendency could perhaps be explained on the basis of the definiteness difference between ACC-ing's and POSS-ing's in the following way: Since POSS-ing gerunds must pick out to familiar events, when (49) is encountered, there are already two distinct entities in the discourse, John's coming and Mary's leaving, which the subject can denote. To add to the discourse a further single event which combines these two would be unnecessary work. In contrast, when the conjoined ACC-ing's in (48) are interpreted, because they are indefinite it is necessary to add something to the discourse. It will be less effort to add a single John-coming-Mary-leaving event than to construct two separate events. So, if we assume that conjoined gerunds in general may have two interpretations--one describing a pair of events and one describing a single complex
event, the presuppositional difference between ACC-ing's and POSS-ing's will result in a tendency to choose one strategy with one type of gerund and the other with the other type. Evidence for this way of looking at the facts comes from that observation that, if we explicitly undermine this tendency, the opposite agreement pattern is clearly fine.

(50) John eating apples and Mary sailing around the world bother me.

(51) John's coming and Mary's consequently leaving bothers me.

Hence it seems that agreement with gerunds is based on semantic factors.

Second, Abney (1987) claims that a subject reciprocal of an ACC-ing embedded in subject position is unacceptable, while with a POSS-ing it is acceptable:

(52) *They thought that each other giving up the ship was forgivable.

(53) They thought that each other's giving up the ship was forgivable.

This contrast could be explained by considering the binding domain of each other in (52) to be a nominalized S. The comparison is flawed, however, because an ACC-ing with a pronominal subject other than a reciprocal is impossible in this context:

(54) *They thought that him giving up the ship was forgivable.
In other cases, such as (55), where a pronominal subject is good, it is not possible for it to be bound to the matrix subject.

(55) \[ \text{NP}_i \text{ None of the major candidates} \] suspected that \\
\[ \text{him}^* \text{ winning an election} \] would cause a riot.

\text{Him} must be accented and disjoint from the major candidates. This fact indicates that there is a general difficulty, separate from the issue of binding domains, with binding the subject of an embedded subject ACC-ing. Additionally, there are other cases in which the structure of (52) is possible.

(56) They believed each other talking to Mary to be unforgivable.

(56) differs from previous examples in containing an embedded infinitive rather than an indicative. This fact indicates that it is not the internal structure of the gerund itself which limits the binding domain of each other in (52).

The third difference is also brought up by Horn. He argues that a subjectless ACC-ing gerund allows only a controlled interpretation while subjectless POSS-ing allows only a non-controlled reading. According to Horn, \textit{defend} takes only POSS-ing's.\(^6\)

(57) John defended Israel's attacking Egypt.

(58) *John defended Israel attacking Egypt.

With no subject, the gerund is claimed to only have a non-controlled interpretation.

(59) John defended attacking Egypt.

\(^6\)I have no explanation for this contrast. Some people seem to accept (58).
However, only a slightly different sentence gives a controlled reading (example due to J. McCarthy p.c.).

(60) Israel defended attacking Egypt.

Thus it seems that Horn's generalization does not hold.

Fourth, Chierchia (1984) argues that only POSS-ing's can passivize. This is meant to support the idea that *keep* takes a subjectless ACC-ing but *practice* takes a subjectless POSS-ing.

(61) Singing the national anthem was practiced by everyone.

(62) *Singing the national anthem was kept by everyone.

However, (62) does not illustrate a general fact about ACC-ing's, since an explicit ACC-ing can passivize:

(63) John kissing Mary was imagined by everybody.

The contrast between ACC-ing and POSS-ing therefore doesn't seem to be the basis of the difference between (61)-(62).

The fifth way in which the two types of gerunds are said to differ is given by Horn. He says that ACC-ing's can cleft and be involved in subject-aux inversion while POSS-ing's cannot.

(64) *It was John kissing Mary that upset everyone.

It was John's kissing Mary that upset everyone.

(65) *Did Mary kissing John upset her parents?

Did Mary's kissing John upset her parents?

However, if the ACC-ing's are put in a less definite environment, clefting and inversion are fine:

(66) It's John kissing Mary that would upset me.

---

7This point holds even if the active form of (63) also has a structure on which *John kissing Mary* doesn't form a constituent.
(67) Would Mary kissing John annoy you?

The sixth difference, also brought up by Horn, is that WH-possessives in POSS-ing's can pied-pipe their gerunds, while WH-accusatives in ACC-ing cannot:

(68) The man whose flirting with your wife you took such exception to
(69) *The man who flirting with your wife you took such exception to

If this is the proper generalization, the ACC-ing seems more like the embedded clause in (71) than the NP in (70) (from Abney (1987)).

(70) The man whose opinions you took such exception to
(71) *The man (for) who to leave early you would have preferred

However, (68)-(69) seems to not really be a fact about pied piping. The non-pied-piped version of (69) given in (72) is bad as well.

(72) *The man who you took such exception to flirting with your wife

This is in contrast to the non-pied-piped version of (71) shown in (73), which is fine:

(73) The man who you would have preferred to leave early

Therefore we can claim that ACC-ing's are generally impossible with subject WH's; all the possible counterexamples I know of--such as (75)--actually seem to involve a structure on which the WH word and the VP-ing do not form a constituent at D-structure. While (74) with the pied-piped POSS-ing requires that I have
imagined an event, the non-pied-piped ACC-ing of (75) requires only that I have imagined the man.

(74) The man whose eating an apple I imagined

(75) The man who I imagined eating an apple

While the difference is hard to perceive in these examples, it is much clearer in (76)-(77).

(76) ??The man whose having eaten an apple I imagined

(77) The man who I imagined having eaten an apple

(76) is odd because a state of having eaten an apple is difficult to make an image of, but (77) is fine because it is easy to make an image of a man who has eaten an apple. Thus it seems likely that the source of (77) does not have who as the subject of a gerund who having eaten an apple.

Of course if the correct generalization is that there are no WH-subject ACC-ing's, it still remains that there is a difference between the constructions. However, as seen by (73), the difference no longer tends to group ACC-ing's with clauses rather than POSS-ing's.

Now I will look at three ways in which ACC-ing and POSS-ing gerunds differ in ways which might appear to support the proposed distinct syntactic analyses. In general, they are facts which tend to group ACC-ing's with clauses and POSS-ing's with other NP's. One could therefore try to explain each by the idea that ACC-ing's contain a clause while POSS-ing's do not. However, it will seem that each of these ways can be given a basis in the proposed contrast of definiteness. First, Horn discusses the fact that ACC-ing's cannot be topicalized while POSS-ing's can:
(78a) *Fred singing the national anthem everyone imagined.
(78b) Fred's singing the national anthem everyone imagined.
This difference can be related to the fact that indefinites don't like to be topicalized because topics should be background information, i.e. presupposed.

(79) *Some man we remembered.
*A flying pig everyone imagined.
Of course in certain cases topicalized indefinites are possible.

(80a) Though I could imagine a swimming pig, a FLYING pig I couldn't even imagine.
(80b) Though I could imagine Fred's brother Sam singing the national anthem, FRED singing the national anthem I couldn't even imagine.

The fact that similar contexts allow one to topicalize an ordinary indefinite and an ACC-ing further support the idea that ACC-ing's are indefinite. Obviously, a better understanding of the precise pragmatic importance of English topicalization is necessary before the explanation of the contrast in (78) is complete.

Horn also shows that it is possible to extract from an ACC-ing gerund but not from a POSS-ing.

(81) Which city do you remember him describing?
(82) *Which city do you remember his describing?
This contrast can be connected to the well-known fact that it is easier to extract from indefinites than definites.

(83) Which man did he take a picture of?
(84) ?Which man did he take the picture of?
At first it may seem a problem that (82) is much worse than (84); however, (84) is best in a circumstance in which he had decided to take the picture--identifiable in some independent way, say as the one with which he'll enter the contest--before he decided which man to take it of. If we have an extraction from a POSS-ing in a similar circumstance, it too is better:

(85) ?Which set of slides did she dread his giving the presentation with?
Example (85) is best if it was determined that he would show slides before he decided which set to use. Then the showing of slides is identifiable independently of the set chosen. It is this factor which appears to make (85), like (84), all but perfect.

The final difference between ACC-ing and POSS-ing gerunds is that the former, but not the latter, may be based on the there-insertion construction.

(86) There being five people in the room bothered me.
(87) *There's being five people in the room bothered me.
This fact is the most difficult of the contrasts to explain. However, I would like to suggest that it is due to the function of there-insertion to introduce new entities into discourse. If the gerund in (87) presupposes a situation in which five people are in the room, then it may not introduce those individuals into the discourse. They must already have been introduced. This idea is related to a possible explanation of the definiteness effect in there-insertion sentences, namely that with a strong determiner like every or the, the existence of the entities the sentence purports to introduce is already presupposed (Bolinger (1977)).
(88) *There is the/every person in the room.

This explanation must remain tentative, however, as an adequate formal explanation of the definiteness effect is yet to be given.

If one proposes that (87) is bad because there-insertion is incompatible with definiteness, a further issue to be worked out is why (86) is acceptable. (86) presupposes that there are five people in the room because of the fact that the gerund is in subject position. However, the same problem comes up with (89), which also presupposes that there are five people in the room.

(89) John knows that there are five people in the room.

When a there-insertion construction is presupposed by virtue of its position in a sentence, as with (89) or (86), it is fine, but when it is presupposed because of its internal makeup, it is not. More work is needed to explain why this difference is relevant for the contrasts in grammaticality.

In this subsection I have argued that each of a set of contrasts between ACC-ing and POSS-ing gerunds follows from proposing that ACC-ing's are indefinite and POSS-ing's are definite. Because these contrasts are the basis for the arguments that ACC-ing's are nominalized S's but that POSS-ing's contain nominalized VP's, the need to postulate such a structural difference has been undermined. Thus, when combined with the scope facts of above, these considerations support the decision to distinguish ACC-ing's and POSS-ing's structurally only by the presence or absence of a POSS morpheme.
3.3.3 Propositional vs. Eventive Gerunds Again

The discussion of §3.2 must be revised somewhat to allow for the difference between POSS-ing and ACC-ing gerunds. According to the ideas of §3.2.3, the gerund in (38) would receive a quantified reading because it would undergo QR onto the S, making it available to serve as the restrictive clause of usually.

(38) Joyce usually dreams about Mary's shouting at her. However, if this were the correct story, there's no reason why (37) could not get a quantified reading as well.

(37) Joyce usually dreams about Mary shouting at her. Instead, the gerund must not QR'd to a position which will let it be quantified over. It must remain somewhere lower than the S, and presupposition accommodation must allow for quantification when the gerund is factive. There are two approaches one could take. First, it may be that these gerunds don't undergo QR at all and that dream (about) is a propositional attitude verb like deny. The other possibility is that the gerund undergoes QR onto the VP, not onto the S. In either case, when the gerund is presupposed--because it is a POSS-ing or the complement of a factive verb--its content may serve as the restrictor of a quantifier through the process at work in (42)-(44).
According to the proposal that the gerunds in (37)-(38) do undergo QR, their LF's are as in (90). If \textit{dream} is to be treated like \textit{deny}, the LF's are the same as the S-structures.

(90)

In either configuration, \textit{usually} must pick up its first argument from context. When the gerund is a POSS-ing, its content must be in the context, so it is possible for \textit{usually} to quantify over situations in the gerund's denotation. When the gerund is an ACC-ing, the possibility is unavailable. (91) gives a new translation rule which gives the adverb of quantification a contextually supplied first argument when none is explicitly provided.
(91) **DYADIC FUNCTIONAL APPLICATION WITH IMPLICIT RESTRICTOR**

with $\Phi$

$$
\Psi
\begin{array}{c}
\omega
\end{array}
\Pi
$$

$\Psi'$ type $<\rho, <\pi, \tau>>$, $\Pi'$ of type $\pi$, $\Phi' = \Psi'(V_\rho)(\Pi')$.

$V_\rho$ is some expression of type $\rho$. In the case of (38), usually's first argument should be $(\text{ing}((\text{shout-at-her})(\text{mary}))))[x_i]$.8

With these changes, the interpretation of factive gerunds works essentially as was discussed in §3.2. While the first argument of an adverb of quantification may contain free variables, these variables can get the same interpretations as were explicitly provided in §3.2.

Before going on, I would like to discuss briefly how the structure in (90) might be interpreted when it contains an ACC-ing. Examples (92) and (93) present the relevant case.

(92) Joyce dreams about Mary shouting at her.
(92) will end up with a LF like (93).

---

8Given the meaning of *usually*, the explicit variable is necessary. This very syntactic treatment of how context supplies the argument could be avoided if we used the fully compositional treatment of adverbs of quantification discussed in Chapter 2.
If one finds the following ideas unsatisfactory, the alternative treatment of *dream (about)* as a propositional attitude verb should be assumed. However, I think that the claim, represented by (93), that *dream (about)* denotes an attitude towards an individual is worthy of pursuing. Unfortunately, at this point I can only sketch a possible approach.

The problem with (93) is, of course, that there need be no actual situation of Mary shouting at her that Joyce dreams about. In order to avoid the unwanted implication that there is, (92) must be true if a merely possible situation of Mary shouting at her is dreamt about by Joyce. Joyce's dream cannot be so specific as to pick out a single possible situation of Mary shouting at her. Thus, we must analyze *dream about* in more detail to see if the LF in (93) can receive an appropriate interpretation. First, let us analyze *dream*, designed to take *that* clause complements, in roughly the following way:
(94) $\alpha$ dreams $p$ denotes $\{s : \text{for all worlds } w \text{ compatible with what } \alpha \text{ dreams in } s, w \in p\}$

To dream is to stand in a relation to some set of worlds, those that give the content of the dream. The intuition I would like to pursue for what dream about means is the following. $\alpha$ dreams about an individual $x$ iff $x$ or a counterpart of $x$ exists in every world compatible with what $\alpha$ dreams.

(95) $\alpha$ dreams about $\beta$ denotes $\{s : \text{for all worlds } w \text{ compatible with what } \alpha \text{ dreams in } s, \beta \text{ or a counterpart of } \beta \text{ exists in } w\}$

(Formally more precise versions of these meanings will be given in §3.5.)

With the meaning for dreams about given in (95), (92) will roughly mean the following:

(96) $\{s : \text{for some possible situation } s' \text{ of Mary shouting at her, for all worlds } w \text{ compatible with what Joyce dreams about in } s, s' \text{ or a counterpart of } s' \text{ exists in } w\}$

(96) says that some situation of Mary shouting at her has a counterpart in every dream-world of Joyce. This is a much weaker requirement than the one we feared earlier, that Joyce's dream had to pick out some particular situation of Mary shouting at her. The dream must simply pick out some class of Mary-

---

9A more sophisticated analysis in the same spirit will be needed to account for discourses like the following:

(i) Joyce dreamed about a cat. She dreamed that it bit her.

The meanings of both dream and dream about are going to have to involve sets of world-assignment pairs, not just worlds, in order to analyze the anaphora in (i). This topic is beyond the scope of this dissertation, but cf. Heim (1991).
shouting situations; these situations are tied together by the fact that they all exist in worlds compatible with the dream and by sufficient similarity to ensure that they are counterparts.

3.4 Internally Quantified Gerunds

In this section I will argue that, if situation are to be used in analyzing the examples above, we must contemplate generic situations, events which are constituted by a repetition of simpler events.\textsuperscript{10,11} This conclusions has been reached by Berman (1988) though consideration of iterated adverbs of quantification. What we will see here is that gerunds which involve internal event quantification show exactly the same range of meanings as those which do not. This will show that generic situations are not merely used in the semantics of sentences, but may be individually referred to by NP's as well. This fact argues strongly that the events NP's can denote are not a separate class of highly concrete situation-like entities, but are actually situations, the items which make up propositions. So consider the following:

\begin{enumerate}
\item[(97)] Always eating cabbage when I had dinner was never fun.
\item[(98)] Eating cabbage whenever I ate corned beef made me very unhappy.
\item[(99)] Always eating cabbage was usually rewarding for me.
\end{enumerate}

\textsuperscript{10}This is something like Montague's (1960) distinction between generic and individual events.

\textsuperscript{11}The arguments in this chapter come largely from Portner (1991a).
(100) Always eating cabbage was not very exciting.
(101) Jaye liked always eating cabbage.
(102) Sarah denied always eating cabbage.

In these examples, internal to the gerund there seems to be quantification over events. In (97), for example, the gerund denotes the set of possible events such that, for each of my eatings of dinner which is a mereological part of this event, I eat cabbage at that dinner. These "generic events" are subsequently quantified over by the adverb never. The type of quantification in (99)-(102) is similar but highly dependent on focus. With focus on cabbage the gerund in (99) seems to denote the set of events e such that all my eating events e' which are part of e are cabbage-eating events. The sentence as a whole then means that most events e such that, whenever I eat in e, I eat cabbage in e, are rewarding. This can be represented semi-formally as in (103).

(103) \[\text{usually} \forall e'((e' \subseteq e \land \exists x(\text{eat}(me,x) \in e')) \rightarrow \text{eat}(me,\text{cabbage}) \in e' \mid \text{rewarding-for-me}(e))\]

In (103) the situations represented by 'e' are in a sense collections of cabbage-eating events. The easiest way of organizing these cabbage-eating events into groups seems to be by time. Thus (99) is easily preceded by

(104) Every winter we always ate CABBAGE.

As we will see, the availability of this kind of reading poses problems for a Davidsonian approach to the semantics of gerunds. A Davidsonian approach says that events come into the semantics for gerunds by way of an implicit event argument of the verb--this event argument is on a par with the subject and other
arguments. The reason for the difficulty is clear: if the Davidsonian event argument of the VP which forms the gerund is bound by a quantifier internal to the gerund (always in (99)), it will not be available for binding by another quantifier (i.e. usually) at the matrix level. Instead, the situation-based semantics will turn out to be more appropriate.

3.4.1 A Categorization of Gerund Meanings

Now I will go through the range of readings gerunds can get in different contexts, showing that each is possible with both simple and internally quantified gerunds. After this categorization we will look at how a Davidsonian semantics and a situation semantics can each give a formal theory of the meanings of gerunds.

In subject position, both internally quantified and simple gerunds can be interpreted as definite, quantified, or event-kind. 

Definite

(105) Eating green beans was not very exciting.
(106) [S [NP PRO eating green beans] | S t1 was not very exciting]]
(107) Always eating GREEN beans was not very exciting.

(105) will receive the Logical Form shown. As we have seen above, the gerund introduces a free variable, the translation of t1, which will be interpreted like a discourse pronoun referring to some contextually salient situation. The sentence will be interpreted as claiming that s was an event of eating green beans and s was not very exciting. Just how (107) is interpreted is
dependent on the focus structure of the gerund. With focus on
*green*, the sentence claims that some particular past situation such
that, whenever I beans in that situation I ate green beans, was
very exciting.

In (108)-(110) there is quantification over the events in the
denotation of the gerund.

**Quantified**

(108) Eating green beans was never exciting.

(109) \[ S \text{ never}_1 \ [NP_1 \text{ PRO eating green beans}] \ [S t_1 \text{ was very exciting}] \]

(110) Always eating GREEN beans was never exciting.

In the LF shown in (109) the adverb of quantification asserts that
nothing which is an event of eating green beans was very exciting.

As the complement of a factive verb, definite and quantified
structures are available for both internally quantified and simple
gerunds.

**Definite**

(111) Lisa didn't enjoy eating green beans.

(112) \[ S \ [NP_1 \text{ PRO eating green beans}] \ [Lisa didn't enjoy e_1] \]

(113) Lisa didn't enjoy always eating GREEN beans.

**Quantified**

(114) Julie never enjoyed eating green beans.

(115) \[ S \text{ never}_1 \ [S Julie \ [VP \ [NP_1 \text{ PRO eating green beans}] \ enjoyed e_1]] \]

(116) Julie never enjoyed always eating GREEN beans.

These get the kind of LF's shown and the same sort of readings as
the subject gerunds.

129
Nonfactive verbs which do not denote a propositional attitude have the reading discussed earlier in §3.4. These can be seen in (117)-(119).

(117) Nick dreamt about eating green beans.
(118) [S Nick [VP [NP PRO eating green beans]
       [VP dreamt about e]]]
(119) Nick dreamt about always eating GREEN beans.

This reading is arrived at because, after QR, the gerunds are interpreted as indefinites.

Other gerund complements of nonfactuals are interpreted propositionally.

(120) Carter avoided eating green beans.
(121) Carter avoided always eating GREEN beans.

These are simply interpreted in their S-structure positions. There is no QR.

From the examples in this section, we can conclude that an adequate semantic theory must be able to accommodate gerunds with internal quantification as well as simple gerunds, and that it should provide them with essentially the same semantics. If it does not postulate the same kind of semantic structure, the fact that the range of readings available for the two classes is identical would go unexplained.

3.4.2 Two Theories of Events

Now we will consider a Davidsonian and a situation semantics approach to the semantics of gerunds. A Davidsonian system claims that events get into the semantic values for
gerunds by way of an extra argument of the verb inside the gerund. Parsons (1990) is a recent advocate of this view.\textsuperscript{12} An intransitive verb like \textit{run} will really be of type \textlangle e, e, s, t \rangle; it is a relation between individuals (runners) and events (runnings). The gerund itself will then be of type \textlangle e, s, t \rangle. It still has an unsaturated event argument. In contrast, as we have seen, the present treatment within situation semantics analyzes gerunds as propositional, of type \textlangle s, t \rangle; however, some of the situations in the proposition can play the role of events.

3.4.2.1 The Davidsonian Theory

Now I will summarize a Davidsonian analysis of gerunds. While a number of details could have been worked out in a different way, I believe that the points crucial to the discussion are not among these. Gerunds will be treated as being of type \textlangle e, t \rangle. The 'e' is the event argument of the verb, so far unsaturated. We should look at a more concrete version of this idea. Consider the following lexicon that we can use to analyze the Logical Forms of a few gerunds:

\begin{itemize}
  \item \textit{run} translates as \textit{run}, which is of type \textlangle e, e, t \rangle
  \item \textit{eat} translates as \textit{eat}, which is of type \textlangle e, e, e, t \rangle
  \item \textit{like} translates as \textit{like}, which is of type \textlangle e, e, e, t \rangle
  \item \textit{-ing} translates as \textit{-ing}, which is of type \textlangle e, t, e, t \rangle
  \item \textit{some} translates as \textit{some}, which is of type \textlangle e, t, e, t, t \rangle
\end{itemize}

\textsuperscript{12}Parsons accepts Vendler's distinction between eventive and propositional meanings for verbal gerunds. While he does not work out a theory of the eventive uses of verbal gerunds, he indicates that it should be virtually identical to his analysis of nominal gerunds.
beans translates as beans, which is of type \(<e,t>\)

PRO\(_i\) translates as \(\text{IP}[P(x_i)]\), which is of type \(<<e,t>,t>\)

Jack translates as \(\text{IP}[P(j)]\), which is of type \(<<e,t>,t>\)

The type \(t\) here is that of propositions, sets of possible worlds. For the LF (122), we will get a translation equivalent to (123).

(122) eating some beans

```
NP
   NP\(_j\)
      PRO
         ING
            VP
               NP\(_k\)
                  DET
                     N
                        SOME
                           BEANS
                           VP
                              NP\(_j\)
                                 V
                                      NP\(_k\)
                                         EAT
```

(123) \(\lambda e[\text{ing(some(beans)}(\lambda x_k[\text{eat}(x_k)(x_j)(e)])])\)

Now consider what happens when a gerund figures in a structure like that in (124).

(124) Jack always likes eating some beans.

(125) \([S \text{always}_1 [\text{NP}_1 \text{PRO eating some beans! Jack likes e}_1] \]

\text{Always} should quantify over events of eating some beans. Thus, (124) will be given the translation (126). (In (126) I give \text{always} the gerund's translation as its first argument. Recall that this officially happens through pragmatic means.):

(126) \(\text{always}_1 [\text{ing(some(beans))}(\lambda x_k[\text{eat}(x_k)(j)(x_1)])])\)

\([\text{like}(j)(x_1)]\)
This denotes the set of worlds in which every entity which is an event of Jack eating some beans is liked by Jack.

Now we can look at a definite, non-quantified gerund. Our rules associate with (127) the translation (128):

(127) Jaye liked reading Bellefleur.

(128) \(\text{ing(read}(B)(\text{Jaye})(x_1)) \& \text{liked}(x_1)(\text{Jaye})(x_2)\)

\(x_2\) is the Davidsonian argument of like. Both free variables are given values from context. It denotes the set of worlds such that \(e_1\) is an event of Jaye reading Bellefleur and \(e_2\) is an event of Jaye liking \(e_1\).

Lastly, propositional attitude verbs combine with their gerunds via functional application, with no movement. The semantics for deny can be analyzed by (129). Ignoring tense, an example is (130).

(129) \(\alpha\) denies \(G\) in \(e = \{w : \text{for all } w' \text{ compatible with what } \alpha \text{ denies in } e \text{ in } w, \text{ there is an } e' \text{ such that } w'e G(e')\}\)

(130) Jaye denies reading Bellefleur.

\(\{w : \text{for all } w' \text{ compatible with what Jaye denies in } e \text{ in } w, \text{ there is an } e' \text{ such that } e' \text{ is an event of Jaye reading Bellefleur in } w'\}\)

(130) denotes the set of worlds \(w\) such that every world \(w'\) compatible with what Jaye denies in \(e\) in \(w\) contains an event of Jaye reading Bellefleur.

Now comes the hard part: what to do about the gerund in (131).

(131) Jack liked always eating some BEANS.
For simplicity, let's only consider the reading with focus on beans, so that intuitively the gerund denotes the set of events in which, whenever Jack eats, he eats some beans.

At first, with this Davidsonian system, one is tempted to derive a structure in which always can quantify over the verb's event argument, yielding a propositional entity. This would mean that the gerund in (131) gets an semantic structure like

\[(132) \ [\text{always} \ [\text{PRO eats something in } e_1] \ [\text{PRO eats beans in } e_1]]\]

However, if we do this, that argument will be bound off and no longer available to provide the semantics for the gerund as a whole. The gerund as a whole is consequently of type t and so the event reference of the gerund in (131) will presumably have to come from the definition of the type t. That is, a situation-based approach to the semantics for gerunds will have to be used for this case.

If this approach is followed, it will also be impossible to provide a uniform semantics for any of the pairs in (105)-(121). In the case of a non-internally quantified gerund, in the ways described above the semantics provides for all the different types of readings for an expression denoting a property of events. With internally quantified gerunds instead, the semantics will have to derive identical readings for propositional phrases. It will have to have near-duplicate systems for adverbial quantification, definite reference for unbound gerunds, and propositional attitude verbs that take gerund objects.
Another possibility is workable—to have always introduce an event argument of its own. The gerund in (131) would then get a meaning like (133).

(133) \( \lambda e'[(\forall e<(e' \& e \text{ is an event of Jack eating something}) \rightarrow e \text{ is an event of Jack eating some beans}]] \)

I am not sure whether a system in which any operator can have an event argument is appropriately called 'Davidsonian'. such a move seems outside the project set by Parsons (1990, p. 8-9), for instance. In any case, the difference between this kind of theory and situations semantics is extremely minor.

3.4.2.2 The Situation Based Theory

We have seen that a Davidsonian approach to the semantics of gerunds either results in an irreducibly mixed theory or ends up being a near notational variant of situation semantics. In this section we will see that within the situation-based theory, the incorporation of internally quantified gerunds goes smoothly (cf. Berman (1988), who makes a similar point for clauses with iterated quantifiers). Let us look at (134).

(134) Always enjoying eating cabbage was pleasant for Sue.

The gerund will get the following translation:

(135) \( \text{always}_1 (\text{eating-cabbage(Sue)}[x_1]) \)

\( (\text{enjoy(Sue)}(x_1)) \)

(135) denotes the set of situations in (136):

(136) \{s : \text{for all } s' \text{ which are situations of Sue eating cabbage, Sue enjoys } s' \text{ in } s \} \)
This is a set of enjoyment situations in which what is enjoyable is every situation of Sue eating cabbage. In order for this to make sense, the quantification should be limited to situations of Sue eating cabbage during the time of s. One enjoyment situation in (136) is what is asserted to be pleasant for Sue by (134).

With an example like (137)

(137) Every winter we ate nothing but cabbage. Sue's seldom enjoying eating cabbage was always strange.

the gerund has the denotation in (138).

(138) \{s : for few s' which is a situation of Sue eating cabbage. Sue enjoys s' in s\}

(138) is a set of minimal enjoyment situations in which Sue enjoys few cabbage-eatings. With the ordinary semantics for quantified gerunds given in §3.2, (137) then asserts that every one of these enjoyment situations was strange.

The goal of this section has been to show how reference to generic events and ordinary events can be unified within a situation-based semantics. Because the situation semantics treats gerunds as propositional, an internally quantified gerund has the same type of meaning as an ordinary, non-internally-quantified gerund. Thus, the same semantic analysis which applies to ordinary gerunds applies to them too. This advantage cannot be met by the Davidsonian theory unless it proposes any operator that can attach to a gerund, in particular an adverb of quantification, itself has a Davidsonian argument. Such a version of the Davidsonian theory appears to be virtually
indistinguishable from the present approach within situation semantics.

Next we will see how the ideas that have been put forth in this chapter can be formalized within the framework of Chapter 2. What we have seen so far, as yet informally, is that the situation semantics framework can give a unified treatment to a large range of semantically quite distinct seeming gerunds. We have looked at the following three parameters of variation among meanings: (i) propositional vs. non-quantified eventive vs. quantified eventive; (ii) POSS-ing vs. ACC-ing; and (iii) internally quantified vs. simple. (i) was attributed to how the gerund is semantically combined with the rest of the sentence, (ii) is based in a presuppositional difference, and (iii) falls out automatically from the rest of the semantics.

3.5 Formalization of the Claims of §§3.2-3.4

I will now show in detail how the following five sentences are to be analyzed within the formal system of Chapter 2.

(18) Mary denied climbing Savoy Mountain.
(139) Mary denied climbing Savoy Mountain and eating the apple.
(140) Joyce regretted Mary’s shouting at her.
(20) Mary always enjoyed climbing Savoy Mountain.
(134) Always enjoying eating cabbage is pleasant for Sue.

(18) represents a propositional gerund, with (139) showing a conjoined version. (140) is a definite non-quantified gerund. (20)
is an example of an externally quantified gerund, while (134) shows an internally quantified gerund.

First we will look at (18).

(18) Mary denied climbing Savoy Mountain.

As discussed above, this gerund is interpreted in place. Therefore it is not necessary to show its LF. The only change we need to make in the translation proposed in (22) is to give the gerund a translation that denotes an individual correlate of a proposition; this will allow it to be compatible with Chierchia's idea, adopted in Chapter 2, that the arguments of verbs are always of type e.

(22') past(deny(Mary)(+ing(climb(Mary)(Savoy Mountain))))

For this chapter I will be assuming that ing has no meaning. Of course this is incorrect, as gerunds are imperfective in the same way as other constructions with ·ing. However, I will delay taking up these matters until Chapter V. I will also ignore the question of whether the gerund in (22) is a POSS-ing or an ACC-ing—i.e. whether it is definite or indefinite. We will see how this contrast is dealt with below. Given these simplifications, translation of the gerund will get the meaning in (141).

(141) +ing(climb(Mary)(Savoy Mountain)) denotes that individual which is the correlate of that function \( f \in D_{<s.t>} \) such that, for any \( s \in S \), \( f(s)=1 \) iff \( s \) is a minimal situation of Mary climbing Savoy Mountain.

Assuming the meaning in (142) for deny, the whole sentence gets the interpretation (143).
(142) denote denotes that function $f \in D_{e,<e,<s,t>>}$ such that, for any $p \in I$ of sort $+<s,t>$, $f(p) =$ that function $h \in D_{e,<e,t>>}$ such that, for any $a \in I$, $h(a) =$ that function $k \in D_{<s,t>}$ such that, for any $s \in S$, $k(s) = 1$ iff for all situations $s'$ which $a$ denies in $s$, $[-p](s) = 1$.

I am using $[-p]$ to indicate the proposition of which $p$ is the correlate. Thus '-' is being used in the metalanguage to indicate the same relation as it does in the logic.

(143) (22) denotes that function $k \in D_{<s,t>}$ such that, for any $s \in S$, $k(s) = 1$ iff for some $s' < s$, $s'$ is past and for all $s''$ which Mary denied in $s'$, $s''$ is a minimal situation of Mary climbing Savoy Mountain.

(143) says that (18) is true if Mary denial has as its content a set of situations which are situations of Mary climbing Savoy Mountain.\(^\text{13}\)

Now we will examine (139).

(139) Mary denied climbing Savoy Mountain and eating the apple.

The translation tree is (144).

\(^{13}\)I am not attempting to capture the de se aspect of the meaning of (18).
Recall that +C denotes the individual correlate of the set of minimal situations of Mary climbing Savoy Mountain and L(+C) denotes the result of lifting this individual to generalized quantifier type. If c is the denotation of +C and e that of +E, the interpretation for the conjoined gerunds (assuming an appropriately type-shifted meaning for conjunction, cf. Partee and Rooth (1983)) is:

(145) that function f e D<<c, s, t>>,<<s, t>> such that for any P e D<<e, s, t>> and any s e S. f(P)(s)=1 iff P(c)(s)=1 and P(e)(s)=1.

Thus, (139) is the set of situations s such that, for some s' < s, s' is past and Mary denied climbing Savoy Mountain in s' and for some s" < s, s" is past and Mary denied eating the apple in s".

The next example to examine is (140).

(140) Joyce regretted Mary’s shouting at her.

(140) will have the translation tree shown in (146).
The interpretation that the sentence will receive with respect to an assignment g is given in (147).

(147) that function f ∈ D<\text{S}, \text{t}> such that, for any s ∈ S, f(s) = 1 iff for some s’ < s, s’ is past and g(x_i) is a minimal situation of Mary shouting at her and s’ is a minimal situation of Joyce regretting g(x_i).

Now we need to concern ourselves with the presupposition of the gerund in (140). The presupposition of a definite NP was stated as follows in Chapter 2:
(148) If $\alpha$ is a [+def] NP$_i$, $[\alpha']^{M,u,C,g,s}$ is only defined if

(i) for all $<g',s'> \in C$, $[\alpha'(x_i)]^{M,u,C,g',s}=1$, and

(ii) $i \in D(C)$.

This formulation is designed for NP's of type $<e,t>$. Our gerunds, however, are of type $<s,t>$. Therefore we need to make the following revision:

(149) If $\alpha$ is a [+def] NP$_i$, $[\alpha']^{M,u,C,g,s}$ is only defined if

(i) if $\alpha'$ is of type $<e,t>$, for all $<g',s'> \in C$, $[\alpha'(x_i)]^{M,u,C,g',s}=1$,

(ii) if $\alpha'$ is of type $<s,t>$, for all $<g',s'> \in C$, $[\alpha'[x_i]^{M,u,C,g',s}(s')=1$, and

(iii) $i \in D(C)$.

The new clause in (149), (ii), merely states what clause (i) does in terms appropriate for a propositional NP. A definite gerund with index $i$ is only felicitous in a context if the context already entails that $x_i$ is a situation in the gerund's denotation.

Given (149), (140) will only be felicitous if every $<g',s'>$ in the context $C$ is such that $\langle$shout-at(y)(M)\rangle[x_i]\langle M,u,C,g',s\rangle(s')=1.

This will be the case if, for all $<g',s'>$ in the context, $g'(x_i)$ is a minimal situation of Mary shouting at her. Therefore the whole sentence presupposes what it should.

The fourth example to consider is an example of a quantified gerund, (20).

(20) Mary always enjoyed climbing Savoy Mountain.

The translation tree for (20) is given in (150).

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The expression 'P[x_i]' of type <s.t.> satisfies the first argument of *usually*. The P must take as its value some proposition salient in the context, and in particular it must be able to take as its value the proposition denoted by the gerund. If P does take this value, (20) has, with respect to an assignment g, the interpretation in (151).
that function \( f \in D_{<s,i>} \) such that for any \( s \in S \), \( f(s) = 1 \) iff for some \( s' < s \), \( s' \) is past and for every \( g' \) differing from \( g \), if at all, in what it assigns \( x_i \), if \( g'(x_i) \) is a minimal situation of Mary climbing Savoy Mountain then \( s' \) is a minimal situation of Mary enjoying \( g'(x_i) \).

(20) will only be felicitous if the context already entails that \( x_i \) is a situation of Mary climbing Savoy Mountain. The decision to treat the gerund in (20) as definite was arbitrary, and the meaning would be the same if it were indefinite. However, then the presupposition would be that the variable \( x_i \) hadn't yet been used.

The last example we will treat is (134), the translation of which is (151).

\[
(134) \quad \text{Always enjoying eating cabbage is pleasant for Sue.}
\]

\[
(151) \quad (\text{always}(P|X_k)|(\text{eat-cabbage}(s) \& \text{enjoy}(s)(X_k)))[x_i] \\
\& \text{pres}(\text{pleasant}(s)(x_i))
\]

Let us assume that the gerund is a subjectless POSS-ing, and so definite. Assuming that \( P \) has the same meaning as \( \text{eat-cabbage}(s) \), the gerund will have the denotation given in (154):

\[
(154) \quad (\text{always}(P|X_k)|(\text{eat-cabbage}(s) \& \text{enjoy}(s)(X_k)))
\]

denotes that function \( f \in D_{<s,i>} \) such that for any \( s \in S \), \( f(s) = 1 \) iff for all \( s' \) which are minimal situations of Sue eating cabbage, \( s \) is a minimal situation of Sue enjoying \( s' \).

Let us call this function AEC. (134)'s meaning, with respect to an assignment \( g \), is then:
that function $f \in D < s, t >$ such that for any $s \in S$, $f(s) = 1$ iff for some $s' < s$, $s'$ is present and $AEC(g(x_i)) = 1$ and $s'$ is a minimal situation of Sue enjoying $g(x_i)$.

(134) will only be felicitous if every $< g', s' >$ in the context is such that $g'(x_i)$ is a situation $s''$ such that $AEC(s'') = 1$. This will be the case if $x_i$ has already been used to pick out a situation in which Sue always enjoys eating cabbage.

This concludes the formal discussion of the ideas put forward in this chapter. We have examined each of the main types of example and seen that they all can be analyzed within the framework of Chapter 2.
4.1 Introduction

In this chapter we will examine some issues in the semantics of English infinitives and subjunctives. Both of these clause types can be divided into several subclasses. The first distinction among infinitives is between to infinitives and bare infinitives; Davidsonian theories of bare infinitives (Barwise (1981), Higginbotham (1983), Vlach (1983), Parsons (1990)) fit into the present framework quite well, and will be discussed in §4.2.2.7. Among to infinitives, there is, as discussed by Bresnan (1972), a division into what we can call the for infinitives and the for less infinitives. According to Bresnan, for infinitives have a unique semantics, the precise nature of which I will attempt to elucidate below. It can loosely be described as 'unreal' or 'future'. Examples are in (1) below. In contrast, for-less infinitives generally alternate with indicative that clauses, and, if Bresnan is right, do not display a meaning difference from them (with the possible exception of whatever is entailed by the lack of tense in infinitives). According to intuitive semantic criteria, (2a) is a for-less infinitive.

(1a) I would like for Mary to come.
(1b) I would like to come.
(2a) I believe him to be crazy.
(2b) I believe that he is crazy.
If we assume for a moment that there really are two distinct categories of infinitives, *for* infinitives and *for*-less infinitives, we can conclude that not every *for* infinitive actually begins with a *for*. Rather, they are generally in a context--in (1b), the complement of *like*--in which *for* is in other cases possible, and they have the 'unreal' semantics. The complement of *believe*, in contrast, can never begin with *for*. However, this structural criterion of whether or not *for* can ever occur in a particular context does not work in general. Based on meaning, intuitively it would seem that the infinitive in (3) is a *for* infinitive, even though there is no case in which *start* embeds an infinitive with *for*.

(3) Robert started to write.\(^1\)

In what follows I will support the claim that this division of infinitives into two varieties is semantically right; I will do this by arguing that *for* makes a consistent semantic contribution to phrases in which it occurs, and that this contribution entails that certain sentence-embedding verbs will not be able to occur with *for* infinitives (§4.3.1). Such a view is distinct from one that claims that all infinitives have the same type of meaning, but that infinitives which begin with *for* happen to show up in a particular kind of semantic context. The proponent of this view could say that the nature of this context makes it appear that *for* infinitives

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\(^1\)F.R. Higgins points out related forms like
Robert started for Paris.
This type of meaning of the preposition *for* is the one on which the complementizer is based. This suggests that the complement of *start* receives the kind of 'goal' role with which we might expect a *for* infinitive.
have a unique meaning. This purely 'contextualist' position will be undermined by the contribution that the unique semantics of for infinitives makes to the explanation of a variety of facts in §§4.2-4.3. In this chapter therefore, as I discuss the semantics of infinitives, I will, unless otherwise noted, be referring in particular to the semantics of for infinitives, and when something is said about the interpretation of indicative clauses, by way of contrast, it presumably applies to for less infinitives as well.

The other main topic of this chapter is the subjunctive. The infinitive and subjunctive are discussed together because the two occur in many of the same constructions. For example, the verbs wish and desire can take infinitive complements, and each can take a subjunctive complement as well. (The two take different kinds of subjunctives, however.) Another case that we will discuss is conditionals with would or might. Both infinitives and subjunctives can occur as the antecedent of such a conditional. However, replacing an infinitive with a subjunctive in a sentence, or vice versa, does not in general preserve the sentence's meaning. We will use the resulting contrasts extensively to try to understand the semantics and pragmatics of the two clause types.

The English subjunctive is a mere shadow of the subjunctive of other languages, many of its functions having been taken over by infinitives and modal clauses. Furthermore, there are major differences between British and American English; the use of the

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2 We will see examples of this shortly—cf. (15)-(16).
3 Quirk et al. (1985). Perhaps certain British English modal clauses with should should simply be considered an alternative form for what is semantically a subjunctive. That is, some 'modals' are really mood markers.
subjunctive is much more widespread in the latter, and it is this dialect that I will be investigating here. The three main descriptive categories of subjunctives are the mandative subjunctive, the optative subjunctive, and the counterfactual subjunctive (Quirk et al. (1985); 'counterfactual subjunctive' is my term). These three types are shown in (4)-(6) respectively.

(4) I demand that you be there.
(5) Long live the King!
(6) I wish that he were here.

Both the mandative and optative are morphologically (bare) infinitives, while the counterfactual subjunctive is morphologically identical to the past tense, except in the case of singular *were*, as in (6).

The optative subjunctive, which cannot be embedded, is quite marginal in contemporary English, though we will look at it briefly in §4.2.1, along with the also marginal unembedded infinitives, to look for evidence concerning the core meaning of these constructions. The mandative subjunctive is a late-nineteenth century innovation in American English, and is apparently a reinterpretation and radical extension of an archaic use of the optative (F.R. Higgins (p.c.)). I don't believe that these three types of subjunctive are unifiable synchronically either; rather, a variety of facts discussed in §4.2.1 and §4.3.2 points to

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This view is also supported by sentences like (i), pointed out to me by F.R. Higgins (p.c.):

(i) It is possible that he may come.

In past sequence-of-tense contexts, the subjunctive will look like a past perfect.
the need to postulate distinct meanings for the mandative and the counterfactual subjunctive. Given the limited distribution and naturalness of the optative subjunctive, it is less clear whether it should be considered distinct from the mandative. I will claim that the two are one and the same.

A topic related to that of the counterfactual subjunctive is the phenomenon of backshifted tenses. It is possible to indicate that a proposition is contrary to fact or expectation either with a subjunctive or simply by shifting its tense one step into the past from the 'natural' value. Consider the following:

(7) If he is here now, I am going to leave.
(8) If he was here now, I would have to leave.
(9) If he were here now, I would have to leave.

For purposes of discussion, we can consider backshifted tenses to merely be an alternative, though stylistically distinct, realization of the counterfactual subjunctive. There is more discussion of the morphological forms of different kinds of subjunctives in §4.2.1 below.

The goal of this chapter will be to explain, by means of their truth-conditional and presuppositional content, the constructions in which infinitives and subjunctives can occur. This approach is in contrast with one that considers these forms to be syntactically conditioned by certain contexts. While I would not deny that the choice of infinitive, subjunctive, or indicative is grammaticized in certain cases, in many of those to be considered below I think that the choice of form can be seen as following from semantic considerations. I will claim that subcategorization or selectional
restrictions have been imposed to rule out combinations that, on purely language-internal grounds, would not make sense in certain ways. We need to impose syntactic restrictions because simple incoherence is not in general a sufficient reason for a sentence to be ungrammatical. However, because of the highly predictable contribution that infinitives and subjunctives make towards the meaning of sentences they occur in, the proposed semantics for them must continue to be alive. The explanation of the distribution of these forms is thus partly diachronic and partly synchronic.

In attempting to understand the semantics of infinitives and subjunctives, we will undertake a detailed exploration of two paradigms in §§4.3-4.4 below. First, the subtle differences in meaning among hope, wish, want, and desire are reflected in their compatibility with infinitives, indicatives, and different types of subjunctives. Hope can either take an infinitive or an indicative, but neither a counterfactual nor a mandative subjunctive:

(10a) They hope for him to be here.
(10b) They hope that he is here.
(10c) *They hope that he were here.
(10d) *They hope that he be here.

Wish is compatible with either an infinitive or a counterfactual subjunctive:

(11a) They wish for him to be here.
(11b) *They wish that he is here.
(11c) They wish that he were here.
(11d) *They wish that he be here.
Want is compatible with an infinitive only:

(12a) They want for him to be here. 
(12b) *They want that he is here. 
(12c) *They want that he were here. 
(12d) *They want that he be here.

Lastly, desire takes either an infinitive or, marginally, a mandative subjunctive:

(13a) They desire for him to be here. 
(13b) *They desire that he is here. 
(13c) *They desire that he were here. 
(13d) ?They desire that he be here.

The judgments given appear to represent the majority dialect of American English, and the explanation of these paradigms in §4.3.2 relies on the meanings of the attitude verbs in that dialect. The following informal characterization of the pattern in (10)-(13) indicates what the relevant aspects of those meanings are: Intuitively, hopes are incompatible with what is already certain to be unattainable, which is why hope cannot take a counterfactual subjunctive. Wishes intuitively can't be for states of affairs that are already believed to be factual, which is why wish cannot take an indicative. Wishes may be for propositions the wisher believes to be false, however. Wants and desires must

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5Many people find examples in which for immediately follows want to be odd. Thus (12a) should be expressed as (i).

(i) They want him to be here.

For is obligatory, however, when there is intervening material:

(ii) They want very much for him to be here.

Because I am pursuing that idea that a for infinitive has a special semantics, whether or not for is present in the surface string, for clarity's sake I will continue to give the examples with explicit for.

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be in the realm of propositions that are believed to be non-factual, yet not counterfactual, which is why want and desire cannot take either indicatives or counterfactual subjunctives. In other words, to want or desire something you must believe that whether it will come about is still up in the air. The contrast between want and desire is due to the fact that desire is able to have an element of commanding to its meaning that want lacks. It is this element which allows the mandative subjunctive. Note the contrast between (13d) and (14), in which there is no possibility of bringing about the desire through command:

(14) ??They desire that the moon be round.

The differences of allowable complement types among these four verbs clearly has to do with their meanings, and so a non-semantic theory of the distribution of clause types will miss something.6

The other set of phenomena that will be investigated in some detail is the use of infinitives and subjunctives in so-called counterfactual conditionals. The counterfactual subjunctive is used in if clauses, as in (15).

(15) If Bill were here with me, I would smile.

Infinitives in subject position or related to an expletive subject can also function as antecedents of counterfactuals.

(16a) For Bill to have won would have been great.

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6The question of what cross-linguistic facts to take into consideration here is quite tricky. If the word which best translates wish, say, in a given language allows a different set of complements clause types than English, it could either be due to a difference between the semantics of mood/finiteness in the two languages or show that there is a subtle meaning difference between the two verbs.
(16b) It would have been great for Bill to have won.
The infinitive in (16a)-(16b) functions as the first argument of would, much as, according to the Kamp/Heim analysis, an indefinite subject can serve as the first argument of an adverb of quantification.

(16c) A farmer who owns a donkey always beats it.

Analyzing (16a-b) will entail giving an analysis of (17), with which they are virtually synonymous, as well.

(17) If Bill were to have won, it would have been great.

This will require understanding the semantics of this it, which seems to stand in for that Bill won. The analysis will predict that it does mean that Bill won, rather than if Bill were to win, despite the fact that the latter is the actual antecedent. Finally, there is the presence of examples like (18)

(18a) For Bill to win would be great.

(18b) If Bill were to win, it would be great.

which do not seem to be counterfactual--despite the presence of the generally counterfactual would--though Bill winning must be contrary to expectation. The group of examples discussed in this paragraph, to be taken up again in §4.4, indicates that the contrast between infinitives and counterfactual subjunctives must all but collapse in the presence of would (or might). This will be argued

7Jespersen (1932. IV) calls these constructions 'imaginative'; describing a range of interpretation of which counterfactuality is only one extreme. In the philosophical literature there has been extensive criticism of the idea that subjunctive conditionals are truly counterfactual: e.g. Chisholm (1946), Anderson (1951), Burks (1951), Adams (1975). Lakoff (1970) suggests that subjunctive antecedents of conditionals are presupposed to be false. Karttunen and Peters (1979) attempt to refute this claim, but in §3 below I will defend it.
to be due to the fact—indicated by the availability of an infinitive in all of (10)-(13)—that infinitives have a quite general meaning of which the varieties of subjunctive are special cases.

4.2 A Brief Survey of Uses of Infinitives and Subjunctives

Both the infinitive and the subjunctive are used to express uncertain propositions, i.e. possibilities. Of course there are many different kinds of possibilities, and one of the main ideas I wish to argue for in this section is the following: While the infinitive is indeterminate as to the type of modality it expresses, the subjunctive is polysemous. While an infinitive denotes a proposition that is roughly 'a set of alternatives of some kind to the reference situation', where what kind may be constrained by context, or left vague, a subjunctive denotes 'a set of desirable alternatives to the reference situation', or 'a set of demand-alternatives to the reference situation', or 'a set of counterfactual-alternatives to the reference situation.' (These meanings would be specific to English, and in languages in which the subjunctive has a wider range of application its interpretation would presumably be unified and more general.) In this section I will survey some of the range of constructions in which infinitives

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8 Huettner (1989), in discussion of infinitival adjuncts, says that their inherent meaning is 'neutral', and that the specific meaning a given infinitive has derives from context. On this she differs from Faraci (1974), Bach (1982), and Jones (1985). However, her discussion does not relate to the type of modality of the infinitive, but only to its relation to NP's in the higher clause.
and subjunctives can occur. This will allow us to see some initial motivation for the meanings I propose. 9

Here is a slightly more specific, though still only semiformal, characterization of the interpretations I would like to defend for English infinitives and subjunctives. A compositional version will be presented in §4.5 of this chapter, using the type of system presented in Chapter 2. I am going to argue that infinitives denote sets of situations which begin with duplicate-counterparts of the reference situation and then "grow into" situations in which the subject of the infinitive has the property denoted by the VP. Two situations are duplicate-counterpart iff they are both duplicates and counterparts according to a counterpart relation that stresses similarity of origins and historical role. The two situations are duplicates if they are qualitatively identical—they share all natural, intrinsic properties (Lewis (1986a)). They are the right kind of counterparts if they are situated in their worlds quite similarly to each other. As Lewis discusses, in general the counterpart relation may stress a variety of factors: qualitative similarity, sameness of origins, and historical role among them. Thus, formally, 'is a duplicate-counterpart of' is a second, extra-strict, counterpart relation. Even if two situations are intrinsically identical, they may fail to be duplicate-counterparts because of other facts about the worlds they exist in. So, imagine two worlds w₁ and w₂ just like each other except in the following respects:

9In trying to list the various uses of infinitives and subjunctives, I have made extensive use of Quirk et al. (1985).
s₁: At 10:36 a.m. on 1/17/90 in w₁ Jill trips, stumbles, and falls.

s₂: At 10:36 a.m. on 1/17/90 in w₂ (the counterpart of) Jill trips and stumbles, but doesn't fall.

s₃: At 11:17 a.m. on 9/19/91 in w₁ Jill trips and stumbles, but does not fall.

s₄: At 11:17 a.m. on 9/19/91 in w₂ (the counterpart of) Jill trips, stumbles, and falls in just the way Jill did in s₁.

According to the looser notion of counterpart that I've been assuming up until now, s₁ and s₂ are counterparts, as are s₃ and s₄. In most cases, one doesn't have such strict requirements of qualitative similarity on the counterpart relation to make s₄ a better match than s₂; so, on the basis of situations like s₂, it could be true in s₁ that Jill might have tripped and stumbled without falling. However, s₁ has no duplicate-counterpart in w₂; s₂ is not anywhere close to being qualitatively identical to it, though it is its counterpart, and s₄ is not its counterpart, though it is qualitatively identical.

With this notion of 'duplicate-counterpart', the meaning of an infinitive that I will argue for can be stated as follows:
In all of the definitions of (19)-(20), s is the reference situation (generally, the situation associated with the embedding verb or other operator). Clearly, these meanings will have to be relativized in some way, so that the reference situation is identified with the right situation in the context—this task will be taken up in §4.3.2. s' is a counterfactual alternative of s iff s and s' are incompatible (i.e. no world\textsuperscript{10} contains both a duplicate-counterpart of s and a duplicate-counterpart of s').

Subjunctives denote one of three closely related propositions:

\begin{itemize}
\item It is impossible for her to win.
\item It is impossible for her to win.
\item It is impossible for her to win.
\end{itemize}

\textsuperscript{10}This may be contextually restricted: no world in some contextually specified set or worlds, such as those compatible with the context or with what some individual believes. This possibility of contextual restriction is why it is possible to have.

The complement presupposes that her winning is possible in a different sense from that denied by the sentence as a whole. For example, it is perhaps possible, given everything the hearer knows, that she will win, but impossible given everything the speaker knows.
(20) \[\text{that } S_{(+\text{subj})} =\]

(a) \(\{s' : S \text{ is true in } s'\}\)

presupposition: for all \(s' \in \text{[that } S_{(+\text{subj})}\}, s' \text{ is a counterfactual alternative of } s.\)

(b) \(\{s' : s' \text{ is part of what is ordered in } s \text{ and } S \text{ is true in } s'\}\)

(c) \(\{s' : s' \text{ is part of what ought to be in } s \text{ and } S \text{ is true in } s'\}\)

It will be argued below that (20b) and (20c) are really subcases of a single meaning: a very general notion of obligation, incorporating the senses 'ought to do' and 'ought to be', is involved. The reasons for having the presuppositions suggested in (19) and (20a) will become clear in §§4.3-4.4. With infinitives, the meaning (19) insures that any situation \(s'\) in the denotation of the infinitive starts off exactly like the reference situation \(s\). In contrast, with subjunctives, the alternatives may be quite unlike \(s\) from the very beginning. Another point is that the presupposition of (20a) seems to be clearly too strong, as seen by (18b), in that it claims that a counterfactual subjunctive is presupposed to be false; however, until we are ready to consider (18b) in more detail in §4.4, we will assume that this use of the subjunctive involves counterfactuality, and not some weaker condition such as unlikelihood. All of these meanings will be elaborated on further, and changed somewhat, in §§4.3-4.4.
4.2.1 Subjunctives

A main claim to defend with respect to the subjunctive is the idea that it is genuinely polysemous. One reason for believing that English subjunctives are not vague as to their modality is the fact that they are ruled out in certain circumstances (cf. (10)-(13)), apparently for semantic reasons. In contrast, the infinitive seems able to fit its meaning to a great variety of contexts. Another reason is the observation that a particular subjunctive form never seems to have multiple interpretations. So, a counterfactual subjunctive has its characteristic form ((21a)), an embedded subjunctive that is morphologically a bare infinitive must be mandative ((21b)), and an unembedded bare infinitive subjunctive must be optative ((21c)).

(21a) I wish he were here.
(21b) I ask that he be here.
(21c) So be it!

I claim that the subjunctive clause of (21a) has the interpretation of (20a); that in (21b) has that of (20b), and (21c) that of (20c). I will argue shortly that (21b) and (21c) should be considered subcases of a single meaning. Initial support for this idea arises from the following considerations: One problem for the claim that an unembedded bare infinitive subjunctive is always optative concerns the status of imperatives. As a verbal form morphologically identical to subjunctives, they have a meaning closely related to the mandative subjunctive. If imperatives are to be considered a type of mandative subjunctive, there are a few
cases, such as (22), that are ambiguous between a mandative and an optative reading:

(22) Let him walk home!

However, there are some factors that can disambiguate. For example, the presence or absence of an intonation break can disambiguate: (23a) is imperative, while (23b) is optative.

(23a) Lord, I help us! ( I = intonation break)

(23b) Lord (*I) help us!

Additionally, the presence of a second person reflexive forces an imperative interpretation:

(23c) Lord, *(I) help yourself!

These facts suggest a syntactic difference in the status of the subjects of imperatives and optative subjunctives. Perhaps the disambiguating factor is simply whether there is a special null second person pronoun in subject position. If the difference can be tied to such a single, isolatable fact about the syntactic context, the case for postulating distinct meanings will be undermined. It will be better to tie the meaning contrast to the explicit difference in form rather than to a postulated invisible difference.

One might worry that there is a single semantics for subjunctives that can incorporate the counterfactual subjunctive too, with particular contexts drawing out different aspects of that meaning. There is a strong morphosyntactic argument that mandative and counterfactual subjunctives are really different types of entities. Counterfactual subjunctives are subject to sequence of tense rules, while mandatives apparently are not.

(24a) I wish he were here.
(24b) I wished that he had been here.
(24c) I demand that he be there.
(24d) I demanded that he be there.

While the complement in (24b) is shifted, that in (24d) is not. This indicates that the two are really different categories.

Now I would like to return to the claim that the optative and mandative subjunctive are one and the same. The two share the general idea of 'desirability'. As pointed out by B. Partee (p.c.), an optative subjunctive has the sense of 'This ought to be', while a mandative has a meaning like 'X ought to do this'. I would like to claim that the morphologically bare infinitive subjunctive can be analyzed as having the same ambiguity as ought. Though the optative meaning never seems to be brought out by an embedding verb, it clearly shows up with adjectives like necessary or desirable.

(25a) It is necessary that this child be healthy.
(25b) It is desirable that Mary come to my party.

These cases do not show sequence of tense shifts either:

(25c) It was necessary that this child be healthy.

All indications are that the subjunctives in (25) are the same as the mandative subjunctive, while notionally they are 'optative', and so I propose that (20a) and (20b+c) are the two subjunctive meanings in English:

(20b+c): \[s' : s \text{ is a situation in which something is obliged and } S \text{ is true in } s']\]

Ignoring tense, (25c) then denotes the set of situations s such that all s' obliged in s are such that this child is healthy in s'. In
unembedded position, the meaning (20b+c) can come out either as an imperative or an optative; when embedded it displays a range of meanings in the semantic field 'ought to do or be'.

4.2.2 Infinitives

In this section I hope to indicate how a variety of the constructions in which the English infinitive is used are compatible with it having the meaning of (19). According to this interpretation, though infinitives frequently are found in modal contexts, their meaning does not limit the type of modality they are compatible with. They are propositions that are generally used in expressions of necessity or possibility but are vague as to what type of modality is involved--in this way they differ from subjunctives, which are restricted to contexts that are compatible with their intrinsic meanings of counterfactuality or obligingness. This indeterminacy of infinitives is suggested by two sources.

First is the fact, seen in (10)-(13), that infinitives can be the complements of verbs that express a variety of propositional attitudes. Of course finite clauses also can be used with a variety of different attitude verbs (though different ones from infinitives), and they do not need to have these notions of 'duplicate-counterpart' and 'growing into a situation...'.

This is why a brief look at the variety of constructions infinitives can occur in is in order. It will be seen that several of these constructions involve necessity in a way that seems to call for the use of the traditional modal logic concept of alternative. Nonetheless, an infinitive is not a straightforward necessity
statement, as is clear from the fact that (26a) is not synonymous with (26b).

(26a) I hope for her to come.

(26b) I hope that she must/should/would come.\(^\text{11}\)

Furthermore, the difference between (26a) and (26b) is not simply that infinitives make a kind of necessity statement different from all the possibilities of (26b), since (26a) does not express a hope that something be necessary (in any sense), but just that it be true.

The second reason to think that infinitives are vague is that some sentences containing them can themselves be vague; they may communicate necessity in view of desires, natural law, orders from above, etc. Examples will be seen just below. These facts suggest too that unlike subjunctives infinitives do not carry any particular type of modality in their meaning.

Another point that this section will hopefully support is the claim in (19) that infinitives are future-oriented. In particular, they denote situations which start off with duplicate-counterparts of the reference situation, a kind of spatiotemporal origin coordinates, and grow into situations in which the proposition is satisfied. This aspect of their meaning has two other consequences as well: First, unlike subjunctives, the situations in an infinitive's denotation cannot have as their initial segment a counterfactual situation. In other words, these situations must at

\(^{11}\)Again, in British English in particular, there are examples of should or other modals which seem to mark subjunctiveness.
least start off factual, though of course in a sentence like (27) they may develop into nonfactual situations.

(27) Mary wanted to be a professor.

The second immediate consequences of this meaning for (for) infinitives is that it allows an account of why verbs like believe and claim are incompatible with them: These verbs denote attitudes which can only be held towards sets of situations that include whole possible worlds, and infinitives do not denote such sets. I come back to this point in §4.3.1.

For the rest of this section I will be pointing out how a variety of constructions with the infinitive can make use of the interpretation suggested above. Clearly the discussion is not intended to be definitive; rather, I hope that, in addition to supporting future-orientation and vagueness of modality, it will become more plausible to think that the meaning proposed for infinitives is not limited to the constructions discussed in more detail in §4.3.

4.2.2.1 Unembedded Infinitives

First we will look at unembedded infinitives. This clause type is marginal in modern English, but it does provide some suggestive data. The use of an unembedded infinitive can express a variety of subjective attitudes toward the proposition. For instance, in (28a), the speaker expresses regret; in (28b), a wish.

(28a) After all that's happened, to have in the end been left by her!
(28b) Oh to some day meet her!
According to the present theory, assuming that in these cases the reference situation is taken to be the utterance situation, in (28a) the proposition expressed by the infinitive is roughly the following:

\[(29) \{s : s \text{ has as its initial segment a duplicate-counterpart of the utterance situation and I have been left by her in } s\}\]

This denotes a set of situations that begin with the utterance situation and later include me having been left by her. From context we limit the situations to those that are regretted. (Let us assume that all situations in which I have been left by her are regretted by me.) Regretted situations happen to have to be actual, so (29) implies that the utterance situation is part of a regretted situation in which I have been left by her.\(^{12,13}\) Note the use of the perfect. Though I was left by her in the past, it is true in the present and the future that I have been left by her. Therefore, this case does not cause problems for future orientation.

Example (28b) is somewhat different. First of all, in this case the future orientation of infinitives is crucial. Its meaning is (30):

\(^{12}\)This contextual limiting of the alternatives to those meeting some further criterion seems to be limited to the unembedded, exclamatory infinitives and the \(be+\) infinitive construction discussed in the next subsection.

\(^{13}\)I need not assume that every situation which follows a situation in which I am left by her is one in which I have been left by her, only that there are some in which I have that follows the utterance situation. We might want every situation which satisfies a perfect to be a state, for example.
Here the alternatives are hoped-for alternatives. By uttering (30) a speaker is essentially conveying that there are hoped-for situations that 'grow out of' the utterance situation and in which I have met her. Though (30) is a proposition, its use is not to say that any of those situations are actual--doing that is the function of a finite clause. Instead, a claim about the psychological state of the speaker in the real world is communicated indirectly, by simply displaying some hoped-for alternatives.

It is not an accident that unembedded for infinitives cannot be used in the way of a finite clause, to make a simple assertion. The impossibility actually follows from the proposed semantics. Consider what would happen if (28b) were used assertively, to try to say (roughly) that I will meet her. As discussed in Chapter 2, when a sentence $S$ is accepted into a conversation, the context $C$ is intersected with the set of assignment-situation pairs with respect to which $S$ is true. In the case of (28b), let us assume that the presupposition of $her$ is met by $C$, and so that the assignment part of each pair in $C$ is irrelevant. The situation part is not irrelevant, however; the context $C'$ which result from updating $C$ for (28b) will be the set of pairs $<g,s>$ such that $<g,s>\in D$ and $s$ is in (30). That is, each such $s$ must have as its initial segment a duplicate-counterpart of the utterance situation and grow into a situation in which I meet her. It must also be a situation in which everything that has been accepted so far is also true. In any remotely reasonable context, there will be no such situations. Every context
should entail propositions about the past, like that the sun is in
the sky, that the speaker and hearer existed the day before, and
so forth. None of the propositions contain a situation in (30), since
all the situations in (30) begin at the time of utterance. Therefore,
if C were updated for (28b), the context would become null; as a
result, the conversation would die. The root of the problem is that
(30) is a set of situations too small to make true all the other
propositions which should be in the context. A tensed clause, in
contrast, will be very suitable for updating the context. Since a
tensed clause is persistent, its denotation contains whole worlds,
and such large situations can support the truth of many different
propositions. This contrast between tensed clauses and infinitives
is very important, and we will come back to it in §4.3.

4.2.2.2 Be + Infinitive

The second construction I wish to look at is seen in (31)-(32).

(31) John is to come tomorrow.

(32) John is to be consulted on all important decisions.

Be + infinitive can either be a type of future or a type of deontic
necessity statement. (31) is not like an ordinary future, however,
in that it allows that, if circumstances change sufficiently, John
won't necessarily come. It is therefore better considered a
relative necessity statement than a pure future. We can interpret
(31) as in (33):
(33) \[ s : \text{in all worlds } w \text{ compatible with what is necessary in } s, \text{ there is an } s' \prec w \text{ such that } s' \text{ has as its initial segment a duplicate-counterpart of } s \text{ and John comes in a portion of } s' \text{ that is tomorrow} \]

The embedded proposition in (33) is the infinitive's meaning. (32) will be similar, since 'necessary' can either denote deontic or predictive necessity. This construction shows that, though infinitives are not straightforward necessity statements, their denoting a set of alternative extensions of the reference situation lets them easily figure in such statements.

4.2.2.3 Cost Infinitives (Tough Predicates)

Next we will look at cost-infinitives. Infinitives involved in tough-movement constructions all seem to involve the idea of a cost for one who tries to bring about the state of affairs denoted by the infinitive (Nanni (1977)).

(34) Alison was tough to please.

It was tough to please Alison.

On one reading, these examples claim that, on some particular occasion, it took a lot out of one who pleased Alison. The infinitive \( x \text{ to please Alison} \) denotes the following:

(35) \[ s' : s' \text{ has as its initial segment a duplicate-counterpart of } s \text{ and } x \text{ pleases Alison in } s' \]

This meaning is appropriate for tough predicates because the situations \( s' \) all stretch from the reference situation \( s \) (the situation associated with the predicate tough) up through the eventual pleasing of Alison. All the struggles and pain involved in
pleasing Alison are contained in the middle. Letting (35) be 'p', (34) is interpreted as

\[(36) \{s : \text{for some actual situation } s' \text{ in } p, \text{ there was a large amount of cost in } s \text{ for } x \text{ in bringing about } s'\}\]

There is also a stative reading of (34). According to it, Alison had the property of being, in general, tough to please. One possibility for analyzing this meaning is to derive it from the nonstative interpretation by means of a VP-level generic operator (Carlson (1977)).

Next we will look at some of the types of verbs that embed infinitive objects. Obviously no complete categorization, much less analysis, is possible here. Hopefully the next two sections can serve as an illustration of how one can approach the lexical semantics of verbs that embed infinitives. §4.3.2 will provide a more detailed discussion of some verbs of desiring.

4.2.2.4 A Brief Study of *Hate*

As we have seen in Chapter 3, due to their behavior with gerunds, verbs like *hate*, *love*, and *enjoy* appear to select events as their first arguments. With this in mind, let us try to understand the contrast in (37)-(38).

(37) ?I hated to go to the party (but I went anyway).

(38) I hated going to the party.

The only reading of (37) concerns the situation just before I went to the party, and claims that I hated the inevitable extension of that situation, which is one in which I attend the party. In other words, the hating situation is just before the party, and the hated
situation is an extension of that situation into one in which I go to
the party. This future orientation of the meaning of (37) is made
more clear by (39).

(39a) I hate to tell you this, but I saw Jack coming out of the
motel with Mabel Davidson. He must be having an
affair.

(39b) I saw Jack coming out of the motel with Mabel
Davidson. He must be having an affair. I hate to tell
you this.

(39b) is much more acceptable if the story goes on. This contrasts
with (40), with a gerund.

(40) I saw Jack coming out of the motel with Mabel
Davidson. He must be having an affair. I hate telling
you this.

According to the present theory, one can conclude that (39b) is
odd because the reference situation—the hating situation—cannot
develop into one in which I tell you this, since I have already told
you.

(39b) is also acceptable if I hate to tell you this. is taken as
a generic statement, as if I tell you again and again. Freed (1979),
in discussing the complements of aspectual verbs, argues that
infinitives always denote generic propositions. Though it is
unclear whether the infinitive, as opposed to the whole sentence,
is generic in (39b), and while examples like (39a) seem to refute

14 Note that (39b) is better if the last sentence is replaced with I hate to
have told you this. This is to be expected, since, even after the time of
utterance, I have told you this. Thus the hating situation can be extended
into the future until it contains a 'I have told you this' situation.
her idea as a general claim, it is true that infinitives often do figure in generics of this kind. However, in a case like (39b) this actually supports the claim that infinitives are future oriented. By making the statement generic, the time of hating no longer need be the utterance time, but is instead taken from the contextually supplied set 'whenever I (am about to) tell you that Jack must be having an affair'. This set supplies reference situations, which are universally quantified over, yielding 'whenever I (am about to) tell you that Jack must be having an affair, I hate to tell it to you.' Given these reference situations, the future orientation of the infinitive again makes sense.

An analysis of (37) is as follows. The infinitive denotes a set of extensions of the reference (hating) situation, each of which includes me going to the party in the future. The infinitive is interpreted like an indefinite NP, restricting a situation variable which is the object of hate at Logical Form. To hate a situation implies that it is actual, which is why the gerund is not 'unreal' in (37), though it is future. The sentence therefore means that, for some actual past situation s, there is an actual situation s' which includes (as its initial segment) s as well as a later situation of me going to the party, and s is a situation of me hating s'.

The situation is of course different with gerunds. The gerund in (38) only denotes a minimal situation of me going to the party. If we assume that any situation in which x hates some s' must temporally overlap that s', (38) requires that I hate going to the party while going to the party. Though the assumption needs
further consideration (which it will receive in Chapter 5), this requirement seems correct.

4.2.2.5 A Brief Study of *Ask*

*Ask* (for) can embed ordinary NP's, infinitives, and mandative subjunctives:

(41) I asked for a cat.
(42) I asked for her to come.
(43) I asked that she come.

(42)-(43) have essentially the same meaning, namely that I have made a request that can be satisfied only by there being an actual event of her coming. ((41) has a related meaning--I have made a request that can only be satisfied by the receipt of a cat.)

(44) \( \forall x \) asks for \( p \) = \( \{ s : \forall w \) \text{what I ask for in } s \text{ is satisfied in } w \rightarrow \exists s' \) \( s \in p \& s' < w \} \)

Thus (43) will have the meaning of (45).\(^\text{15}\)

(45) \( \{ s : \forall w \) \text{what I ask for in } s \text{ is satisfied in } w \rightarrow \exists s' \) \( s \text{ is a situation in which something is obliged } \& \text{ she comes in } s' \& s' < w \} \)

(42) has the slightly different meaning (46):

(46) \( \{ s : \forall w \) \text{what I ask for in } s \text{ is satisfied in } w \rightarrow \exists s' \) \( s' \text{ has as its initial segment a duplicate-counterpart of } s \& \text{ she comes in } s' \& s' < w \} \)

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\(^{15}\)How the asking situation \( s \) gets identified with the reference situation of the infinitive is discussed in §2.2. I skip over it here in order to keep the discussion less technical.
The difference between (45) and (46) is that (46) implies that the asked-for situations are extensions of s into the future, but (45)'s implication that the asked-for situations can be brought about by human action after the time of s means that, in terms of truth conditions, the difference will be all but imperceptible.

4.2.2.6 Adjunct Infinitives

Next, I would like to consider various kinds of adjunct infinitives: purpose infinitives, rationale infinitives, goal infinitives, etc. For a survey of these types, see Huettner (1989). In many cases, adjunct infinitives are interpreted as intended by the matrix subject.

(47a) In order to turn the light on, he pushed two switches.

(47b) John went to the store to find a bottle of gin.

Huettner discusses a fact important for understanding this intentionality: for an VP-level adjunct infinitive to be interpreted intentionally, rather than factively, the clause it is embedded in must have an agentive subject. This agent is the one who "intends" the infinitive. Thus (47b) contrasts with the factive (47c):

(47c) John awoke to find a bottle of gin by his bed.

One approach to explaining Huettner's observation that could be tried in the present system is the following: Assume that sentences with agentive subjects are analyzed in terms of some predicate like DO (Ross (1972), Dowty (1979)). The notion of agentivity includes the idea of intention, since any agent is acting to bring about some end. So one might propose that DO has an
argument, often left implicit, which expresses the intended outcome of the agents action. There can be a variety of proposals about the status of this DO. It could be part of the verb meaning, or an element in I which relates the subject argument to the verb, or part of a complex meaning for the subject NP itself. For purposes of illustration, let's choose the idea that DO is part of the lexical meaning of agentive verbs. Thus agentive go would have a translation like \( \lambda ! [\lambda \Phi[\lambda x[\text{DO}(x)(\text{be.at}(l)){(\Phi)}] \!]. \) \( \Phi \) is a propositional argument expressing the intended outcome of \( x \)'s action, and \( x \) must control the subject argument of \( \Phi \). DO would be given analysis like any other propositional attitude verb.\(^{16}\) Often \( \Phi \) is just 'be.at(l)', i.e. one goes to the store to be at the store. In this case \( \Phi \) is filled in from context. However, it is possible for \( \Phi \) to be some other proposition, expressed by an adjunct infinitive. In such a case, the adjunct infinitive would be a semantic argument of go.

Treating intended infinitives as semantic arguments is supported by several facts. First is that intentional infinitives are not iterable. This suggests that the reading is associated with a particular argument slot. Second, intended infinitives are also intensional; given that a verb like go is not intensional with respect to everything in its scope, we do not want to explain this fact simply by saying that intended infinitives are in the scope of

\(^{16}\)cf. §2 for the type of approach I have in mind. The idea would be that DO(a)(be.at(l))(\( \Phi \)) would be true in a situation \( s \) iff \( a \) acts in \( s \) in such a way as to get to \( l \) and for every situation \( s' \) compatible with what \( a \) intends in \( s \), there is an \( s'' \) such that \( s'' \) e \( \Phi \), where \( s \) is the reference situation for \( \Phi \). The underlined portion is of the general form for analyses of propositional attitudes.
the matrix verb. Instead, the situation seems to indicate that go is intensional with respect to one of its arguments--the one that may optionally be filled by an infinitive. Of course an alternative proposal could be that the intensionality arises within the infinitive itself, perhaps via a null version of the complementizer for. However, as will be seen in the next paragraph, explicit for infinitives may be extensional. Furthermore, the general meaning that is being advocated in this chapter for for infinitives is not intensional, even though it is a meaning that often results in infinitives showing up in intensional contexts. To the extent that this general interpretation for for can be maintained across other constructions, there is reason not to postulate a separate intensional for just for these cases. Lastly, as Huettner emphasizes, the availability of intentional readings is completely predictable on the basis of the verb's argument structure, so it would be theoretically redundant to encode the difference between the infinitives in (47b) and (47c) in the infinitives themselves.

As Huettner discusses, there are also both intended and non-intended S-level adjunct infinitives. (47a) is a case of the former, while (47d) is one of the latter:

(47a) (In order) to turn the light on, he pushed two switches.

(47d) He pushed two switches, only for the lights to come on.

Note that (47d) contains a for, but is extensional; this supports the idea that for infinitives are not intrinsically intensional, but
merely often show up in intensional contexts. The intender of a rationale clause like (47a) need not be present in the linguistic context (as in *To turn the lights on, two switches were pushed*). The suggests that S-level adjuncts do not associate with the DO provided by an agent role. Instead, a 'higher DO' must be postulated, and presumably this is just what *in order* represents when it is present. (In other cases DO/*in order* would be null.) (47a) would therefore have roughly the semantic structure of: \[ \text{DO}(x)(\text{he pushed two switches})(\text{to turn the lights on}). \] \(x\) may be identified with the matrix subject, but it needn't be.

When an adjunct infinitive is not associated with any DO, it is necessary for it to be interpreted factively. In such cases, the relation between the fact expressed by the infinitive and that expressed by the matrix clause is somewhat vague. The situation is similar to that discussed by Stump (1985) for absolute constructions. Absolutes, according to Stump, may either be an argument of a modal or other quantificational operator or be connected to the rest of the sentence by a vague connective that just states that the one proposition is relevant to the other. Such a relevance connective would be useful for non-intended adjunct infinitives as well.

4.2.2.7 Bare Infinitives and *To* Infinitives

Bare infinitives in perception and causative contexts can be given a fairly straightforward treatment in the present system.

\[ \text{17 Stump's proposals are discussed in Chapter 5. Thanks to B. Partee for pointing out this connection.} \]
(48a) Mary made John come.
(48b) John saw Mary leave.

The constituency of these constructions is controversial (Barwise (1981), Akmajian (1977), Williams (1983), Higginbotham (1983)). Barwise and Higginbotham argue that *Mary leave* in (48b) is a constituent, while Akmajian and Williams claim that *see* takes both an NP and a VP object. On the assumption that these verbs take a single complement, *make* or *see* can be given an analysis parallel to that of *imagine* (plus gerund) in Chapter 3. The complement undergoes QR onto the VP at Logical Form, where it is bound by existential closure. Thus the sentence means 'there is a situation *s* ∈ [Mary leave] such that John saw *s*.' Alternatively, if *see* takes two complements, an NP and a VP, this analysis can be easily mimicked: \{see:([Mary];([leave];([John]))), the interpretation of (48b), is true iff there is a situation s ∈ [leave;([Mary])] such that John saw *s* (where saw. is the *saw* that takes concrete objects as complements, i.e. of John saw the cat.).

On either approach, the question arises as to whether there is a meaning difference between bare infinitives and *to* infinitives. Though to the extent that they are grammatical, the passive of a sentence like (48b) has a *to* infinitive, I don't believe that meaning is quite preserved:

(48c) ??Mary was seen to leave (by John).
This sentence is marginal, and the better (48d) means the same as *John saw Mary to be leaving/that Mary was leaving*.

(48d) Mary was seen to be leaving by John.
Here John need not have had a visual perception of anything; he has come to understand that Mary was leaving. Thus it seems that there is a difference between the semantics of bare infinitives and that of to infinitives. Furthermore, if it is correct that (48c) is not the passive of (48b), the impossibility of a passive of the latter argues that NP+bare infinitive forms a single constituent.

I would like to make the following suggestion about the difference between bare infinitives and to infinitives: According to the first analysis of causative and perception sentences presented above, bare infinitives can, like gerunds, undergo QR, leave a type e trace, and be existentially closed. Fully clausal elements, including both to infinitives and that clauses, never undergo this sequence of operations, and in particular, as far as I know, they never are subjected to existential closure. If existential closure could be limited to elements which are not clausal, we would have an explanation for why only bare infinitives or ordinary NP's, and not to infinitives, are compatible with make and see when they express an attitude towards an individual. A potential principled way of limiting existential closure to non-clausal elements is to limit it more severely to NP's, and argue that all syntactic nominalizations in English are

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18Since make can only be an attitude towards an individual, it is ungrammatical otherwise.
19Since according to the official formalism, every argument of a verb is an individual, this must be reformulated somewhat: These verbs can only take an NP or a bare infinitive when they express an attitude towards individuals which are not the individual correlate of some higher-order meaning like a proposition.
nominalizations of projections of V (and never of projections of I). This is precisely what is argued by Jackendoff (1977). Then see and make in (48a-b) would take a single NP object, as argued by Higginbotham (1983).

4.2.2.8 Infinitives and Conditional Modality

While we have looked so far at a variety of complement infinitives, we have not seen how such constructions interact with conditionals. In a case of conditional modality like (49), we would like for the if clause to restrict the set of situations accessible through possible.

(49) If Mary won last year, it is possible for her to win again this year.\(^{20}\)

Excluding the conditionalization, and ignoring tense, this denotes the set of situations s such that, for some situation s' possible with respect to s, s' is a situation in the denotation of for her to win again this year. This set of situations in the denotation of the infinitive all begin with a duplicate-counterpart of the possibility situation s and include her winning again this year.

To incorporate the if clause, we should intersect its denotation with the set of situations accessible from s; then sentence then says that some situation s' in this intersection is one that begins with a duplicate-counterpart of s and later includes her winning again this year. At first glance, it may appear that no s' in the intersection could do this, since the denotation of the if

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\(^{20}\)Thanks to A. Kratzer for pointing out the issues having to do with this type of example.
clause is the set of supersituations of situations of her winning last year. They all have a part which took place last year, and thus apparently couldn't have started with a duplicate-counterpart of s.

There is only a problem with (49), however, if it is assumed that none of the minimal situations s—the situations associated with the predicate possible—extend back in time as far as last year. Given that possible is an individual-level predicate (and thus a stative), such an assumption would be unwarranted. In the default case, the situations associated with individual-level predicates are of quite long duration; this is why these predicates are often intuitively classed as denoting permanent properties. It thus seems reasonable to assume that some of the minimal possibility situations started at the time of Mary's winning last year. Such situations provide a reference situation for the infinitive, giving it a meaning which need not have a null intersection with the if clause's denotation. In Chapter 5 there is further discussion of the precise nature of the situations associated with individual-level predicates.

4.2.2.9 Other Constructions

The for infinitives that have been briefly discussed above are those for which the beginning of an analysis pretty straightforwardly suggests itself. This is because they are, or are related to, the objects of prior investigation by semanticists, whether formally or informally. There are, however, other examples of infinitives that must eventually be brought into
consideration. Unfortunately, to cover them all here is beyond the scope of the work. I would like to briefly mention a couple of these constructions, however.

First, there are infinitives with *enough* or *too*.

(50a) Her work is too intelligent (for you) to ignore.
(50b) Her work is dumb enough (for you) to ignore.

These are clearly *for* infinitives, both literally and in their meaning.

And second, there are infinitival relatives. Quirk *et al.* (1985) note that with infinitival subject relatives, a non-modal (i.e. *for*-less) interpretation is possible, while with object relatives, it is not:

(51a) He was the last man to arrive.
(51b) He is a good man (for you) to see.

These facts suggest that an underlying *for* is obligatory with infinitival object relatives, but not with infinitival subject relatives. It is unclear why this might be. Examples like (51b) involving *for* infinitives typically express generics or habituals, and so are probably in some way intensional. Furthermore, it seems likely that *good... (for you) to see* actually forms a semantic unit, and so perhaps these aren't really relatives at all.

### 4.3 Selectional Restrictions of Attitude Verbs

In this section I will attempt to explain some of the selectional restrictions of attitude verbs by utilizing the meanings for infinitives and subjunctives presented above. First we will look at cases in which infinitives are not possible (§4.3.1). Then
we will discuss some cases in which infinitives are possible, but different kinds of subjunctives and indicatives are not (§4.3.2).

4.3.1 Believe and Claim

Verbs of mental judgment and assertion typically cannot embed for infinitives.

(52a) *I believe for him to be coming.

(52b) *I claim for him to be coming.

The basis of the explanation that I will offer for this fact is the following: these verbs make claims about the whole world. For example, a believe p asserts that a believes that w e p, and a claim p asserts that a claims that w e p (where w is the belief/claim world). First I will show how assuming that the meanings of believe and claim quantify over whole worlds implies that for infinitives are not possible, and then I will discuss how such an assumption can be justified by the semantics of the verbs.

We will use (52b) as an example. If claim has the meaning of (53a), (52b) would get the interpretation (53b).

(53a) [claim:: = f<e<s,i>,<e<e<s,i>>>: for all a ∈ D_e, p ∈ D<e<s,i>, f(p)(a) =
{s : ∀w[w is a claimed world for a in s → w e p]}

(53b) {s : ∀w[w is a claimed world for a in s → w e [for him to be coming]]}

However, [for him to be coming] doesn’t contain any whole worlds, except for some quite strange ones that have no history
prior to the reference situation (i.e. the claiming situation). The claimer certainly isn't saying that the real world is one of these.

It is obviously a crucial stipulation that \textit{claim} and \textit{believe} involve quantification over whole worlds rather than smaller situations. First I will present an argument that the stipulation is correct and then I will argue that the assumption is actually a good analysis of an aspect of the meanings of \textit{believe} and \textit{claim}.

The additional piece of evidence that verbs like \textit{claim} and \textit{believe}-in contrast to verbs that can take infinitival complements like \textit{hope} of \textit{want}-must denote attitudes towards whole worlds is the fact that they cannot have situation-denoting NP's as objects:

\begin{itemize}
  \item (53c) *I claim a good dinner.
  \begin{quote}
    (cf. I hope for a good dinner.)
  \end{quote}
\end{itemize}

(53c) is ungrammatical on the relevant meaning for \textit{claim}. This suggests that it would not make sense if we changed (53a) to (53d), because there are no 'claimed situations'.

\begin{itemize}
  \item (53d) [\textit{claim}] = f_{<s,t>,<e,<s,t>>}: for all a \in Dc, p \in D_{<s,t>}, f(p)(a) =
    \\{ s : \forall s' | s' is a claimed situation for a in s \rightarrow s' \in p \}\}
\end{itemize}

As will be discussed in the next subsection, verbs that can take \textit{for} infinitives have a meaning like this one--there will be universal quantification over situations. However, due to the ungrammaticality of (53c), such an analysis is impossible for \textit{claim} and \textit{believe}.

Now I will indicate why the meanings of \textit{believe} and \textit{claim} should be analyzed with quantification over very large situations

\footnote{How the reference situation gets identified with the claiming situation is discussed in the next subsection.}
and not the small ones in the denotations of infinitives. Using *believe* as our example, the class of verbs of mental judgement and assertion have the following property: All of the beliefs that someone has should be true together.\(^{22}\) If John believes that the moon was round 1,000 years ago and that Mary arrived at five p.m. the day before, every situation compatible with his beliefs should both have the moon being round 1,000 years ago in it and Mary arriving at five p.m. the day before in it. For this reason, if John does have these beliefs, none of the situations in the infinitive of (52a) will be in his set of belief situations. Each belief situation must include both the moon 1,000 years ago and part of yesterday, and the situations in the denotation of *for him to be coming* are all too small to include either. They are all quite small situations which begin with the belief situation and grow into situations in which he is coming. Since everyone has beliefs about things far away or past, any sentence in which *believe* or *claim* took a *for* infinitive would be necessarily false.

Notice that the requirement that *believe* and *claim* must involve quantification over whole worlds is actually stronger than is needed or justified. *Believe* and *claim* must simply involve quantification over situations large enough for propositions about different places and times to be true together. However, when it comes up below I will continue to speak as if these verbs required

\(^{22}\)When they are unable to connect the content of different beliefs, people often do have inconsistent beliefs. Within a group of propositions the connections among which are clear, however, belief must be consistent. The kind of grammatically induced inconsistency that using *for* infinitives with *believe* would cause is clear to any competent speaker of English.
quantification over worlds because doing so makes the difference between them and verbs like *hope* or *want* clear and easy to talk about.

The reason that these verbs cannot take *for* infinitives is the same as the reason, discussed in §4.2.2.1, that *for* infinitives cannot be used assertively in an unembedded context. Both discourse contexts and the set of worlds compatible with belief must be able to simultaneously support the truth of a wide variety of propositions. They need to work with propositions that are true of large situations, and for this reason persistent propositions are good for their purposes. The analogy between the set of situations someone's belief projects and a discourse context goes even deeper than this similarity. In discussing presupposition projection with attitude verbs, Heim (1985, 1991) shows that the properties of verbs like *believe* can be captured if updating a context for a belief sentence *α believes p* is accomplished by updating the set of assignment-situation pairs compatible with what *α* believes for the set of such pairs with respect to which *p* is true. In other words, belief is essentially an attitude towards a context, and new beliefs are incorporated by updating the context in the same way discourse contexts are updated. Heim's treatment of presupposition projection with attitude verbs therefore requires the same analogy between belief sets and discourse contexts as we needed to explain the selectional properties of *believe* and *claim*.

To prevent confusion, I should note that I'm not claiming that every verb which cannot take *for* infinitives can't take them
for the reasons just discussed. For instance, since it can take gerund complements, *deny*, discussed in Chapter 3, must be able to utilize quantification over small situations. Yet it cannot take an infinitive. I suspect that *deny* is incompatible with *for* infinitives because because of the possibility presupposition that *for* infinitives have.23 In general, the project of this section and the next one is to begin to understand the complex system of selectional restrictions in English by analyzing the interactions between verb meanings and the semantics of different classes of propositional expressions. In §4.3 I simply intend to present some case studies.

4.3.2 *Hope, Wish, Want, and Desire*

The goal of this section is to explain, in a more formal way, the contrasts of (10)-(13), repeated here:

(10a) They hope for him to be here.
(10b) They hope that he is here.
(10c) *They hope that he were here.
(10d) *They hope that he be here.

(11a) They wish for him to be here.
(11b) *They wish that he is here.
(11c) They wish that he were here.
(11d) *They wish that he be here.

23 This presupposition is discussed extensively in the next section. Briefly, deny with a *for* infinitive would presuppose that the denyer believes it possible that the infinitive is true. Such a presupposition is in conflict with the meaning of *deny*.
(12a) They want for him to be here.
(12b) *They want that he is here.
(12c) *They want that he were here.
(12d) *They want that he be here.

(13a) They desire for him to be here.
(13b) *They desire that he is here.
(13c) *They desire that he were here.
(13d) *They desire that he be here.

In order to understand these contrasts, we will have to be more specific about the notion of 'counterfactual alternative'. For the time being, it can be defined as follows:

s' is a counterfactual alternative of s iff no world possible with respect to s contains both a duplicate-counterpart of s and a duplicate-counterpart of s'.

The kind of possibility relevant for this definition is left somewhat vague, but as we will see it is typically based on someone's beliefs. In the absence of any further specification, s' and s are counterfactual alternatives if no world in the context (i.e. no world w such that for some g, <g,w> ∈ C) contains a duplicate-counterpart of both. This is clearly a special case of belief-based possibility, with the relevant beliefs being those shared by a group of speakers.

As we go about analyzing (10)-(13), in some cases it will be asserted that a sentence, for example (10d), is unacceptable because the attitude verb and the complement impose
contradictory requirements. Either there will be contradictory presuppositions about what the attitude holder's state of mind is or there will be an unsatisfiable presupposition about the nature of the hoping/wishing/etc. situation. In each case, therefore, it will be impossible to satisfy all presuppositions of the ungrammatical sentences. What this means is that it will be impossible to assign an interpretation to these sentences. It is because of this, I propose, that the sentences are unacceptable. As discussed above, perhaps the best way to look at the explanations is as providing a basis for selectional or subcategorization restrictions: a syntactic restriction is imposed to rule out the choice of an inappropriate attitude verb. An example like (11b) would have to express an attitude that is impossible on grammatical grounds, and any competent speaker of English would know that it expresses an impossible attitude. Someone who uttered (11b) would have to mean to express some closely related attitude, like that of (10b) or (11c). So, even if the ungrammaticality is technically the result of a subcategorization violation, if all and only structures that bear presuppositions which are impossible to satisfy are so ruled out, investigating the semantic causes would appear to be crucial for a true understanding of the facts.

4.3.2.1 *Hope*

The pattern shown in (10) can only be understood in light of an understanding of what it is to hope. One cannot hope for what one believes to be false. This aspect of the meaning of *hope* is
suggested by the phrase *to have hope*—to have hope of obtaining something, one must believe one can obtain it. It is only possible to hope so long as one still believes there's a chance of satisfaction. Additionally, no act of hoping is also a situation in which something is obliged—more on this when we discuss (10d). With this in mind, a first attempted interpretation for *hope* can be the following:

\[(54) \text{[hope]} = f_{<s,t>,<e,<s,t>>} \colon \text{for all } p \in D_{<s,t>}, a \in D_e, f(p)(a) = \]
\[
\{ s : \forall r (r \text{ is a hoped-for situation for } a \text{ with respect to } s \rightarrow \exists s'(s' \in p \land s'<r)) \}
\]

As with deny, discussed in Chapter 3, intuitively here \( r \) is a hoped for situation for \( a \) with respect to \( s \) if \( r \) would be the basis for \( a \)'s saying that a situation which contains it fulfills what he or she hopes for in \( s \). In contrast to the case with *claim* or *believe* in the preceding section, the meaning of *hope* involves quantification over situations rather than only whole worlds. This does not contradict the reasoning for why *believe* only involves quantification over whole worlds, since unlike beliefs all of ones hopes need not converge on a single set of situations. As discussed by Heim (1991), hopes are always relative to some set of beliefs, and one may simultaneously hope to get a well-paying job and to win a lottery so that one does not have to work. The quantification over mere situations in (54) will let *hope* take infinitival complements.

(54) does not encode the restrictions on what it is to hope; these are separate conditions on what can be a set of hoped-for situations.
What this meaning yields for (10a) is (55):

(10a) They hope for him to be here.

(55) \( \{s : \forall r(r \text{ is a hoped-for situation for them with respect to } s \rightarrow \exists s'(s' \text{ has as its initial segment a duplicate-counterpart of } s'' \text{ & } s' \text{ includes a situation of him being here & } s' < r)\} \)

This is wrong, because the initial segment of \( s''' \) is required to be a duplicate-counterpart of some potentially unrelated situation \( s'''' \). What is needed is to identify that situation with \( s \). (This problem was briefly mentioned in §4.2, but I didn't go into it there because of the level of informality of the discussion.) In order to do this, infinitives will not be able to simply denote propositions, but must be functions from reference situations to propositions.

(56) \( \{\text{for NP to VP} : f_{<s, <s,t> >} : \text{for all } a \in S, f(a) = \{s : s \text{ has as its initial segment a duplicate-counterpart of } a \text{ and } [\text{NP VP}] \text{ is true in } s\} \)

With a revised interpretation for \( \text{hope} \), all will work out.

(57) \( \{\text{hope} : f_{<s, <s,t> >, <c, <s,t> >} : \text{for all } P \in D_{<s, <s,t> >}, a \in D_c, f(P)(a) = \{s : \forall r(r \text{ is a hoped-for situation for a with respect to } s \rightarrow \exists s'(s' \in P(s) \& s' < r)\} \)

Now (10a) means

(58) \( \{s : \forall r(r \text{ is a hoped-for situation for them with respect to } s \rightarrow \exists s'(s' \text{ has as its initial segment a duplicate-counterpart of } s \& s' \text{ includes a situation of him being here & } s' < r)\} \)
According to (19), (10a) has a presupposition too:

Presupposition: it is not the case that, for all $s' \in [\text{for him to be here}], s'$ is a counterfactual alternative of $s$.

As discussed by Karttunen (1973), verbs of propositional attitude convert presuppositions of their complements into presupposed beliefs of their subjects. Thus, (10a) will presuppose that they believe that it is possible for him to be here. This prediction seems correct; I will come back to the presupposition of infinitives in the discussion of wish. Want and desire do not differ from hope with regards to this presupposition, so I will not mention it when talking about those verbs.

Assuming that finite clauses are propositional, it will be impossible to combine the meaning of hope given in (57) with the meaning of $\text{that he is here}$ to yield (10b).

(10b) They hope that he is here.

This is because the $\text{that}$ clause is of type $<s,t>$, not $<s,<s,t>>$. However, there may be reason to think that $\text{that}$ clauses should be of type $<s,<s,t>>$--the fact that, as indicated by sequence of tense phenomena, the time of a higher clause influences the choice of tense in an embedded clause. While in the present case, with two present tenses, there may not appear to be an issue, past tense sequence of tense phenomena are notoriously difficult to analyze. One way of looking at examples like $\text{He will hope that John has come;}$ and $\text{He will hope that John will come;}$ is as showing that embedded clauses with relative tenses need the event of the
higher clause to serve as their reference situation.\textsuperscript{24}

Reichenbach's (1947) proposal, which I will follow for the time being, is that the reference time of an embedded tense must match that of the clause that embeds it. According to Reichenbach, the choice of grammatical tense should follow from this. In order to explicitly relate the reference situation and the situations which satisfy the embedded clause, the function denoted by the embedded clause will have to take the reference situation as an argument. The meaning of the \textit{that} clause will therefore be the following:

\begin{equation}
(59) \{ \text{that} S[+\text{indic}]: = f_{<s,<s,t>} : \text{for all } a \in S, f(a) = \{s : s \in \text{Ref}(a)([S]) \} \}
\end{equation}\textsuperscript{25}

Assuming that with the present tense the time of the embedded clause's situations and that of the reference situation must match, (10b) means

\begin{equation}
(60) \{s : \forall r(r \text{ is a hoped-for situation for them with respect to } s \rightarrow \exists s'(\text{he is here in } s' \text{ and } s \text{ and } s' \text{ have the same time } & s' < r)) \}
\end{equation}\textsuperscript{26}

This is very close to the classical interpretation for a propositional-attitude sentence.

\textsuperscript{24}Of course this isn't to say that these can't be analyzed differently, in a non-situational way.

\textsuperscript{25}I'm leaving open exactly what role the reference situation plays. Consider the function Ref(a) to stand in for an appropriate theory of sequence of tense. There is much more discussion of the role of the reference situation in §4.

\textsuperscript{26}s and a are not necessarily in the same world. If s and a are not in the same world, s and a have the same time if (i) a has a nearest counterpart in the world of s and (ii) that nearest counterpart and s have the same time. This relation is not necessarily symmetrical.
Now we will see how to explain the ungrammaticality of (10c).

(10c) *They hope that he were here.

Counterfactual subjunctives are presupposed to denote sets of counterfactual alternatives to some specific situation, and so they will have to have the same type as infinitives: propositional functions.

\[(61) \text{[that } S_{[+subj]} ] = f_{<s,<s,t>>}: \text{for all } a \in S, f(a) = \{s : S \text{ is true in } s\}\]

presupposition: for all s' such that S is true in s', s' is a counterfactual alternative of a.

At first there would appear to be no problem with (10c). It is perfectly possible to hope for a situation that happens to be counterfactual, so long as one doesn't know that it is counterfactual. However, as just mentioned, Karttunen (1973) discusses the fact that verbs of propositional attitude convert presuppositions of their complements into presuppositions of the attitude holder. Therefore the interpretation of (10c) will be (62).

\[(62) \{s : \forall r(r \text{ is a hoped-for situation for them with respect to } s \rightarrow \exists s'(s' \text{ is a situation of him being here } & s'<r))\}\]

presupposition: They believe in s that all s' such that s' is a situation of him being here are counterfactual alternatives of s.

Given this, (62) necessarily attributes a contradictory state of mind to them. In order for a situation to be hoped-for, they must not believe it to be counterfactual; this is the restriction on what can be a hope. However, for the attitude to be described using a
counterfactual subjunctive, they must believe it to be counterfactual.

In order to see why (10d) is ungrammatical, we will have to provide the mandative subjunctive with an interpretation as a propositional function. This is given in (63).

(10d) *They hope that he be here.

(63) \[ S_{[+]msubj} = f_{<s,<s,t>} : \text{for all } a \in S, f(a) = \{ s : a \text{ is a situation in which something is obliged and } [S] \text{ is true in } s \}\]

The mandative subjunctive requires that its reference situation be an obliging situation. One way of looking at this is as a presupposition: (63) is undefined if the reference situation it takes as argument is not an obliging situation. The meaning of (10d) will be:

(64) \{ s : \forall r (r \text{ is a hoped-for situation for them with respect to } s \rightarrow \exists s'(s \text{ is a situation in which something is obliged & } s' \text{ is a situation of him being here & } s' < r)) \}

No basic hoping situation is also a situation in which something is obliged in a relevant sense, so meaning of the complement clause is undefined. At this point, we should think briefly about why no basic hoping situation is an obliging situation. Clearly the 'ought to do' sense is inappropriate. And as for the 'ought to be' sub-meaning, note that none of the embedded optatives express anyone's parochial desires, but always a good in some more general sense: \textit{it is desirable/necessary/crucial that } p. \textit{ Though } p \textit{ may only be desirable for some small group, it is still more than a single person's hope. Furthermore, in using one of these forms,
one identifies what is best for the relevant group with what is best for the whole world. So, no mere hoping situation will be the right kind of 'ought to be' situation, and thus no basic situation will satisfy (64). From this it follows, given the function of tense to convert sets of basic situations into persistent propositions (cf. Chapter 2; Portner (1991a)), that no situations at all will be in the interpretation of (10d).

As I discuss wish and want, I will simply point out that the problem for using them with the mandative/optative subjunctive is the same as that for hope. However, in §4.3.2.4, when desire is taken up, I will have more to say about why only desiring situations, and not hoping, wishing, or wanting situations, seem able to be obliging situations.

4.3.2.2 Wish

As we discuss wish, the following interpretations will be utilized.

\[(65) \text{[wish]} = f_{s, s', D, D_e}: \text{for all } P \in D_{s, s', D}, a \in D_e, f(P)(a) = \{ s : \forall r (r \text{ is a wished-for situation for } a \text{ with respect to } s \rightarrow \exists s'(s' \in P(s) \& s' < r)) \} \]

This meaning has exactly the same structure as that of hope.

There are different conditions on wishing and hoping, however. Unlike hopes, wishes may be for conditions that are counterfactual and are believed to be counterfactual by the wisher. However, a wish may not be for a situation that the wisher believes to already hold--a wish must be for a situation which the wisher believes to be either future or counterfactual. Furthermore,
wishing situations are never obliging situations in the relevant sense as well.

The interpretation of (11a) is (66).

(11a) They wish for him to be here.

(66) {s : \forall r(r \text{ is a wished-for situation for them with respect to } s \rightarrow \exists s'(s' \text{ has as its initial segment a duplicate-counterpart of } s \& s' \text{ includes a situation of him being here} \& s'<r))}

There is no problem with (66). Additionally, we predict that (11a) has the presupposition that they believe it is possible for him to be here. This seems right, and is interesting given that the only other form with wish, (11c), presupposes that they believe that he is not here. This contrast supports assigning infinitives and counterfactual subordinatives the presuppositions suggested.

The interpretation of (11b) is (67a).

(11b) *They wish that he is here.

(67a) {s : \forall r(r \text{ is a wished-for situation for them with respect to } s \rightarrow \exists s'(he is here in } s' \text{ and } s' \text{ and } s \text{ have the same time} \& s'<wr))}

Intuitively, (11b) is unacceptable because it implies that they wish for something to already be the case, and it is not possible to wish for such a thing. One might think that, if it happened that he is not here, (11b) should be the same as (11c) (repeated below), and therefore acceptable.

(11c) They wish that he were here.

The ungrammaticality of (11b) is due to the following kind of Gricean reasoning: If one uses the counterfactual subjunctive with
wish, one indicates that attitude holder (here, them) believes the embedded clause to be counterfactual. If one fails to use the counterfactual subjunctive, this must not hold. If the attitude holder believes that the embedded clause is not counterfactual, or fails to be certain that it is, and given that this does not refer to a potential future situation, then any attitude he or she has towards it cannot be that of wishing. An attitude of wishing cannot pick out a contemporaneous proposition that the speaker does not believe to be counterfactual.

What about a case like (67b), with a future tense embedded clause?

(67b) *They wish that he will be here.

This sentence will receive a meaning like (67c).

(67c) \([s : \forall r(r \text{ is a wished-for situation for them with respect to } s \rightarrow \exists s'(\exists s''(he \text{ is here in } s'' \& s' \text{ precedes } s'') \& s' \text{ and } s \text{ have the same time } \& s'<r)])\]

The future tense of a proposition \(p\) is assumed to be true of a situation \(s''\) iff some later situation \(s'''\) is in \(p\); \(s'''\) must have the same time as the reference situation \(s\). The reason for having this meaning for the future is discussed further in §4.5.1.3 below.

This interpretation does not meet the criteria for wishing either. The wished-for situations are the \(s'''\)--and these have the same time as the wishing. Because the future is a relative tense, it is satisfied not by future situations in which he is here, but by present situations which precede situations in which he is here. Now we can resume the same kind of Gricean reasoning of above. Because the speaker chose not to use the counterfactual
subjunctive here, one may conclude that the wisher does not believe those situations to be counterfactual. Given this, the case is just like that with the present tense. The wisher (them) is represented as wishing for present situations that are not believed to be counterfactual. This attitude is in conflict with the requirements on what it is to be a wish. It does not matter that the situations denoted by the embedded clause are picked out by reference to some later situation.

It is worth noting that if a language had a true future--a future tense that was true of really future situations, rather than of present situations which precede other situation--the facts might be different. In such a language, the future might pattern more like the infinitive does in English. I do not have any facts relevant to this, however.

(11c) receives the interpretation (68).

(11c) They wish that he were here.

(68) \( s : \forall r (wr \text{ is a wished-for situation for them with respect to } s \rightarrow \exists s'' (s'' \in \{s''' : s''' \text{ is a situation of him being here}\} \land s'' < r))\)

presupposition: They believe that all \( s'' \in \{s''' : s''' \text{ is a situation of him being here}\} \) are counterfactual.

(68) has none of the problems of (67). The wishers are presupposed to believe that he is not here, and that is as it should be.

Lastly, (11d) is unacceptable for the same reason that (10d) was. Its denotation is (69):

(11d) *They wish that he be here.
(69) \( \{ s : \forall r (r \text{ is a wished-for situation for them with respect to } s \rightarrow \exists s''(s'' \in \{ s'': s''' \text{ is what is ordered in } s \& s''' \text{ is a situation of him being here} \& s''\langle r \}) ) \} \)

No basic situation can be both a wishing situation and the complement clause of (11d) has a presupposition that cannot be met.

4.3.2.3 Want

Wants are very particular states of mind. One cannot want a type of situation unless one believes both that the situation does not exist yet in the real world and that it still could come to exist. This restriction essentially assures that a wanted situation must be (at least partially) future. Intuitively, wants must be for states of affairs that are believed to be as of yet undetermined as to whether they will be actualized; however, the particular statement just given will be necessary for explaining (12b) and (12c).

Let us consider (70) as a meaning for want.

(70) \( \{ \text{want} \} = f_{<S,<S,I>,<C,<S,I>}, \text{for all } P \in D_{<S,<S,I>}, a \in D_a, f(P)(a) = \{ s : \forall r (r \text{ is a wanted situation for } a \text{ with respect to } s \rightarrow \exists s'(s' \in P(s) \& s'\langle r) \} \}

With this meaning (12a) will mean (71).

(12a) They want for him to be here.

(71) \( \{ s : \forall r (r \text{ is a wanted situation for them with respect to } s \rightarrow \exists s'(s' \text{ has as its initial segment a duplicate-counterpart of } s \& s' \text{ includes a situation of him being here} \& s'\langle r) \} \)}
It is possible for it to be uncertain whether there will be any actual situations in the denotation of the infinitive, so (12a) is ok. In official terms, they can believe that no \( s'' \) in \( \{ s'' : s'' \) has as its initial segment a duplicate-counterpart of \( s \) \& \( s'' \) includes a situation of him being here} exists yet at the time of \( s \), but that it is possible that one will.

The interpretation of (12b) is (72).

(12b) *They want that he is here.

(72) \( \{ s : \forall r (r \) is a wanted situation for them with respect to \( s \rightarrow \exists s' ( \text{he is here in} \ s' \ \& \ s' \ \text{and} \ s \ \text{have the same time} \ \& \ s' < r)) \}

It is obvious why this is contradictory. The truth of \( \text{he is here} \) cannot be undetermined at the time of \( s \) since \( s \) and the situation in which he is here must have the same time. However, there might seem to be a problem with (73), which has a future tense embedded clause.

(73) *They want that he will be here.

It seems that the truth of \( \text{he will be here} \) could still be undetermined at the time of wanting. Given this, (73) should be ok. However, (73) and (12b) are essentially the same. (73) would have the following meaning.

(74) \( \{ s : \forall r (r \) is a wanted situation for them with respect to \( s \rightarrow \exists s' ( \exists s'' ( \text{he is here in} \ s'' \ \& \ s' \text{ precedes} \ s'') \ \& \ s' \ \text{and} \ s \ \text{have the same time} \ \& \ s' < r)) \}

This interpretation is unacceptable for a reason parallel to that with \( \text{wish} \) above: again, we take advantage of the fact that future tense statements are true of present situations, not future
ones. In this case, the condition on what can be a want in \( s \) is 'the wanter must believe that the real world does not yet contain an \( s'' \) in \( \{ s'' : \exists s'''(\text{he is here in } s''' \& s''' \text{ precedes } s'') \& s'' \text{ and } s \text{ have the same time} \} \) but must believe it to be possible that it eventually will.' But since such an \( s'' \) and the reference situation \( s \) have the same time, the real world must already contain this \( s'' \) or not. Therefore, one cannot believe that such an \( s'' \) doesn't exist yet without believing that it cannot ever exist. In other words, if they believe that \textit{he will be here} is currently false, they cannot believe that it is possible that he will be here. The problem here comes from the fact that the wanted situations are actually present, though they are only wanted by virtue of the fact that they precede situations in which he is here. The case is different with the infinitive in (12a) above, since there the wanted situations themselves are (partially) future.

The interpretation that would be assigned to (12c) is (75).

\[
\begin{align*}
(12c) & \quad \text{They want that he were here.} \\
(75) & \quad \{ s : \forall r(r \text{ is a wanted situation for them with respect to } s \rightarrow \exists s'(s' \text{ is a situation of him being here } \& s' \subset r)) \} \\
\text{presupposition: They believe that all } s'' \in \{ s''' : s''' \text{ is a situation of him being here} \} \text{ are counterfactual.}
\end{align*}
\]

The sentence presupposes that they believe that he is not here at any relevant time. Therefore, they do not believe that it is undetermined whether there is a real-world situation in \( \{ s''' : s''' \text{ is a situation of him being here} \} \).

The problem with (12d), like (10d) and (11d), is that no basic wanting situation is an obliging situation as well.
(12d) *They want that he be here.

(76) \{s : \forall r(\text{r is a wanted situation for them with respect to } s \rightarrow \exists s'(s \text{ is a situation in which something is obliged } \& \text{ } s' \text{ is a situation of him being here } \& \text{ } s'<r))\}

(76) shows what (12d) would mean: any basic situation in (76) would have to be both a wanting situation and an obliging situation.

4.3.2.4 Desire

Desire is exactly the same as want, except that desiring situations may be ordering situations (and therefore obliging situation) as well. This observation is already present in dictionary entries listing 'request' as a meaning of desire. 27 We will skip over (13a)-(13c), since there is nothing new to be learned from them. (13d) is considered marginal by some speakers, though all find it better than (10d), (11d), and (12d).

(13d) *They desire that he be here.

The marginality is presumably due to the fact that desiring situations may only marginally be ordering situations. As B. Partee has pointed out, (13e) is significantly better.

(13e) It is desirable that he be here.

(13e) is better because situations that satisfy *It is desirable that p.* are core 'ought to be' situations.

It may seem to be a problem for this account of the contrast between (13d) and (10d), (11d), and (12d) that wish is also

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typically listed with 'request' as a meaning. However, we should distinguish actually requesting something and suggesting a request indirectly. Presumably the 'request' senses of both desire and wish have their origins in indirectly suggesting a request by expressing a wish. It is possible that this is how things still stand with wish --when wish is used to make a request, it just does so indirectly, exactly analogously to saying That is a beautiful necklace. in order to request the necklace. In the case of the necklace, the requesting presumably arises from a conversational implicature. With wish the indirect suggesting might also be a conversational, or perhaps a conventional, implicature. In contrast, perhaps desire has actually taken on a secondary interpretation, so that it can literally mean 'to request'. (Probably it is limited to requesting something also wished-for.) Though it is difficult in practice to separate an instance of implicating a request and actually asserting one, that a difference like this exists between desire and wish is suggested by the grammatical evidence. The facts also indicate that, in determining what borderline cases fall under a concept like 'x is an obliging situation', there is a good deal of arbitrary choice and conventionalization. Finally, given the proposal that essentially semantic restrictions have been grammaticized into syntactic ones, it is possible that at one time the contrasts were more predictable than they are now. A previously stronger 'request' sense of desire
could conceivably have left a fossil record in desire's compatibility with the mandative subjunctive.28

This concludes the discussion of selectional restrictions as they apply to infinitives and subjunctions. While the explanations that relate to infinitives and subjunctions are the most crucial in the present discussion, which is after all about them, it is clear that the overall plausibility of what I have said also depends on the analysis of indicatives (in particular, tense).

4.4 Infinitives and Subjunctions in Counterfactual and Contrary-to-Expectation Conditionals

The examples in (15)-(18) display the phenomena that we will be concerned with in this section.

(15) If Bill were here with me, I would smile.
(16a) For Bill to have won would have been great.
(16b) It would have been great for Bill to have won.
(17) If Bill were to have won, it would have been great.
(18a) For Bill to win would be great.
(18b) If Bill were to win, it would be great.

The purpose here will not be to provide a new semantics for counterfactual conditionals, but rather it will be to integrate the claims about the meanings of infinitives and subjunctions into Kratzer's (1989a) theory of them. Doing this will have three consequences. First, by showing that this set of phenomena can

28A final possibility worth mentioning is that desire is compatible with the mandative subjunction somehow on analogy to desirable. How the selectional restriction would be passed is unclear, however.
be successfully analyzed with the interpretations that have been suggested for infinitives and subjunctives, those interpretations will be made more plausible. Second, it will allow us to learn some new things about the semantics and especially pragmatics of those clause types. And third, we will gain a better understanding of the semantic/pragmatic unity of counterfactual and contrary-to-expectation conditionals.

This section will begin with a summary of Kratzer's semantics for counterfactuals. Then, in §4.4.2, we will see how the proposed semantics for the subjunctive is compatible with that semantics. §4.4.3 contains an analysis of sentences in which an infinitive serves as the antecedent of a counterfactual, as in (16a-b). And §4.4.4 presents a refinement of the proposed semantics and pragmatics for the subjunctive, allowing for examples, as in (18), in which an antecedent of a conditional seems not to be presupposed false, but merely unlikely to be true.

4.4.1 An Outline of Kratzer's Semantics for Counterfactuals

In this section I will briefly present the analysis of counterfactuals given by Kratzer (1989a). Her treatment will provide a basis for discussing some aspects of the meanings of infinitives and subjunctives. One of the basic notions of her theory is that of 'lumping'. Lumping is a relation between situations defined as follows:
(77) For all propositions $p$ and $q$ and all worlds $w$: $p$ lumps $q$ in $w$ iff

(i) $w \subseteq p$, and

(ii) For all situations $s$, if $s \prec w$ and $s \subseteq p$, then $s \subseteq q$.

A proposition $p$ lumps another $q$ in a world iff every situation in that world which supports the truth of $p$ also supports the truth of $q$. Another important fact is that some propositions are true in every situation of a world, and so are lumped by every proposition true in that world. These are the generic propositions, and the way in which this assures the unique counterfactual entailments of generics will be seen below.

Kratzer also distinguishes a set of propositions $F_w$ that are relevant in $w$ for the evaluations of counterfactuals. Discussing the restrictions that are placed on this set is not really crucial here, but it should be noted that the propositions are required to be true in $w$. In terms of $F_w$ 'the crucial set' is defined as follows, skipping over some subtleties.

(78) For any world $w$ and proposition $p$, let $F_{w,p}$ be the set of all subsets $A$ of $F_w \cup \{p\}$ such that the following conditions are satisfied:

(i) $A$ is consistent

(ii) $p \in A$

(iii) $A$ is closed under lumping

In terms of this, semantics for would- and might- counterfactuals can be given as in (79a) and (79b).

(79a) A *would* counterfactual with antecedent $p$ and consequent $q$ is true in a world $w$ if and only if for every set in $F_{w,p}$ there is a superset in $F_{w,p}$ which logically implies $q$. 

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A *might* counterfactual with antecedent *p* and consequent *q* is true in a world *w* if and only if there is a set in $F_{w,p}$ such that *q* is compatible with all its supersets in $F_{w,p}$.

By way of example, let us examine (15).

(15) If Bill were here with me, I would smile.

Why might this statement be true? Let us suppose that I like Bill, and so (15) is true in virtue of the generic proposition (80):

(80) Whenever Bill is present with me, I smile.

As was noted above, a generic proposition is true in every situation which is part of a world in which it is true, and so it is lumped by every proposition true in that world. (To see exactly how (81) gets such a meaning, consult Kratzer (1989a).) When (15) is evaluated, we consider supersets of \{Bill is here with me\}. Any proposition we add to \{Bill is here with me\} will lump (80), yielding a set of the form (81).

(81) \{Bill is here with me. Whenever Bill is present with me, I smile\}.

These sets all entail \{I smile\}.

4.4.2 Counterfactuals and the Subjunctive

In this section we will see that the meaning proposed in §4.3 for the counterfactual subjunctive is compatible with Kratzer's semantics. Recall the proposed interpretation of the counterfactual subjunctive:
(61) \[ \text{that } S_{\text{subj}} \vdash \text{ for all } a \in S f(a) = \{ s : S \text{ is true in } s \} \]

presupposition: for all \( s' \in \{ s : S \text{ is true in } s \} \), \( s' \) is a counterfactual-alternative of \( a \).

Let us assume that if + counterfactual subjunctive has the same meaning. (Clearly if and that don't in general have the same meaning; something about the meaning of an if clause forces it to show up in specific semantic contexts. However, I am not taking up the distribution of if clauses here.) The first thing to note is that, because this meaning is not a proposition, but instead a propositional function, the above definitions will need to be modified somewhat. Second, we must consider whether the proposition denoted by a subjunctive is persistent. Recall that a propositions \( p \) is persistent iff, for all situations \( s \) and \( r \), if \( s \in p \) and \( s \prec r \), then \( r \in p \). Persistence is important because nonpersistent propositions aren't necessarily true in worlds, while entailment, which is crucial in (79), is defined in terms of worlds. The presupposition part of (61) has no problem for persistence. For \( s \) to be a counterfactual alternative of \( a \), there must be no world that has a duplicate-counterpart of each. Any situation \( r \) containing such an \( s \) will also be a counterfactual alternative of \( a \), because if a world contains a duplicate-counterpart of \( r \), it also contains a duplicate-counterpart of \( s \) and so can't contain a duplicate-counterpart of \( a \). Whether the assertion part of (61) entails persistence depends on the meaning of the \( S \). In indicative clauses, I have been assuming that tense adds persistence. Counterfactual subjunctives seem to show the presence of a tense
morpheme, as seen by the fact that they undergo sequence of
tense shifts ((24a-b)) as well as the presence of contrasts like
(82):

(82a) I wish he were here.
(82b) I wish he had been here.

Because the counterfactual subjunctive only shows
morphologically the past and past perfect, one might argue that it
had no true tense (as opposed to aspect) contrasts, and so really it
has no tense. While semantically this may be true, it is clear that
morphologically and syntactically a past tense morpheme must be
present. Though this morpheme's semantic role may be to mark
the counterfactual subjunctive, and not be a real past, I will
assume that it also makes the clause persistent, like other tense
morphemes. This assumption is not really crucial, since, as will be
seen in the next subsection, infinitives are not persistent, and so
we have to make provision for nonpersistent antecedents of
conditionals anyway.

The following revised interpretation of *would* takes account
of the fact that the antecedent denotes a propositional function.

(79a') A *would* counterfactual with antecedent P and
consequent q is true in a world w if and only if for
every set in $F_{w,P(s)}$ there is a superset in $F_{w,P(s)}$ which
logically implies q.

s is some actual situation contextually, i.e. potentially non-
linguistically. supplied--the situation the counterfactual is in some
sense 'about'. (In the default case, if the counterfactual can't be
said to be 'about' any particular situation. s can be the actual

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world.) \( P(s) \) will be a set of situations presupposed not to be actual. In the case of (15), it will be the set of situations

\[(83) \quad \{s' : \text{Bill is here with me in } s'\}\]

presupposition: No world has both a duplicate-counterpart of \( s \) and a situation in \( \{s' : \text{Bill is here with me in } s'\} \).

\( s \) intuitively is the situation in which Bill might have been here with me, but wasn't. Since \( s \) is actual, it is presupposed that Bill is not here with me. Because the assertion of \( P(s) \) is the same as the 'p' utilized by Kratzer, the meaning of (15) will be identical to that calculated in the last section. However, (15) will only be defined if the presupposition that he is not here is met. To fully formalize this, it would be necessary to cast the discussion in terms of an appropriate theory of presupposition, such as that of Heim (1982). This is undertaken in §4.5. However, this is roughly how the reasoning goes: The import of (83) is spelled out in (84).

\[(84) \quad \text{for any situation } s, \]
\[\text{if } s \text{ and him being here are compatible, } [\text{he were here with me}] (s) \text{ is undefined.} \]
\[\text{otherwise, } [\text{he were here with me}] (s) = \{s' : \text{Bill is here with me in } s'\}\]

Let \( C \) be the set of worlds which are compatible with everything in the conversational background. Because \( s \) is contextually filled-in and actual, we know that every \( w \in C \) fails to have \( s \) as a part. Incorporating this reasoning and projecting the presupposition to the whole conditional, we get:
A counterfactual conditional ‘if P then q’, with s the contextually filled in, actual situation, is felicitous with respect to a context C iff for all w ∈ C, w ∈ P(s).

(15) will only be felicitous if the conversational background implies that he is not here.

4.4.3 Counterfactual Conditionals and Infinitives

The purpose of this section is to understand examples like those in (16), in which an infinitive serves as the antecedent of a counterfactual would or might.

(16a) For Bill to have won would have been great.

(16b) It would have been great for Bill to have won.

There are two major issues to address before we can go on to detailed analysis. One is the fact that the meanings provided so far for infinitives are not persistent propositions; this is a problem because entailment, which plays a crucial role in the meanings of would and might, is defined in terms of the worlds a proposition is true in. The other is the lack of a counterfactual presupposition for many infinitives, in contrast to subjunctives. The latter problem will be taken up in more detail in the next subsection. At this point it is necessary to anticipate a bit, however. I will argue that infinitives in 'counterfactual' conditionals never share the counterfactual presupposition of subjunctives, but that, when the conditional is past (really, perfect: would/might have), there is a conventional implicature that the antecedent is false. This implicature will explain why the infinitives in (16) do seem counterfactual.
The problem of the lack of persistence of infinitives could be met simply by changing the meaning of infinitives. In place of

\[(56) \text{ [for NP to VP]} = f_{<S, <s, t> >} : \text{for any } a \in S, f(a) = \{s : s \text{ has as its initial segment a duplicate-counterpart of } a \text{ and } [NP \ VP] \text{ is true in } s\}\]

we could use

\[(86) \text{ [for NP to VP]} = f_{<S, <s, t> >} : \text{for any } a \in S, f(a) = \{s : \exists s'(s' < s \& s' \text{ has as its initial segment a duplicate-counterpart of } a \text{ and } [NP \ VP] \text{ is true in } s')\}\]

This change would not make a difference to the semantics of *hope*, *wish*, *want*, or *desire*. Recall the meaning \((57)\) for *hope*.

\[(57) \text{ [hope]} = f_{<S, <s, t> >} : \text{for all } P \in D_{<S, <s, t> >}, a \in D_e, f(P)(a) = \{s : \forall r(r \text{ is a hoped-for situation for } a \text{ with respect to } s \rightarrow \exists s'(s' \in P(s) \& s'<r))\}\]

The question is, with \(P(s)\) now, in the case of infinitives, a bigger, persistent set, would new and unwanted sentences with *hope* come out true? The answer is clearly 'no', since any \(s'\) in \(P(s)\) which is part of a hoped-for \(r\) contains a minimal situation in the old, nonpersistent definition of \(P(s)\) that is also part of \(r\).

Unfortunately, the proposed change in the meaning of infinitives would be disastrous for the treatment of *believe* and *claim*. It was claimed that these verbs could not embed infinitives because they could only be true of propositions that contain worlds. With the changed meaning for infinitives, their denotations will now contain whole worlds, however, so sentences like
(52b) *I claim for him to be coming.

should be fine.

An alternative to adjusting the meaning of infinitives is to change the definition of $F_{w,p}$ so that (56) acts as if it is persistent for purposes of counterfactual reasoning. This is the approach I will follow. Add to (78):

(iv) for all $q \in A$, for all $r \in D_{<s,t>}$, if $\forall s (s \in r \rightarrow \exists s'(s' \in q \& s' < s))$, then $r \in A$.

The infinitives in (16) will enter into a Logical form like (87).

(87) would ($\langle s_i \text{ for Bill to have won} \rangle$) ($x_i$ was great).

We must decide on an interpretation for $x_i$. The first issue is its type: is it of type $e$ (similar to cases with gerunds) or of type $<s,t>$? If the former, the sentence would mean, roughly, 'if Bill were to have won, the situation in which he won would have been great.' If the latter, 'if Bill were to have won, that he won would have been great.' The second seems more accurate, and this intuition is backed up by (17).

(17) If Bill were to have won, it would have been great.

(17) is seems to be synonymous with (16), and there is no precedent for believing that if Bill were to have won can restrict a situation variable.29 We should try to treat $x_i$ like this it.

29 An example like

(i) If Bill were to have won, it would have caused a riot.

does seem to have a reading on which it refers to the possible winning event. This may be a case of accommodation, since the subjunctive is perfect and therefore presumably stative. This it refers to an event related to the antecedent, but not one actually in its denotation, which is a set of situations in which Bill has won, and not in which he wins. However, I do not want to claim that subjunctive clauses can never restrict situation
$x_i$ and $it$ are definite NP's, picking up on an entity already introduced in the discourse; the subjunctive or infinitive antecedent act like indefinite NP's, introducing the entity. However, in these cases the entity is a proposition. Other, simpler, examples exist:

(88) A: Mary's here.
    B: Is it true?

A first attempt at formulating the restriction on this $x_i$ or $it$ could be something like the following:

(89) The use of $x_{<s.t>\cdot i}$ is felicitous in a context C with respect to a variable assignment $g$ iff $C$ entails $[x_{<s.t>\cdot i}]^g$.

In other words, these propositional pronouns and variables must have as their reference some proposition already in the common ground. This requirement does not force our $x_i$ to pick up some proposition explicitly given in the discourse, and this is a bad effect.\(^{30}\) It is bad because not just any presupposed proposition can be filled in for $it$ and $x_i$; it must be 'that Bill won'. Given this, it seems that infinitive and subjunctive clauses must introduce propositions into the discourse in the same way that an indefinite NP introduces an ordinary entity. Here detailed formulation will be put off until §4.5, in which the claims of §§4.2-4.4 are variables, just that in these cases it does not. Thanks to B. Partee (p.c.) for pointing out example like (i).

\(^{30}\) Cf. Partee's contrast, discussed in Heim (1982), in the nominal domain:

(i) I dropped ten marbles and found all of them, except for one. It is probably under the sofa.
(ii) ?I dropped ten marbles and found only nine of them. It is probably under the sofa.

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formalized. The general idea, natural within Heim's (1982) file change semantics, is that the antecedent p of a conditional will always have an index, say i, and that one of the effects of interpreting the antecedent is to rule irrelevant any variable assignments which do not assign the proposition \([p]\) to \(x_{<s,1>,i}\).\(^{31}\)

It will also be necessary to find a way to allow both this case and that discussed in §4.2.2.4, in which an infinitive restricts a situation variable and the trace of the infinitive is interpreted as of type e. One possibility is that the infinitive with index i introduces two variables, \(x_{<s,1>,i}\) and \(x_{e,i}\). The former must refer to \([p]\) and the latter to a situation in \([p]\). Alternatively, we could have a mechanism for allowing the argument position to which the infinitive is related to cause the infinitive to restrict the right type (or sort) of variable. For example, whether the variable should be propositional or of type e could be recorded in the index. On this idea, (87) would really be something like:

\[(87')\) would \(([s_{<s,1>,i}\text{ for Bill to have won}]) (x_{<s,1>,i} \text{ was great}).\]

The infinitive will restrict variable \(x_{<s,1>,i}\), which is also the variable its trace is translated as, and if the wrong type of index were assigned (say \(s_{<e,i>}\)) the structure would be ruled out because \(be \text{ great}\) selects for a propositional subject.

Now I believe that (16)/(87) will receive the right interpretation. Again a situation \(s\) must be contextually supplied. Here I repeat the meaning for \textit{would}.

\(^{31}\)Perhaps \(x_{l,i}\) refers to the individual correlate of \(p\) (Chierchia (1984)). The difference between these possibilities is not relevant here.
A *would* counterfactual with antecedent $P$ and consequent $q$ is true in a world $w$ if and only if for every set in $F_w, p(s)$ there is a superset in $F_w, p(s)$ which logically implies $q$.

(16) asserts that every way of adding true propositions to

(90) \{s' : s' contains a situation whose initial segment is a
duplicate-counterpart of $s$ and in which he has won\},
while maintaining consistency, reaches a point when it entails

(91) has-been-great(\{s' : s' contains a situation whose initial
segment is a duplicate-counterpart of $s$ and in which
he has won\}).

This could be true because of some generic truth like

(92) It's always great when Bill wins.

Because of the perfect in the consequent of the example, there is a conventional implicature that Bill did not win.

### 4.4.4 The Presuppositions of Subjunctive *If* Clauses

The use of a conditional with *would* or *might* often indicates that its antecedent is false. (I will from now on call these *would* conditionals.) The account I would like to offer for this has two parts:

(i) Past *would* conditionals conventionally implicate that their antecedent is false.

(ii) Subjunctive clauses are presupposed to be false.

Karttunen and Peters (1979) argue that (ii) cannot be right, because of examples like (93).

(93) If Mary were allergic to penicillin, she would be showing exactly the symptoms she is showing.
Here one imagines a doctor running through various possible diagnoses, and perhaps after saying (93) concluding that Mary is allergic to penicillin. So how could the sentence possibly presuppose that Mary is not allergic to penicillin?

The solution to this puzzle is to realize that the conversational background can be adjusted in many ways during the course of a conversation. Semanticists often make the deliberate simplification of assuming that the conversational background only gets smaller and smaller as a conversation proceeds. In reality, at many times a speaker may want to overturn presuppositions that have governed the discourse up until then. The context would then be widened to include worlds previously ruled out. To do this, I claim, is one of the prime uses of would conditionals. The situation is similar to saying 'But wait, the present King of France isn't bald--I just remembered that there isn't a King of France any more.' This is why a sentence like (93), while actually refuting the proposition that Mary is not allergic to penicillin, gives the feeling that the idea that Mary may be allergic to penicillin is new and unexpected. It therefore validates another traditional nomenclature for the 'counterfactual conditional'--'hypothetical conditional'; it tells the hearer to widen the range of possibilities considered to allow for a hypothesis previously assumed false. Exactly which widened set is arrived at is a difficult problem (cf. Lewis (1979b)) that I cannot say anything more about here.

Another important factor to realize is that the presupposition of (93) may be met not only because the
proposition Mary is allergic to penicillin has been actively deemed false, but alternatively because the possibility has not even been considered. The context may lack worlds in which Mary is allergic to penicillin from the very beginning of a conversation, simply because the participants lack imagination. In such a case, uttering (93) is as if to say: 'We've been acting as if we knew Mary isn't allergic to penicillin, but if we step back for a moment, we'll see that she probably is.'

This view also partially explains the apparently varying amount of 'counterfactualness' present in past, present, and future would conditionals.

(94) If Jack had been there, Jay would have smiled.
(95) If Jack were there, Jay would smile.
(96) If Jack were to go there, Jay would smile.

As discussed by Lewis (1979c), we generally hold our opinions about the past more strongly than those about the present, and the latter in turn are held more strongly than opinions about the future. In many cases, an opinion about the future is little more than a working assumption, one that we're quite ready to discard if given a good reason. This is why, in (96), all we can conclude about the antecedent is that the speaker doesn't expect that Jack will go there. The possibility that Jack will go there had been tentatively ruled out for whatever reason, but now perhaps the speaker is wondering if, in fact, it shouldn't have been ruled out. For example, one possible scenario for saying (96) is when the speaker has control over whether Jack goes there. He or she may have previously decided that Jack should not go, but upon
realizing that Jay would smile. the speaker says (96) to explain why he or she will overturn this prior narrowing of the common ground. So after saying (96) the set of worlds considered still possible may have actually widened to include worlds in which Jack will go there.

(95) yields a somewhat stronger disinclination than (96) to believe that Jack is there. This is because an opinion about the present is generally more than a mere expectation or working assumption; it is a premise that probably has good deal of other information about the present to back it up. Lastly, beliefs about the past usually have more evidence behind them than those about either the future or the present. Therefore (94) tends very strongly to be viewed as a contrary-to-fact, though it doesn't absolutely have to be. We can get a similar effect with a present or future conditional by choosing an antecedent the falsity of which the speaker could be very sure of.

(97a) If Bill were here, I would smile.

(97b) If Bill were coming to my party tomorrow, nobody else would come.

In these cases, the presupposition won't be undone because the speaker has good reason for holding onto it.

At the beginning of this subsection, I also proposed that past *would* conditionals carry an implicature that their antecedent is false. This implicature might not seem really necessary anymore, given the considerations of the last paragraph. However, there is evidence for it in the contrast between subjunctive antecedents and infinitive antecedents. Note that, while both infinitives and
subjunctives in past *would* conditionals tend to be considered counterfactual, in the present infinitives have no sense of being contrary to expectation or opinion.

(98) For Mary to have won the prize would have made us happy.
(99) If Mary were to have won the prize, it would have made us happy.
(100) For Mary to be on speaking terms with Joe would make us happy.
(101) If Mary were on speaking terms with Joe, it would make us happy.

(100) is not contrary-to-belief, in contrast to (101).

Next, consider the contrast between (102) and (103).

(102) A: Mary is winning the race.
    B: Yes, I agree.
    A: But wait, if Bill were winning the race, it would really excite the fans, and that could explain all the screaming we hear from the stadium.
    B: Oh yes, Bill must be winning.

(103) A: Mary is winning the race.
    B: Yes, I agree.
    A: ??But wait, for Bill to be winning the race would really excite the fans, and that could explain all the noise we hear coming from the stadium.
    B: Oh yes, Bill must be winning.
The questionable sentence in (103) is fine in other contexts, such as (104).

(104) Now that it seems possible that Bill is winning the race, everything is so much clearer. For example, for Bill to be winning the race would really excite the fans, and that explains all the noise we hear coming from the stadium.

However, in a context such as (103), in which the antecedent is explicitly contrary to what the speaker and hearer assume, only a subjunctive is possible. This indicates that the proposed presupposition of subjunctives is not shared by infinitives. In fact, (103) shows that the infinitive must be incompatible with a context supporting such a presupposition, and the presupposition assigned to infinitives in §4.2 captures this.

Our study of infinitives and subjunctives in general has led us to a better understanding of the pragmatics of so-called counterfactual conditionals. Karttunen and Peters' conclusion that subjunctive antecedents are not presupposed to be false is based on a too inflexible notion of presupposition. In fact, one of the main uses of these subjunctives is to be part of a sentence that refutes its presupposition. These would conditionals have the use of giving a reason why the common ground is too narrow, and should be widened. This use is best seen in (102). On the other hand, Karttunen and Peters are right in claiming that conditionals with subjunctive antecedents implicate that their antecedents are false. This implicature is limited to past would conditionals, but
extends beyond subjunctive conditionals to cases in which an infinitive is antecedent as well.

4.5 Formalization of the Claims of §§4.2-4.4

In this section the ideas presented so far in this chapter will receive a formal exposition. In the process, the more intuitive semantic values attached above to the subjunctive, for infinitives, and tense will be refined somewhat. This task involves detailed discussion of four semantic issues: First, what is the meaning of the complementizers that and for? Second, How do we formalize the meanings of the two types of English subjunctive, the mandative/optative and the counterfactual? Third, what is the interpretation of the future tense, such that the contrast between infinitives and future tense indicatives discussed in §4.3.2.2 comes out? And lastly, how should we formalize the meanings of the words claim, hope, wish, want, and desire? In §4.5.1 these four topics will be taken up one by one, and then in §4.5.2 some of the examples that are crucial to the claims of this chapter will be worked through in detail. This process will show how the predictions presented informally above can be derived in a rigorous way.

4.5.1 Formalization

4.5.1.1 The Complementizers

One of the functions of the complementizers is to take an ordinary proposition and turn it into a meaning that is dependent on the reference situation of whatever operator it is embedded
under. For example, in (105), we want *that* to turn the
proposition that James walked into the something that, when
relativized to the situation s of Sarah's saying, will return the
proposition that James walked, with those walkings simultaneous
with s.

(105) Sarah said that James walked.
The way of approaching this task suggested in the informal
discussion of above is to make *that James walked* translate into an
expression of type <s,<s,t>>. Let's call the function denoted by this
translation TJW. In order to do the relativization, we would want
to apply the function TJW to the reference situation: TJW(s).
(106) gives a possible translation for (105), with tJw' the
translation of *that James walked*, and (107) shows the meaning
that this results in. It is the meaning of *say* that, in effect, applies
TJB to the reference situation, here s'.

(106) Sarah₁(\text{past}(\text{say}(x_1)(tJw')))

(107) Sarah said that James walked. denotes that function
\begin{align*}
&\text{fe } D_{<s,\lambda>} \text{ such that, for any } s \in S, f(s)=1 \text{ iff for some } s'<s, s' \\
&\text{ precedes } u \text{ and for every } w \in S \text{ that is a world} \\
&\text{ compatible with what Sarah says in } s', \text{ TJW(s')(w)=1.}
\end{align*}
s' is a basic saying situation. It must be past, and for a
situation s to be in the denotation of (105), s must contain s'; this
much is contributed by the matrix tense. The worlds w are those
that are compatible with what Sarah said in s', and (105) is only
true if every such w is a situation in the proposition TJW(s').

What situations does TJW(s') denote? By figuring this out,
we will be able to arrive at the meaning of *that* by itself. What
we want to do is make TJW(s') refer to the proposition that James walked refers to if its reference situation is s'. In the informal discussion of §4.3, I acted as if all that had to be done to properly use reference situations is say something like the following (where JW is the denotation of James walked):

(108) TJW(s') denotes that function $f \in D_{s,t}$ such that, for any $s'' \in S$, $f(s'') = 1$ iff $s'$ and $s''$ have the same time and $\text{JW}(s'') = 1$.

This is incorrect for two reasons. One problem is that the only situations $s''$ that will be able to meet the condition $s'$ and $s''$ have the same time are quite small situations, since $s'$ is a minimal saying situation, and so whole worlds will never be in the denotation of TJW(s'). This is a problem because, as we see from (107), we do want whole worlds to be in TJW(s'). The discussion in §4.3.1, concerning believe and claim, shows why the possibility of whole worlds being in the denotation of a that clause is crucial. Thus we need to have a that clause denote a function which, when it is applied to a situation, results in a persistent proposition.

The other complication is that, of course, reference situations can be used in a greater variety of ways than just enforcing simultaneity of some events. For instance, with the subjunctives, the reference situation can be required to be an obliging situation (mandative/optative subjunctive) or can be used to distinguish the counterfactual worlds from the non-counterfactual worlds (counterfactual subjunctive). With infinitives, the proposition expressed must be possible with respect to the reference situation, and the situations denoted by the infinitive are all
future extensions of the reference situation. Thus, we will do better to treat it as a parameter of interpretation, and not try to settle within the meaning of *that* the use of the reference situation. All *that* does is identify the evaluation situation of a higher predicate with the reference situation of the embedded clause; it places no restrictions on what importance the reference situation may have for that embedded clause.

In order to develop a more adequate interpretation of TJW(s') than that given so far, we will now interpret phrases with respect to a model, a context of utterance, a Heimian context, a reference situation and a pair of a variable assignment and a situation. What is new here is the use of the reference situation.

(108') \[ \text{that James walked} \mathcal{M}_{u,C,r,g}.s(s') = 1 \text{ iff, for some } s'' < s', \text{ r is simultaneous with } s'' \text{ and } s'' \text{ precedes } u \text{ and } p;\mathcal{M}_{u,C,r,g}.s(s'') = 1. \]

(Recall that $S$ is the set of situations.) This meaning for the *that* clause does result in a proposition containing whole worlds. Furthermore, *James walked* has its reference situation identified with the situation, here $s'$, that (108') takes as argument. Tense is able to be sensitive to this parameter. So the past tense, for instance, has the following interpretation:

\[ \text{[past(p)]} \mathcal{M}_{u,C,r,g}.s(s') = 1 \text{ iff, for some } s'' < s', \text{ r is simultaneous with } s'' \text{ and } s'' \text{ precedes } u \text{ and } p;\mathcal{M}_{u,C,r,g}.s(s'') = 1. \]

We will look at the revised meanings for tenses in more detail as we discuss examples in §4.5.2.
Now we can abstract out of (108) a meaning for *that*. It is given in (109).

(109) *that* denotes that function $t \in D_{<S,I>1,<S,I>}$ such that, for any $p \in D_{<S,I>}$, $t(p)$ is that function $h \in D_{<S,I>}$ such that, for any $s' \in S$, $h(s')$ is that $f \in D_{<S,I>}$ such that for any $s'' \in S$, $f(s'') = 1$ iff $p_{1}^{M.u.C.s'.g.s}(s'') = 1$.

With $t$ the meaning of *that* and JW the meaning of *James walks*, $t(JW)$ is the interpretation in (108).

This analysis differs from usual treatments of *that* clauses as simply denoting propositions. Here, *that* clauses denote something we can intuitively see as an incomplete proposition, a proposition without a reference situation. They therefore lack crucial parameter of interpretation, and this is why they are semantically dependent. The role of *that* can therefore be seen as to make a dependent proposition-denoting expression, and hence it serves to link the situational reference of the embedded clause with that of the matrix. In this way, the traditional notion of 'subordinator' is given a formal characterization.

Now we will develop a meaning for *for*. The hard work has already been done in §§4.2-4.4. I will use (110) to illustrate the discussion:

(110) James hopes for Sarah to leave.
An appropriate denotation of *for Sarah to leave* is (111).

(111) *for Sarah to leave* denotes that function \( f \in D_{<s',<s,t>} \)

such that, for any \( s' \in S \), \( f(s') \) = that function \( h \in D_{<s,t>} \) such

that, for any \( s'' \in S \), \( h(s'') = 1 \) iff \( s'' \) has as its initial

segment a duplicate-counterpart of \( s' \) and Sarah leaves

in \( s'' \).

**Presupposition of [for Sarah to leave]**

There are \( r', s'' \in S \) such that \( r' < r \) and [for Sarah to leave] \( m.u.c.s', g.s(r) \) = 1 and \( r' \) and \( s'' \) are not counterfactual alternatives of each other.

(Alternatively)

Presupposition of [for Sarah to leave]

There are \( r', s'' \in S \) such that \( r' < r \) and [for Sarah to leave] \( m.u.c.s', g.s(r')(s'') = 1 \) and \( s'' \) is possible.

The second version of the presupposition given here is somewhat simpler to read. However, it has the disadvantage of containing all the ambiguity of the word *possible*. I would like to claim that the sense of possibility relevant here is exactly that derived from the idea of 'counterfactual alternative'. And 'counterfactual alternative' is going to show up again in the meaning of the counterfactual subjunctive. For this reason, the first formulation is the official one.

This is very similar to the meaning used in earlier sections; existential quantification over \( r' \), a situation which is part of the reference situation, is introduced because the reference might be "too big" to properly grow into a situation in which Sarah leaves.
For example, the actual hoping situation might stretch far into the future beyond Sarah's leaving, if James is unaware that Sarah has left. (This point will become more clear when examples are discussed in §4.5.2.) Assuming that *Sarah to leave* simply denotes \[\text{[leave]}_{M,u,C,s'\cdot g.s}(\text{Sarah}),\] we can deduce that (112) is the meaning of *for*.

(112) *for* denotes that function \(f \in D_{<s,t>,<s',<s,t>>}\) such that, for any \(p \in D_{<s,t>,<s',<s,t>>}\) such that, for any \(s' \in S, h(s') = \) that function \(k \in D_{<s,t>}\) such that, for any \(s'' \in S, k(s'') = 1\) iff \(s''\) has as its initial segment a duplicate-counterpart of \(s'\) and for some \(s''' < s'', p(s''')\).

presupposition of *for*(\(p\))(\(r\)): There are \(r', s \in S\) such that \(r' < r\) and *for*(\(p\))(\(r'\))(\(s\)) = 1 and \(r'\) and \(s\) are not counterfactual alternatives.

With this \(f\) as the meaning of *for* and STL the meaning of *Sarah to leave*, \(f(\text{STL})\) is the interpretation given in (111). Recall that the notion of 'counterfactual alternative' is always relativized to some type of epistemic modality. In other words, not just the existence of any \(s \in S\) which has the characteristics mentioned in (112) will do to satisfy the presupposition: \(s\) must not be in too crazy a world. For \(s\) and \(r\) to not be counterfactual alternatives with respect to a some set of worlds \(U\), some world in \(U\) must contain a duplicate-counterpart of \(s\) and a duplicate-counterpart of \(r\). \(U\) will typically either be the set of worlds in the context \(C (U = \{w : \exists g(<g,w> \in C)\})\) or the set of worlds compatible with what some attitude holder believes.
4.5.1.2 The Meanings of the Subjunctives

This subsection gives the meanings and presuppositions of the mandative/optative subjunctive and the counterfactual subjunctive. I will assume that mood is an operator on $S'$, so that a counterfactual subjunctive mood clause $S'$ is translated by $c$-subj$(S'^*)$, where $S'^*$ is the translation of $S'$.

First let us look at the mandative/optative. Here I will use the symbol $O$ to mean 'is an obliging situation'. That is, $O(s)$ is true iff $s$ is a situation in which (i) someone has a duty imposed on them ($s$ is an 'ought to do' situation) or (ii) some situation is rated as preferable ($s$ is an 'ought to be' situation). Hopefully the reader agrees that $O$ represents a natural set of situations. (113) will be the example sentence for discussing the mandative optative.

(113) It is desirable that Mary be found.

We want to build up a meaning for That Mary be found that (i) has the effects discussed in §§4.2-4.4 and (ii) interacts correctly with the meaning for that. Task (ii) will force us to have a more complicated system than that used in §§4.2-4.4; there, that used with subjunctives was assumed to be semantically transparent, and subjunctives were considered to be relativized to the reference situation of themselves, without the intervention of that. Of course it will be better, if a bit more complicated, to have a consistent meaning for that which always relativizes a proposition to a new reference situation. Indeed, I believe doing so will give a fair formalization of the traditional view that that serves to semantically subordinate one proposition to another.
Consider the following meaning for the untensed, but not yet subjunctive that Mary be found.

(114) that Mary be found denotes that function \( h \in D_{<s,<s,t>} \) such that, for any \( s' \in S \), \( h(s') = \) that \( f \in D_{<s,t>} \) such that, for any \( s'' \in S \), \( f(s'') = 1 \) iff \([\text{Mary be found}]_{M.u.C.s'.s.s(s'')} = 1\).

The \textit{m-subj} operator will apply to this meaning. Note that \textit{Mary be found} is an infinitive, since it has not had any tense, or for that matter other persistent-proposition-making operator, applied to it. Thus, the only situations in \( h(s') \), as defined in (114), will minimal finding situations. One might think that this would cause a problem with sentences like (115).

(115) It is desirable today that Mary be found tomorrow.

The problem that threatens is that the desiring situation and the finding situation might be required to be simultaneous. As a comparison, recall that in the case of a past tense complement, as we have seen above, the time of the reference situation and that of the 'event' situation must be the same. Clearly, in light of (115), this would be unacceptable with subjunctive complements. However, it was the tense of (105) that was sensitive to the reference situation, and the lack of tense in (113) means that the proposition embedded under \textit{that} will ignore the reference situation.

Now we can go on to look at the meaning for the mandative/optative subjunctive. First, (116) gives the kind of meaning we would like to derive for a whole clause in the end.
(116) *that Mary be found* denotes that function
\[ h \in D_{<s,\langle s, l \rangle >} \text{ such that, for any } s' \in S, \text{ if } O(s') \text{, then } h(s') = \]
\[ f \in D_{<s, l >} \text{ such that for any } s'' \in S, \text{ } f(s'') = 1 \text{ iff } \]
\[ MBF(s'') = 1. \text{ (and } h(s') \text{ is undefined otherwise.)} \]

(116) says that the denotation of mandative/optative subjunctive
is a function which is only defined for obliging situations. In a
sense, *that Mary be found* presupposes that its reference
situation is in \( O \). However, for our purposes there's no reason to
write out a separate presupposition.

(117) extracts the contribution of \( m\text{-subj} \) from (116).

(117) \( m\text{-subj} = \text{ that } f \in D_{<s,\langle s, l \rangle >, <s, <s, l >> \text{ such that, for any } q \in D_{<s, <s, l >}, f(q) =\text{ that } h \in D_{<s, <s, l >} \text{ such that, for any } c \in S, \}
\[ \text{if } O(c) = 1, \text{ then } h(c) = q(c). \text{ (and } h \text{ is undefined otherwise.)} \]

All the mandative/optative subjunctive does is require that the
reference situation be an obliging situation.

A brief aside is in order here to examine the following
question: why can't \( m\text{-subj} \) apply to a tensed proposition? The
type of explanation used throughout this chapter seems to apply
here as well. If a situation \( s \) is an obliging situation, the one who
obliges cannot believe that it is already determined whether what
is obliged will be the case. However, as discussed in §4.3, such a
belief of determination is exactly what a tensed complement
introduces. In other words, the problem with having a tensed
mandative/optative is the same as that caused by using *wish*,
*want*, or *desire* with a tensed indicative. These verbs through
their lexical meaning restrict the reference situation in a way
incompatible with tense. The mandative/optative likewise restricts the reference situation in a way incompatible with tense, but in this case the difficulty is due to grammatical form rather than lexical content.

Now we will develop a formal version of the meaning of the counterfactual subjunctive. As was noted above, the only effect of the counterfactual subjunctive is on presupposition. So, with an example like (118), we want the complement to have a meaning like that in (119).

(118) Bill wishes that Mary were in Boston.

(119) \([\text{that Mary were}_{(\text{+c-subj})} \text{ in Boston}] \text{M.u.C.s'.g.s}= \text{that f} \in D_{s'<s>} \text{ such that, for all s''} \in S, f(s'')= [\text{that Mary were in Boston}] \text{M.u.C.s'.g.s}(s'').\]

Presupposition of \([\text{that Mary were}_{(\text{+c-subj})} \text{ in Boston}] \text{M.u.C.s'.g.s}(s'')\): for all s''\in S such that [Mary were\text{_{(+c-subj)} in Boston}: M.u.C.s'.g.s(s'')(s'')=1, s'' and s''' are counterfactual alternatives.

Of course [that Mary were in Boston M.u.C.s'.g.s(s'') is [Mary were in Boston] M.u.C.s''.g.s. Thus, the presupposition expressed in (119) is this:

(120) Presupposition of \([\text{that Mary were}_{(\text{+c-subj})} \text{ in Boston}] \text{M.u.C.s'.g.s}(s'')\): for all s''\in S such that [Mary were\text{_{(+c-subj)} in Boston}: M.u.C.s''.g.s(s'')] =1, s''' and s'' are counterfactual alternatives.

(121) now gives the meaning of c-subj.
(121) \(c\)-subj = that \(f \in D_{<s,<s,l>>} \) such that, for any
\(q \in D_{<s,<s,l>>} \), \(f(q) = q\).

Presupposition of \(c\)-subj(q)(r): for all \(s \in S\) such that
\(c\)-subj(q)(r)(s)=1, \(r\) and \(s\) are counterfactual
alternatives.

(121) reflects that idea that the counterfactual subjunctive adds a
presupposition to its clause, but does not affect its assertion at all.

4.5.1.3 The Future

What I would like to do in this section is defend the idea
that English \textit{will} denotes a relative tense and give a meaning for
it. By calling the future a relative tense, I mean to suggest that it
has a meaning generally like that in (122a), and not (122b).

(122a) Fut(p) is true in a situation \(s\) iff for some \(s'\) which
follows \(s\), \(p\) is true in \(s'\).

(122b) Fut(p) is true in a situation \(s\) iff \(s\) follows the
reference situation and \(p\) is true in \(s\).

The meaning that has been given for the past tense is the mirror
of (122b); past(p) is true of actually past situations, and not
present situations which are preceded by situations satisfying \(p\).
In contrast, I assume that the perfect is a relative tense, with the
present perfect being the mirror of (122a). Very roughly, perf(p)
is true of a situation \(s\) iff \(p\) is true of some \(s'\) which precedes \(s\).
The issue of whether the future is a relative tense is complex and
the topic of much debate. (See Binnick (1991) for discussion and a
recent bibliography.) Here I would just note that the syntactic
form of will clauses in English suggests that the meaning of (122a) would be more appropriate. Embedding verbs generally introduce a new situation into the semantic representation; for instance, the meaning of claim from §4.3.1, repeated here,

\[ (53a) \text{[claim]} = \{s : \forall w[w \text{ is a claimed world for } a \text{ in } s \rightarrow w \in p] \}\]
does not identify the claiming situation (s) with the situations which satisfy its complement (w). Instead, the meaning of the verb relates them in a complex way. That the future is also represented by a verbal embedding structure suggests that it should be 'relative' in the way claim and perfect have are.

It is crucial to the explanation of why verbs like wish and want cannot embed future tense indicatives that the future be a relative tense. According to the theory developed above, the for infinitive is the closest thing in English to a true, non-relative, future. One can believe that the truth of an infinitive is as-of-yet undetermined because it denotes a set of situations which are partially in the future. In contrast, the basic situations in the denotation of a future indicative are not future at all, but present. One cannot believe that their existence is undetermined.

(123) gives a meaning for He will come.

\[ (123) [\text{he will come}]^{M.u.C.r.g.s} = \text{that } f \in D_{<s,t>} \text{ such that, for any } s' \in S, f(s')=1 \text{ iff } r<s' \text{ and for some } s'' \text{ which follows } r, [\text{he come}]^{M.u.C.r.g.s}(s'')=1. \]

He will come is true of a situation iff it contains the reference situation and the reference situation is followed by a situation of
which *He come* is true. Therefore the future *will* has this meaning:

\[(124) \text{[will]}^{M,u.C.r.g.s} = \text{that } f \in D_{<s,t>,<s,t>} \text{ such that, for any } p \in D_{<s,t>}, f(p) = \text{that } h \in D_{<s,t>} \text{ such that, for any } s' \in S, h(s') = 1 \text{ iff } r < s' \text{ and for some } s'' \text{ which follows } r, p(s'') = 1.\]

We may want to put some more restrictions on (124). For instance, perhaps only states and situations which have a state as a part should be able to be in the denotation of *he will come*. I will leave this matter open.

### 4.5.1.4 Aspects of the Semantics of Attitude Verbs

In this subsection I will discuss the meanings of the five attitude verbs *claim*, *hope*, *wish*, *want*, and *desire*. Then, in §4.5.2 these meanings will be used in formalizing some of the reasoning of §4.3 above.

#### 4.5.1.4.1 Claim

The meaning given in §4.3.1 for *claim* must be adjusted somewhat to fit it into the formal system. Here is the revised meaning.

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32Here and below sometimes I do not relativize the interpretation of constants to the model, utterance situation, etc. This indicates that the intended F, the part of M that assigns semantic values to constants, provides the interpretations given.
(125) \[\text{claim} = f_{c,<c,<s,t>>}: \text{for all } p \in l \text{ of sort } +<s,<s,t>>, f(p) = \]
that \(h \in D_{<c,<s,t>>}\) such that, for any \(c \in l\), \(h(c) = \)
that \(k \in D_{<s,t>}\) such that, for any \(s \in S\), \(k(s) = 1 \iff \forall w[w \text{ is a}
world compatible with what } c \text{ claims in } s \rightarrow
\]
[\[-p](s)(w) = 1].

Two main things have changed here. First, the first argument of
\textit{claim} is now an individual--the individual correlate of some
higher-order meaning. Here, \([-p]\) is the function that this first
argument is the correlate of. (I am using the '\-' in the
metalanguage to indicate the same shift it does in the object
language.) This has been done in accordance with the proposal in
Chapter 2, in which I follow Chierchia (1984), that all verbal
arguments are entity-denoting or propositional. The other change
is that this first argument, \(p\), is not (the correlate of) a proposition,
but (the correlate of) a denotation in \(D_{<s,<s,t>>}\). This move should
not come as a surprise either, as it is required by the treatment of
\textit{that} above. \([-p]\) is first applied to \(s\), the reference situation, in
order to yield a properly relativized proposition which either will
or won't be true in \(w\).

4.5.1.4.2 Hope

The rest of the verbs to be discussed, \textit{hope}, \textit{wish}, \textit{want}, and
\textit{desire}, all have the same basic meaning. (126) gives it
schematically.
(126) \[ V ] = f_{<e,<c,<s,t>>}: \text{for all } p \in \text{I of sort } +<s,<s,t>, f(p) = \text{that } h \in D_{<e,<c,<s,t>>} \text{ such that, for any } c \in I, h(c) = \text{that } k \in D_{<s,t>} \text{ such that, for any } s \in S, k(s) = 1 \text{ iff } \forall s'[c V's (for) s' in s } \rightarrow [-p](s)(s') = 1].

This interpretation is intended to apply across all uses of these verbs with propositional complements, whether infinitive, subjunctive, or indicative. The meanings of these verbs involve quantification over arbitrary situations, instead of the quantification over whole worlds used in the semantics for claim and believe. As discussed in §4.3, believe and claim cannot utilize quantification over arbitrary situations because of their intrinsic semantics.

In addition to the general meaning of (126), there will be more specific restrictions on the interpretation of each of the attitude verbs hope, wish, want, and desire. The restrictions are intended to capture the subtle differences among the meanings of these verbs, and will be used to explain, in a more formal way than was done in §4.3.2, the restrictions on the types of propositional complements that each verb can take. Examples (10)-(13) presented the pattern that we are trying to understand. Briefly, it is the following: hope occurs with infinitives and indicatives; wish occurs with infinitives and counterfactual subjunctives; want occurs only with infinitives; and desire occurs with infinitives and mandative subjunctives.
For hope, (126) yields the following:

\[(127) [\text{hope}] = f_{e,e,<s,t>} : \text{for all } p \in I \text{ of sort } +e, <s,t>\text{, } f(p) =\]

that \( h \in D_{s,<s,t>} \) such that, for any \( c \in I \), \( h(c) = k \in D_{s,t} \) such that, for any \( s' \in S \), \( k(s) = 1 \iff \forall s'[c \text{ hopes for } s' \text{ in } s \rightarrow [\neg p](s)(s') = 1]. \)

Now, there is a restriction on what situations can be hoped for in (127). (128) presents two restrictions on the meaning of hope (for).

\[(128) \]

(a) \( \forall x \forall s \forall s'[x \text{ hopes for } s' \text{ in } s \rightarrow \text{it is possible (based on what } x \text{ believes in } s \text{) that } s' \text{ is/will be actual}] \)

(b) \( \forall x \forall s \forall s'[x \text{ hopes for } s' \text{ in } s \rightarrow \neg O(s)] \)

The part of (a) in parentheses indicates what kind of possibility is being used. As for (b), recall that \( \neg O(s) \) will mean that \( s \) is not an obliging situation. (a) and (b), as well as the corresponding restrictions on wish, want, and desire, will be used in formalizing the explanation in §4.3.2 of which complement classes each verb can occur with.

I think that (128a) is backed up by intuitions about hope for when it takes a situation argument directly. For example, if I hope for a good dinner, I must still think it's possible that I will get one.\(^{33}\) This kind of independent validation of the meaning postulate (128a) and its cousins below for other attitude verbs makes the explanations that are based on them significantly stronger.

\(^{33}\)Thanks to M. Cresswell for pointing out this example.
4.5.1.2.3  Wish

The meaning for wish is an instantiation of (126).

(129) \[ \text{[wish]} = f_{<c, c, <s,t>}> : \text{for all } p \in I \text{ of sort } +<s, <s,t>\text{, } f(p) = \]

\[ \text{that } h \in D_{<c, c, <s,t>}> \text{ such that, for any } c \in I, h(\text{c}) = \text{ that } \]

\[ k \in D_{<s,t>} \text{ such that, for any } s \in S, k(s) = 1 \text{ iff } \forall s'[c \text{ wishes for } s' \text{ in } s \rightarrow [\neg p](s) (s') = 1]. \]

The meaning postulates associated with wish are given in (130).

(130)

(a) \[ \forall x \forall s \forall s'[x \text{ wishes for } s' \text{ in } s \rightarrow \text{it is not possible (based on what } x \text{ believes in } s) \text{ that } s' \text{ is actual at the time of } s] \]

(b) \[ \forall x \forall s \forall s'[x \text{ wishes for } s' \text{ in } s \rightarrow \neg \Box(s)] \]

Postulate (130a) says that any wished-for situation is believed to not possibly exist already at the time of the wishing. However, it is compatible with wishing that the wisher believe that his or her wish will be satisfied in the future. (130b) is completely parallel to (128b). (130a) is backed up by intuition concerning (131).

(131) John wishes for a good dinner.

(131) could not be uttered if John is already having a good dinner. However, it is compatible with him currently eating a dinner he finds bad. Thus wish is compatible with a belief of counterfactuality, but not one of factuality.
4.5.1.2.4 Want

The meaning of want again comes directly from (126).

\[(132) \left[ \text{want} \right] = f_{\mathcal{C}, \mathcal{C}, \mathcal{S}, \mathcal{I}}: \text{for all } p \in \mathcal{I} \text{ of sort } +\mathcal{S}, \mathcal{S}, \mathcal{I}, \mathcal{C}, f(p) = \text{that } h \in D_{\mathcal{C}, \mathcal{C}, \mathcal{S}, \mathcal{I}} \text{ such that, for any } c \in \mathcal{I}, h(c) = \text{that } k \in D_{\mathcal{S}, \mathcal{I}} \text{ such that, for any } s \in \mathcal{S}, k(s) = 1 \text{ iff } \forall s'[c \text{ wants } s' \text{ in } s \rightarrow \neg \neg \neg p(s)(s') = 1].\]

The following restrictions hold on the meaning of want.

\[(133)\]

(ai) \( \forall x \forall s \forall s'[x \text{ wants } s' \text{ in } s \rightarrow \text{it is not possible (based on what } x \text{ believes in } s) \text{ that } s' \text{ is actual at the time of } s]\)

(aii) \( \forall x \forall s \forall s'[x \text{ wants } s' \text{ in } s \rightarrow \text{it is possible (based on what } x \text{ believes in } s) \text{ that } s' \text{ is/will be actual}]\)

(b) \( \forall x \forall s \forall s'[x \text{ wants } s' \text{ in } s \rightarrow \neg \neg \neg \neg O(s)]\)

(133ai) has the same form as the first restriction placed on wish, and (133aii) has that of the first restriction placed on hope. Thus want has the conjunction of the restrictions of these other two verbs. The combination of (ai) and (aii) requires that any wanted situation be at least partially future. A situation wholly not later than \(s\) would have to be believed to be both possible and impossible.

(134) backs up the validity of (133a).

(134) John wants a good dinner.

(134) is impossible if John is already eating a good dinner. It is also somewhat odd if he is currently eating a dinner which he believes to be bad. So want is not compatible with the belief of either present factuality or counterfactuality.
4.5.1.2.5 Desire

Finally, with desire the meaning is as expected:

\[(135)\] \[\text{desire } i = f^{<c,<c,\langle s,t\rangle>}, \text{ for all } p \in \mathcal{I} \text{ of sort } +<s,\langle s,t\rangle>, f(p) = \text{ that } h^{<c,\langle s,t\rangle>} \text{ such that, for any } c \in \mathcal{I}, h(c) = \text{ that } k^{\langle s,t\rangle} \text{ such that, for any } s \in S, k(s) \equiv \text{ iff } \forall s'[c \text{ desires } s' \text{ in } s \rightarrow [-p](s) (s') = 1].\]

The restrictions on desire are the following.

\[(136)\]

(a) \(\forall x \forall s \forall s'[x \text{ desires } s' \text{ in } s \rightarrow \text{ it is not possible (based on what } x \text{ believes in } s) \text{ that } s' \text{ is actual at the time of } s]\)

(bii) \(\forall x \forall s \forall s'[x \text{ desires } s' \text{ in } s \rightarrow \text{ it is possible (based on what } x \text{ believes in } s) \text{ that } s' \text{ is/will be actual}\]

(136) places the same restrictions on desire as (133a) places on want. There is no (136b). This means that a desiring situation may be an obliging situation.

4.5.2 Examples

In this section I would like to examine in detail the analyses of these sentences.

(137) Mary hoped for John to leave.

(138) *Mary hoped that John were leaving.

(139) *Mary wished that John will leave.

(140) Mary desired that John leave.

(141) If John were leaving, Mary would smile.

(17) If Bill were to have won, it would have been great.

These examples are similar to ones discussed in earlier sections.
A partial translation tree for (137) is given in (142).

(137) Mary hoped for John to leave.

(142)

\[
\text{IP; past(hope+for(leave\&john)))(mary)}
\]

\[
\text{NP; mary} \quad \text{VP; past(hope+for(leave\&john)))(x_1)}
\]

\[
\text{I; past} \quad \text{VP; past(hope+for(leave\&john)))(x_1)}
\]

\[
\text{PAST; past} \quad \text{VP; past(hope+for(leave\&john)))(x_1)}
\]

\[
\text{NP; t} \quad \text{V; hope+for(leave\&john))}
\]

\[
\text{CP; +for(leave\&john))} \quad \text{CP; for(leave\&john))}
\]

\[
\text{hope; hope} \quad \text{CP; for(leave\&john))}
\]

\[
\text{C; for(leave\&john))} \quad \text{C; for(leave\&john))}
\]

\[
\text{IP; leave\&john) \quad \text{IP; leave\&john) }
\]

The lower CP in (142) has the following denotation:

(143) that function \( f \in D_{<s_1,s_2>} \) such that, for any \( s' \in S \),

\[ f(s') = \text{that function } h \in D_{<s_1,s>} \text{ such that, for any } s'' \in S, \]

\[ h(s'') = 1 \text{ iff } s'' \text{ has as its initial segment a duplicate-counterpart of } s' \text{ and John leaves in } s''. \]

Presupposition: for a situation \( r \), \( f(r) \) is only defined if there are \( r', s \in S \) such that \( r'<r \) and \( f(r')=1 \) and \( r' \) and \( s \) are not counterfactual alternatives.
This meaning is just like that in (111). The higher CP simply denotes the individual correlate of this function.

Now let's examine the meaning of the whole sentence. FJL will be an abbreviation for the $f$ given in (143).

(144) Mary hoped for John to leave. denotes that $h \in D_{<s,t>}$ such that, for any $s \in S$, $h(s)=1$ iff for some $s''<s, s''$ precedes $u$ and $\forall s' [\text{Mary hopes for } s' \text{ in } s'' \rightarrow FJL(s')(s'')=1]$ 

Presupposition: Mary believes that there are $r', s' \in S$ such that $r'<s$ and $FJL(r')(s')=1$ and $r'$ and $s'$ are not counterfactual alternatives. 

The presupposition of the infinitive itself has been converted into a presupposed belief of Mary. How this comes about is a difficult topic that I will not get into (cf. Heim (1985; 1991)). What the presupposition says is that $h(s)$ is only defined if Mary believes that $s$ and John's eventually leaving are compatible. How this interacts with the context will be discussed shortly.

Now we must check that the meaning and presupposition given in (144) do not contradict the requirements of (128) on what can be a hope. (145) shows what we can conclude from (128) about each $s$ which satisfies (144).

(145)

(a) $\forall s' [\text{Mary hopes for } s' \text{ in } s \rightarrow \text{it is possible (based on what Mary believes in } s) \text{ that } s' \text{ is actual}]$

(b) $\forall s' [\text{Mary hopes for } s' \text{ in } s \rightarrow \neg O(s)]$

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There is clearly no problem with (b), since obligingness is not mentioned anywhere else. As for (a), the presupposition of (144) and the possibility requirement of hoping are very similar. While (144) says that, in situation s that contains Mary hoping, Mary must believe that s is compatible with some situation in which John leaves. (a) says that any situation s' hoped for in s must be compatible with what Mary believes in s. Surely for a situation to be compatible with what Mary believes in s, she may believe it to be compatible with s, so the requirement of (a) can be satisfied.

The next question is what happens when (144) is used to update the context. If C is the context before (137), C+(137) will be the set of assignment-situation pairs <g,s> in C such that h(s)=1 (where h is as given in (144)). However, h(s) is only defined in the circumstances given in the presupposition part of (144), and the update will only be defined if h(s) is defined for every situation in the context. Thus the context C will have to entail that Mary believes that it is possible that John will leave. This is exactly the kind of presupposition we want.
Now we will go on to explain an ungrammatical case.

(138) *Mary hoped that John were leaving.

The denotation and presupposition of the *that clause is given next. The form of this meaning is taken directly from (119).

(147) that f ∈ D_S,<s,t>> such that, for any s ∈ S, f(s) = that h ∈ D_S,<s,t>> such that, for any s' ∈ S, h(s') = 1 iff John is leaving in s'.
Presupposition: for a situation r, f(r) is only defined if for all s ∈ S such that f(r)(s)=l, r and s are counterfactual alternatives.

Let JWL be the function f given in (147). Now the denotation of the whole sentence (138) is:

\[(148) \quad *\text{Mary hoped that John were leaving.}\] denotes that there is a D_{s,t} such that, for any s ∈ S, h(s)=l iff for some s"<s, s" precedes u and ∀s'[Mary hopes for s' in s" → JWL(s") (s')=l] \]

Presupposition: Mary believes that, for all s' ∈ S such that JWL(s)(s'), s and s' are counterfactual alternatives. This presupposition is a restriction on when h(s) is defined. Now we can see why (138) is ungrammatical. Compare (148) with (145a), which states one of the restrictions on hopes. Take s to be some arbitrary situation which satisfies the h of (148).

\[(145) \]

(a) ∀s'[Mary hopes for s' in s → it is possible (based on what Mary believes in s) that s' is actual]

Plainly (145a) and the presupposition in (148) are incompatible. (145a) says that any hoped for s' must be viewed in s by Mary as possible, and we know from the assertion part of (148) that all such situations are ones in which John leaves. However, the presupposition in (148) states that for h(s) to be defined, s must be a situation that Mary believes to be incompatible with John leaving. So the context is going to have to entail that Mary
believes that John's leaving is impossible. Therefore (138)'s presupposition is incompatible with the meaning of hope.

The next example is (139). (149) gives the translation. (I do not give a translation tree because it is only minimally different from those of above.)

(139) *Mary wished that John will leave.

(149) past(wish(+that(Fut(leave(John))))(mary))

The meaning of that John will leave is given in (150).

(150) that f∈ D<s,S,I> such that, for any s∈ S, f(s)= that h∈ D<s,t> such that, for any s′∈ S, h(s′)=1 iff s<s′ and for some s" which follows s, John leaves in s".

This f will be called JFL. The meaning of (139) would therefore be:

(151) *Mary wished that John will leave. denotes that h∈ D<s,t> such that, for any s∈ S, h(s)=1 iff for some s"<s, s" precedes u and ∀ s′[Mary wishes for s′ in s" → JFL(s") (s′)=1]

(130) above places the following restrictions on wish.

(152)

(a) ∀ s′[Mary wishes for s′ in s → it is not possible (based on what Mary believes in s) that s′ is actual at the time of s]

(b) ∀ s′[Mary wishes for s′ in s → ¬O(s)]

s is some arbitrary situation which, for the purposes of argument, we assume satisfies the h of (151). Because the speaker chose not to use the counterfactual subjunctive in (139), we may conclude that Mary does not believe in s that s is incompatible with a
situation s' in which in which her wishes are satisfied, i.e. in which John will leave. Since *John will leave* has s as its reference situation, s and s' must be contemporaneous. However, (a) requires that Mary believe that it is impossible that any situation she hopes for in s is actual at the time of s. Thus no s' can both be hoped for and satisfy the implicature that arises from not using the counterfactual subjunctive.

(140) has the translation shown in (153).

(140) Mary desired that John leave.

(153) past(desire(+m-subj(that(leave(John)))(mary))

The meaning of the complement clause is given in (154).

(154) that f∈D_{s<, s,t>} such that, for any s∈S, if O(s), then f(s)=
that h∈D_{s<, t>} such that, for any s'∈S, h(s')=1 iff John leaves in s' (and h(s') is undefined otherwise).

Call this f TJL. The meaning of (140) is then given in (155).

(155) Mary desired that John leave. denotes that h∈D_{s<, t>}
such that, for any s∈S, h(s)=1 iff for some s"<s, s" precedes u and ∀s'|Mary desires s' in s" → TJL(s'')(s')=1

Since it is possible for desiring situations to be obliging situations, (155) is acceptable. The crucial situations to look at are those picked out by s". They must be basic desiring situations, and for TJL(s") to be defined, we must have O(s"). This is fine. However, if in the place of *desire* we had a verb like *wish*, there would be a problem. If s" is a wishing situation, then (156) will be necessarily undefined.

(156) ∀s'|Mary wishes for s' in s" → TJL(s'')(s')=1

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Due to (130b), repeated here,

\[(130b) \forall x \forall s \forall s'[x \text{ wishes for } s' \text{ in } s \rightarrow \sim O(s)]\]
o no s' and s'' which satisfy the antecedent of (156) will result in a defined consequent, because TJL(s'') will always be undefined for a wishing situation.

The next example I would like to look at is (141).

(141) If John were leaving, Mary would smile.
The translation of this sentence is the following:

\[(157) \text{if(c-subj(leave(john)))}[x^{+<s,<s,t>}_i] \& \text{would(P)(smile(mary))}\]

Here I will continue from §4.4 the practice, followed by much of the literature on donkey anaphora and modals,\(^{34}\) of assuming that if and that have the same meaning. I do not believe that the distinctions between their meanings affects the present discussion. Recall that \(x^{+<s,<s,t>}_i\) is the ith variable of type e and sort \(+<s,<s,t>\), the sort of individual correlates of functions of type \(<s,<s,t>\). As discussed in the preceding chapter, P, the variable which functions as the first argument of the modal, must gets its value from context. Here it most plausibly takes if John were leaving, and thus the meaning for the antecedent that we will use is (158).

\[(158) \text{that } f \in D_{<s,<s,t>} \text{ such that, for any } s \in S, f(s) = \text{ that } h \in D_{<s,t>} \text{ such that, for any } s' \in S, h(s') = 1 \text{ iff John is leaving in } s'.\]

Presupposition: for a situation r, f(r) is only defined if for all s ∈ S such that f(r)(s) = 1, r and s are counterfactual alternatives.

Let us call this f: IJL.

The meaning of would has been discussed extensively in §4.4. I repeat (79), which partially specifies would’s meaning, here.

(79) A would counterfactual with antecedent P and consequent q is true in a world w if and only if for every set in Fw,P(s) there is a superset in Fw,P(s) which logically implies q.

In other words.

(159) would denotes that function f ∈ D<<s,<s,t>> such that, for any P ∈ D<<s,<s,t>>, f(P) = that h ∈ D<<s,t>,<s,t>> such that, for any q ∈ D<s,t>, h(q) = that k ∈ D<s,t> such that, for any w ∈ S, k(w) = 1 iff w is a world and for every set in Fw,P(s) there is a superset in Fw,P(s) which logically implies q.

Recall that s is some actual, contextually supplied situation.

The meaning of the whole of (141) is then:

(160) that function f ∈ D<s,t> such that, for any w ∈ S, f(w) = 1 iff w is a world and g(x+<s,<s,t>>)=IJL for every set in Fw,IJL(s) there is a superset in Fw,IJL(s) which logically implies that Mary smiles.
Presupposition: f is only defined if, for all s, s' such that IJL(s)(s')=1, s and s' are counterfactual alternatives.

The part of (160) 'g(x+<s,<s,1>=IJL ' is the result of interpreting the first conjunct in (157); thereby the if clause introduces a discourse referent for IJL. The use this can be put to will be seen in the next example. The presupposition in (160) in the most interesting part. So far, in discussing (137)-(140), we have only seen the idea of counterfactual alternative show up within the scope of an attitude verb, as in 'Mary believes that (...) s and s' are counterfactual alternatives.' Here, however, we have a straight presupposition that s and s' are counterfactual alternatives. In such a case what is required is that no world in the context contain duplicate-counterparts of both s and s'. As mentioned above, this is the basic case, and when this presupposition is generated in an attitude context, it is converted into a presupposed belief of the attitude holder.

In the event that, after the utterance of (141), the speaker and hearer want to conclude that John is leaving, they will shift their context to one in which the presupposition in (160) is no longer met. As discussed in §4.4, bringing about such a shift seems to be one of the prime uses of would conditionals. However, at the time of (141)'s utterance the context must entail that John is not leaving.

The final example that I will discuss in this chapter is (17).

(17) If Bill were to have won, it would have been great.
What I will concentrate on is how it gets as its meaning *that Bill were to have won*. The translation of (17) is (161).

\[
\text{(161) if(c-subj(Bill is to have won)))\left[x^{+<s<s.t>}_{i}\right] \& \\
\text{would}(P)(\text{has been great}(x^{+<s<s.t>}_{i}))
\]

Parallel to (160), the meaning for (17) is (162). Let BHW be the denotation of 'if(c-subj(Bill is to have won))'.

\[
\text{(162) that function } f \in D_{<s,t>} \text{ such that, for any } w \in S, f(w)=1 \text{ iff w is a world and } g(x^{+<s<s.t>}_{i})=BHW \text{ for every set in } F_{w,BHW}(s) \text{ there is a superset in } F_{w,BHW}(s) \text{ which logically implies that } g(x^{+<s<s.t>}_{i}) \text{ has been great.}
\]

Presupposition: f is only defined if, for all s, s' such that BHW(s)(s')=1, s and s' are counterfactual alternatives.

In (162), the *if* clause serves to introduce the variable \(x^{+<s<s.t>}_{i}\) as denoting BHW. The pronoun *it* gets this function as its value.

BHW also functions as the first argument of *would*. Though *would* gets its first argument pragmatically, in this case the choice of BHW is virtually forced by the content of the sentence. The presupposition of the counterfactual subjunctive requires that *Bill is to have won* be false. However, the subject position of *has been great* is factive, a situation that is only compatible with the counterfactuality of *Bill is to have won* if the modal sets up a temporary context which entails that Bill has won. It can do this most straightforwardly by taking BHW as its first argument.

This concludes the formal exposition of the core ideas of this chapter. The goal has been to show how the syntactic and
semantic behavior of infinitives and subjonctives can, at least in part, be seen as following from the type of propositions they denote. The most important aspect of the meaning of infinitives is their future orientation. This results in their being able to occur with any attitude verb which quantifies over situations, but with no attitude verb that quantifies over worlds. Subjonctives were distinguished by having characteristic presuppositions: Counterfactual subjonctives are presupposed false, while mandative/optative subjonctives presuppose that their reference situation is an obliging situation. The presuppositions place strong restrictions on where these clause types can occur. When a given verb can occur with more than one complement type, it has a general meaning that is compatible with the special requirements of each. In contrast, when a verb cannot occur with some type of clausal object, I have tried to uncover an aspect of its meaning that is incompatible with the characteristic meaning of that clause type. In doing so, it has been possible to uncover subtle aspects of the meaning of several English attitude verbs.
5.1 Introduction

In the preceding chapters we have seen how it is possible to assign different characteristic sorts of propositions to various types of syntactically distinct propositional expressions. Doing this has shown the advantage of treating propositions as sets of possible situations, rather than sets of possible worlds. Situation semantics provides us with more linguistically relevant kinds of propositions than possible worlds semantics does. However, so far we have not investigated in detail the structure of individual situations or the typology of situations. These topics are central to the theory of aspect, as it is conceived within a situation-based theory. In this chapter I would like to begin to investigate how questions of aspect can be addressed within the present system.

There are two main areas that we will explore below. First is the nature of perfectivity. Gerunds share with other -ing forms the possibility of picking out uncompleted events:

1. Frank was eating that apple.
2. Max enjoyed eating that apple.
3. The eating of that apple made her sick.
4. While eating that apple, John stopped and cried.
5. Eating that apple, Mary had her brilliant idea.
All of these sentences are compatible with the apple not getting eaten--an incomplete event of eating the apple may be referred to.

In §5.2 we will concentrate on examples involving gerunds that are the complements of attitude verbs, as in (2). Such examples will allow the introduction of the framework in which I would like to consider the question of perfectivity. Notice that, while in (2) the gerund is interpreted imperfectively, in (6) it most likely is not.

(6) Max celebrated eating that apple.
With (6), the whole apple has been eaten. The contrast between (2) and (6) is, I believe, quite revealing as to the right way to approach the semantics of aspect. As we will see in more detail in §5.2, the perfectivity of the gerund is conditioned by the nature of the attitude expressed by the matrix verb; *enjoy* in (2) expresses an attitude that one holds towards an ongoing event, and this fact about the nature of enjoyment allows the gerund to be imperfective. In contrast, *celebrate* in (6) denotes an attitude towards an event which, at least as a default, is completely past; this brings about perfectivity in the gerund. Thus it seems that the relation between the situation associated with the embedding verb (here, the enjoyment or celebration) and that of the gerund is crucial in understanding the aspectual properties of gerunds. Intuitively, the reason that the embedding verb's situation is relevant to the gerund's aspect is that it provides a point of view on the gerund's event; in (2), there is an 'internal' perspective, while in (6) there is an 'external' or 'retrospective' perspective. In
§5.2 a system will be developed that allows us to express the relationship—and, hopefully, that makes intuitive why the dependency holds.

§5.3 will complete the analysis of perfectivity given in §5.2. While §5.2 will have provided a general system for approaching questions of perfectivity, it will not have explored in detail the topic of what it is for an event to be an uncompleted event of a certain type. In §5.3, then, we will look at this question, which has been extensively investigated in studies of the progressive (e.g. Dowty (1979), Vlach (1981), ter Meulen (1985), Parsons (1990), Landman (1991)). The perspective of §5.2 will allow these different views of the nature of perfectivity to be expressed in somewhat novel ways. Furthermore, we will be able to treat the *-ing* form in the progressive as having the same semantics as the gerunds discussed in §5.2.\(^1\) with progressive *be* having what we might think of as the most simple of all meanings that could be associated with a verb that embeds \(VP\)-*ing*.

In §5.4 I will show how a semantics for a variety of other *-ing* forms can be developed in this system. I examine free adjuncts, as in (5), and *-ing* forms with explicit subordinators such as (4). These elements can be treated as semantically the same as the gerunds and progressive of §5.3. Finally, an analysis of aspectual verbs is provided. A somewhat revised version of the ideas of von Wright (1963) and Dowty (1979) is compatible with the semantics that will have been given here for infinitives and

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\(^1\)Whether the progressive *-ing* form is actually a gerund, or of another category that has identical semantics is a question I will leave open.
gerunds. Then we will examine the contrasts between aspectual verbs with -ing forms and aspectual verbs with infinitives (Freed (1979), ter Meulen (1990)). Differences like that between (7) and (8) follow from the semantics for gerunds and infinitives discussed so far:

(7) I started leaving.
(8) I started to leave.

In contrast to (7), (8) is compatible with my merely making preparations to leave, and not actually moving towards the door. This is due to that fact that, with an infinitive, the reference (starting) situation may grow into a leaving situation, while with the gerund it must already be one. Additionally, the difference between (9) and (10) also follows.

(9) I continued to mow the lawn.
(10) *I kept to mow the lawn.

According to ter Meulen, keep requires that the very same mowing event exist both before and after the time of 'keeping'. Such a requirement is incompatible with the future orientation of the infinitive. In contrast, all that (9) requires is that a mowing event exist before, and a (possibly different, though related) mowing event exist after, the 'continuing'.

Finally, in §5.5, a formal treatment of the ideas of §§5.2-5.4, utilizing the framework of Chapter 2, will be presented. We will see in detail how several of the examples in (1)-(9) are analyzed.
5.2 Perfective and Imperfective Gerunds

Traditional discussions of aspect often equate the difference between perfective and imperfective predicates with a contrast between an 'internal' and an 'external' view of an event (cf. Binnick (1991)). This idea has not come much into formal semantics, perhaps because there have not been attempts to formalize the notion of 'point of view' until recently. In this section we will see that the kind of contrast exemplified in (2) vs. (6) suggests that the various formal theories of perfectivity that are current (e.g. Dowty (1979), Vlach (1981), ter Meulen (1985), Parsons (1990), Landman (1991)) can be improved by incorporating this notion. In particular, it will allow us to predict in which contexts gerunds are interpreted perfectively or imperfectively.

When an eventive gerund is the complement of a verb that denotes an attitude towards an event that is over and done with, the gerund must be interpreted perfectively. In contrast, when the verb expresses an attitude towards an event that one must be involved in or in direct perceptual contact with, the gerund is interpreted imperfectively. (11) shows a set of cases in which the gerund has a strong tendency to be interpreted perfectively, while (12) shows cases where imperfectivity is virtually obligatory.

(11) Perfective--'Celebrate-class'
(a) I celebrated building a house.
(b) They commemorated travelling to Rome.

(c) I praised her writing the book.
(d) I regretted walking to town.
(e) We deplored her writing her memoirs.

(12) Imperfective—'*Enjoy-class'
(a) I enjoyed building a house.
(b) I saw him building a house.
(c) I hated her writing the book.
(d) They loved travelling to Rome.
(e) We disliked her writing her memoirs.

An intuitive way to put the difference between (11) and (12) is to say that *enjoy-class* verbs give an internal perspective on the gerund's event, while *celebrate-class* verbs give an external perspective. The classification of verbs is not absolute, and many can express either an internal or external perspective on an event. What is crucial, however, is the fact that the perspective taken will determine whether the gerund is perfective or not. I believe that, of the examples above, (11a-b) and (12a-d) are firmly in their respective categories, while the others go the way indicated in normal circumstances. Still other verbs are completely free to represent either an *enjoy-type* or a *celebrate-type* attitude; consider (13):

(13) Jackie remembered reading *Jude the Obscure*.

This example is compatible with Jackie's having had either an internal or an external perspective on the reading. On the internal perspective, she called to mind the book in front of her face--the act of reading. This internal view does not require perfectivity. The external perspective, in contrast, brings to mind the whole,
necessarily completed, reading event—the thing that causes the fact that she read *Jude the Obscure* to be true.\(^3\)\(^4\) Thus, though some attitudes are flexible as to the type of perspective they provide on an event, it seems that the aspectual contrast can be seen as relating to one of point of view.

Merely saying that there is a difference between an internal and an external perspective on an event is not enough to predict a contrast in perfectivity. There is no reason that one cannot have an external view on an uncompleted event of building a house; nor is it impossible to imagine a verb rather like *enjoy* that gives an internal view of a necessarily completed event. However, in what follows I will argue that once we formalize point of view in a way adequate to the difference between *enjoy*- and *celebrate*-class verbs, the semantics of these constructions will actually entail the observed difference in aspect.

Recall that we are treating gerunds as sets of minimal situations, which we can also call 'events'. As was argued in

\(^3\)One might think that the supposed 'external perspective' reading is really a propositional attitude. In order to see that this is not right, notice the contrast between (i) and (ii).

(i) Jackie remembers reading *Jude the Obscure*.
(ii) Jackie remembers that she read *Jude the Obscure*.

In order for (i) to be true, Jackie must be able to bring to mind some part of the experience of reading *Jude the Obscure*, while (ii) is compatible with merely recalling that someone told her that she read it.

\(^4\)Kratzer has suggested that many supposed propositional attitudes actually express a combination of a *de re* attitude towards an event and a propositional attitude. For example, *to know that* \(p\) roughly means: to have a belief that \(p\) that is caused by an actual event that makes \(p\) true. Kratzer's approach is relevant here in two ways. First, many of the verbs we will consider (including *celebrate* and *remember*) have readings of the kind she examines. And second, the readings, more important to us, that involve an external perspective on an event can be seen as closely related to Kratzer's interpretation. Our readings involve the attitude towards an event without the allied propositional attitude.
Chapter 3, the semantics of (12a) will be something like the following:

(14) that proposition p such that, for any s ∈ S, \( p(s) = 1 \) iff for some s", s' is a minimal situation of my building a house & s" is past & s" is a part of s & s" is a situation in which I enjoy s'.

Assuming the the gerund here is definite, i.e. a POSS-ing, s' is some situation salient in the context.

The semantics for the gerund developed in Chapter 3 did not take into account the gerund's aspect. Instead, -ing was semantically neutral, only changing the syntactic category of the gerund. Here, we would like to provide a formalization of the notion that it is the point of view taken on the gerund that determines whether it is interpreted perfectively or not. I will use the reference situation to represent the point of view that is taken on the gerund. The interpretation for -ing given by (15) illustrates the way in which the reference situation will be used with gerunds:

(15) \([-\text{ing}(\text{VP})]_{\text{M.u.C.r.g.s}} = \text{that proposition p such that, for any s' ∈ S, p is true in s' iff. from the point of view of r, s'} \text{ has the characteristics of a situation in } [\text{VP}]_{\text{M.u.C.r.g.s}}\]

Though (15) does not yet explain what it is for a situation to have the relevant characteristics from the point of view of another, it does allow us to see how point of view can become relevant for the gerund's aspect. In the case of building a house, for instance, if the reference situation r temporally overlaps s', then s' need not be a completed event of building a house; it is only required that
the part of s' that does not follow r have the characteristics of a completed house-building. In contrast, if r completely follows s', then all of s' must have the usual characteristics of house-buildings; this will require that s' be completed.

The relation 'has the characteristics of' in (15) may itself be analyzed along the lines of a variety of previous theories of perfectivity. Let us consider, by way of example, Dowty's (1979) approach. We can modify Dowty's theory to give an analysis of what it is for an event s to have the characteristics of a complete house-building from the point of view of r—it does if it in all inertia worlds that branch off of the world of s at the end of r (the counterpart of) s is a complete house-building. §5.3 will consider in more detail exactly how the schema in (15) should be spelled out.

Even without having yet settled in detail the semantics of imperfectivity, (15) will let us understand the contrast in (11)-(12). First we will see why with verbs of the celebrate class gerunds are perfective. We want to treat celebrate as denoting an attitude towards an event, as enjoy was above. We will therefore end up with a Logical Form for (11a) like (16), whose translation is (17):

\[
(16) \text{\[S\ N_{NP} \text{PRO building a house} \ [S I \text{celebrate } t_1]\]}
\]
\[
(17) \text{\[my\text{-building-a-house}\_x_1 \ & \ \text{celebrate}(me)(x_1)\]}
\]

We want for two things to be the case concerning the interpretation of the underlined part of (17). First, we want to say that g(x_1) is a situation in the gerund's denotation; i.e. it is the gerund's evaluation situation. This much is established by the
semantics of \(\Phi[x]\) given in Chapter 2. Furthermore, we want the celebration situation to be the point of view from which the gerund is interpreted. This is to say that we want the evaluation situation of the clause as a whole to be the gerund's reference situation. In order to insure this, semantic rule 9 from Chapter 2 will have to be modified:

9. \([\alpha[x]]^{M.u.C.r.g.s} = \text{that function } f \in D_{<s,t>} \text{ such that, for any } s' \in S, f(s') = 1 \iff [\alpha]^{M.u.C.s'.g.s}(g(x)) = 1, \text{ and } f(s') = 0 \text{ otherwise.}\)

The underlined \(s'\) is the change in 9; when the proposition denoted by the gerund is evaluated at a situation \(s'\), \(s'\) is also made the reference situation for the gerund. (Rule 9 will again be revised in §5.5. There will be arguments that the relativization to the reference situation should be independent of the workings of this semantic rule. However, for the time being the form given above will be the most perspicuous.) Given this, (17) will get the following interpretation (ignoring dynamic factors in the conjunction):

\[(18) \{(17)\}^{M.u.C.r.g.s} = \text{that } f \in D_{<s,t>} \text{ such that, for any } s' \in S,
\]
\[f(s') = 1 \iff [\text{my-building-a-house}[x]]^{M.u.C.s'.g.s} = 1 \text{ and } [\text{celebrate}(\text{me})(x)]^{M.u.C.r.g.s(s')} = 1.
\]
i.e., (...) \(f(s') = 1 \iff [\text{-ing(I build a house)}]^{M.u.C.s'.g.s}(g(x)) = 1\)
and I celebrate \(s''\) in \(s'\).

i.e., (...) \(f(s') = 1 \iff g(x) \text{ has the characteristics of a my-building-a-house situation from the point of view of } s'\)
and I celebrate \(g(x)\) in \(s'\).
Since it is a fact about celebrations that (at least in the default case) the celebration (s') entirely follows the event celebrated (s"), according to (15) the whole of s" must have the characteristics of a complete building-a-house situation. (On the Dowty-style version of (15), all the inertia worlds must be like the real world up through s', and so they all contain s" as-is--but this will be spelled out in more detail in §5.3.) s" will therefore have to be a completed house-building.

Though the semantics for (12a) is exactly parallel to (18), the relation between enjoying situations and building situations is different from that between celebrating situations and building situations. In order for s' to be a situation in which one enjoys s", s' must temporally overlap s". This is a fact about the nature of enjoyment. With (12a) this means that the gerund's situation must merely have the characteristics of a complete building-a-house situation while I have my enjoyment--e.g., from my perspective as I am at work on it. Nothing requires that it continue to have the characteristics of a complete building-a-house situation after that. On the Dowty-style theory, all the inertia worlds must be like the actual world up until the time of s'; then they may differ from the actual world, and in particular the house-building may be completed in the inertia worlds but not in the actual one. Thus, our informal theory predicts that the house never need actually be completed.

In sum, a single interpretation for -ing forms can be used with both celebrate- and enjoy-class verbs. The precise aspectual properties of the resulting sentences are derived from the relation
between the gerund's and the clause's evaluation situations. The latter of these serves as the reference situation of the gerund, and works as a kind of point of view parameter for it.

5.3 The Imperfectivity of -ing Forms

§5.2 has indicated why the notion of 'point of view' should be incorporated into the analysis of perfectivity. The contrast between perfective and imperfective gerunds seems to be based on whether the gerund is in a context that provides an external or an internal perspective on its events. However, the interpretation given in (15) did not really say what perfectivity is; it merely demonstrated how the idea of perspective is to be incorporated into the semantics of perfectivity. In this section I will work towards a general approach to the semantics of -ing forms. There has been much work done on the analysis of the progressive, and it will be the task here to adapt that work to meet the following goals:

(i) There should be a core meaning of -ing that can apply across constructions: the progressive, gerunds, free adjuncts (Stump (1985)), participles, and action nominals. This core meaning should be able to be used naturally with the different syntactic forms of the constructions.

This first goal incorporates a working hypothesis that all of the -ing forms do have unifiable meanings, though in this dissertation I will not be able to discuss in detail each of them.
(ii) The account of perfective gerunds given in §5.2 should be preserved.

(iii) The theory must be able to be incorporated into the general semantic framework of Chapter 2.

First, in §5.3.1 I will illustrate how a variety of previous analyses of the progressive can be modified to take into account the conclusions of §5.2. I will show how each theory can be stated in the form of (15). Then, in §5.3.2 I will lay out what I think is the best general view of the imperfectivity of -ing forms. I will show how it can be used to give an analysis of the progressive and that it predicts the contrast between enjoy- and celebrate-class verbs. In §5.4 I will examine how the semantics of other -ing forms can be analyzed along the same lines as gerunds and the progressive.

5.3.1 Prior Analyses of Imperfectivity

In this section I will discuss several previous formal analyses of the progressive. In each case, I will attempt to see how the core idea of what imperfectivity is can be combined with the conclusion reached in §5.2, that imperfectivity is determined with respect to a perspective or point of view. While I have tried to cover the basics of each approach, a reader who is unfamiliar with the workings of these theories may find the discussion rather condensed, and so may want to skip the relevant sections on first reading. I have not tried to examine all the worthy theories of the progressive, but rather have focussed on those approaches that bring out most clearly points that I believe to be crucial to refining (15) into a more complete analysis of the semantics of -
ing. As for the theories not discussed, it should be noted that I believe every formal analysis of the progressive that I am aware of to be compatible with (15); as will be illustrated below, once one has determined what plays the roles of (15)'s r, s', and s" in a given theory of the progressive, it is generally straightforward to transform (15) into something equivalent to that theory. However, the goals of this section are limited to evaluating several different views to see how they can help us meet the requirements listed at the beginning of §5.3.

5.3.1.1 Dowty's Theory

Dowty (1979) presents a modal analysis of the progressive that has become its best-known formal treatment. Dowty attempts to state in the terms of interval semantics the intuition that (19) is true iff something was going on that, if it had gone on normally, would have been a complete house-building.

(19) John was building a house.

The progressive is treated as a sentence operator with the following semantics:

(20) PROG(Φ) is true at a pair of an interval and a world <i,w> iff for some interval i' which includes, and extends beyond, i, and for all inertia worlds w' with respect to <i,w>, Φ is true at <i',w'>.

The intuition as to what the progressive means is expressed formally in the following way: the inertia worlds w', with respect to <i,w> are those in which what is going on in w during i continues as one would expect it normally to; nothing unexpected happens
in these w'. \text{PROG} (\Phi) \text{ is therefore true at } <i,w> \text{ iff in all the worlds in which nothing unexpected happens, } i \text{ can be extended into an interval in which } \Phi \text{ is true.}

Now I would like to show how Dowty's view of what imperfectivity is can be used to make more specific the semantics of the gerund given in (15). Then we will see how gerunds which are the complements of \textit{enjoy-class} and \textit{celebrate-class} verbs and the progressive can all make use of this meaning. I put off until §5.3.2, when it can be compared to a variety of other approaches, extensive discussion of whether this explication of imperfectivity is ideal.

To try to see how to combine the ideas of (15) and (20), we need to consider what intuitive role each of the parameters of interpretation in those definitions is playing. In the case of (15), repeated here,

\begin{equation}
\text{(15)} \quad \hat{\text{-ing}}(\text{VP})^M.u.C.r.g.s = \text{that proposition } p \text{ such that, for any } s' \in S, p \text{ is true in } s' \text{ iff, from the point of view of } r, s' \text{ has the characteristics of a situation in } [\text{VP}]^M.u.C.r.g.s
\end{equation}

we have discussed that the reference situation r provides a point of view on the in-progress event, while the evaluation situation s' represents that in-progress event itself. The point of view is used to determine what is relevant in determining whether s' has the characteristics of a situation of the appropriate type. Now, to consider (20), the interval i plays the same role as s'; it is the interval in which the event is in-progress. Both i and w are relevant in determining whether i contains the right kind of imperfective event. This can be seen from the fact that both are
used in determining the set of inertia worlds. Thus we can see that $<i,w>$ has the same function as $r$ in (15).

The essential differences between (15) and (20), as analyses of imperfectivity in general, can now be summarized: First, in (20) the perspective is taken to be a interval-world pair—a temporal slice of a world—while in (15) it is a situation. (15) can therefore be more restrictive in what it takes into account in determining whether an imperfective statement is true, since a situation can be both temporally and spatially a proper part of a world. The second essential difference is that (20) identifies the interval which is relevant for determining whether an appropriate in-progress event is going on (the 'reference interval') with the evaluation interval, the interval in which that event actually is going on. $i$ does both things. In contrast, (15) separates these roles, with $r$ giving the perspective but $s'$ being the evaluation situation. We have seen in §5.2 that it is necessary to let the reference situation completely follow the evaluation situation with verbs of the *celebrate*-class. Finally, (20) gives a theory of what it is for an event to be in progress during the evaluation interval, while (15) provides nothing but the vague 'has the characteristics of'. The analysis in terms of inertia worlds is the core of Dowty's theory, and our next task we be to integrate it into (15).

Taking into account the comparison in the preceding paragraphs, (21) provides a 'Dowty style' version of (15):

\[\text{270}\]

\[\text{5}^{\text{indeed, as we saw in chapter II, a situation can be extremely abstract. This will let the situation-based theory be even more restrictive in what it takes into account.}}\]
(21) \([-\text{ing}(\text{VP})]\text{M} \cdot \text{u} \cdot \text{C} \cdot \text{r} \cdot \text{g} \cdot s = \text{that proposition } p \text{ such that, for any } s' \in S, p \text{ is true in } s' \text{ iff, for all inertia continuations } s'' \text{ of } s' \text{ with respect to } r, [\text{VP}]\text{M} \cdot \text{u} \cdot \text{C} \cdot \text{r} \cdot \text{g} \cdot s(s'') = 1. \]

Notice that \( r \) has taken the place of \( <i,w> \) as the parameter with respect to which 'inertianess' is determined. In order to be consistent with our overall situation semantics, it has been necessary to replace the idea of 'inertia world' with that of 'inertia continuation'. Inertia continuations are situations, not worlds, but their nature can be explained in a way quite parallel to that of inertia world:

(22) \( s'' \) is an inertia continuation of \( s' \) with respect to \( r \) iff

(i) \( s'' \) is just like \( s' \) up through the end of \( r \), and

(ii) everything that is going on in \( s' \) continues normally in \( s'' \).

According to (22), the whole idea of 'point of view' developed in §5.2 is reduced to just this: the inertia continuations do not differ from the situations they are continuations of until after the reference situation has ended. One might think that (22) is incompatible with Dowty's semantics for the progressive, since according to him the inertia worlds may differ from the evaluation world at the end of the evaluation interval—in our terms, the evaluation situation \( s' \)--and not some other 'reference interval'. However, this is not the case, as the semantics of the progressive \( be \) is going to identify the evaluation situation \( s' \) with the reference situation \( r \). This topic will be discussed in detail in §5.3.2. However, I will briefly show here how the the progressive
can be analyzed using (21) in a way virtually equivalent to Dowty's (20).6

I propose that progressive *be* has the following interpretation:

\[(23) \text{[be}_{\text{prog}}(P)]^{M.u.C.r.g.s} = \text{that } f \in D_{<s,t>} \text{ such that, for any } s' \in S, f(s')=1 \text{ iff } [P]^{M.u.C.s'.g.s(s')}=1.\]

The best way to see how this works is with an example. According to (23), (24) has the interpretation (25), ignoring tense.

(24) Jack is crying.

(25) \[[(24)]^{M.u.C.r.g.s} = \text{that } f \in D_{<s,t>} \text{ such that, for any } s' \in S, f(s')=1 \text{ iff } [-\text{ing}(\text{cry(jack)})]^{M.u.C.s'.g.s(s')}=1.\]

i.e., (...) \(f(s')=1\) iff for all inertia continuations \(s''\) of \(s'\) with respect to \(s'\), \([-\text{cry(jack)}]^{M.u.C.s'.g.s(s'')}=1.\)

(25) shows how, due to the meaning of \(\text{be}_{\text{prog}}\), a progressive sentence is true in a situation \(s'\) iff in all inertia continuations \(s''\) of \(s'\), the nonprogressive sentence is true. Thus we end up with a theory of the progressive very close to Dowty's. The only essential difference is that Dowty determines what is a normal continuation with respect to an interval-world pair, while here it is calculated with respect to a situation. The importance of this difference will be discussed in §5.3.2.

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6A fully compositional version of *be*'s meaning will be given in §4. In order to do so, we must be able to abstract over the gerund's reference situation. In §§3-4 it is argued that--like the subordinate clauses in chapter IV--gerund meanings should be functions from reference situations to propositions.
5.3.1.2 Vlach's, ter Meulen's, and Parsons' Theories

Vlach (1981), ter Meulen (1985), and Parsons (1990) present theories of the progressive that rest on the view that the relation between uncompleted and completed events is a primitive fact about the structure of the model and not definable in modal terms (cf. also Bach (1986)). Though there are significant differences among the three, I will base my discussion on Parsons' theory, since I think it represents most straightforwardly this core idea. Below, in §5.3.2.1, I will evaluate the three theories independently as I compare them to my own proposal. According to Parsons, (26) and (28) receive the translations (27) and (29) respectively.

(26) Agatha crossed the street.
(27) (\exists t)[t precedes now & (\exists e)[crossing(e) & Subject(e,Agatha) & Object(e,street) & Cul(e,t)]]
(28) Agatha was crossing the street.
(29) (\exists t)[t precedes now & (\exists e)[crossing(e) & Subject(e,Agatha) & Object(e,street) & Hold(e,t)]]

The essential thing to notice is that, according to Parsons, there are two properties that crossing events may have at a time. A crossing event may culminate at a time ('Cul(e,t)') and a crossing event may hold at a time ('Hold(e,t)'). An event of Agatha crossing the street culminates at t iff Agatha finishes crossing the street at t, while it holds at t iff she is in the process of crossing the street at t, whether or not she ever does cross. She may however eventually cross, and this is to say that an event that holds at one time may culminate at a later time.
According to Parsons, and, in their own terms, the other two authors, the relation between events of a given variety that hold and those that culminate is primitive. There is no way of defining, in terms of culminating crossing events, which events are crossing events that hold (or vice versa). There are two main arguments given for considering the relation to be primitive. The first is limited to Parsons; in a variety of ways, the semantics of the progressive given above fits naturally into a broader system of tense and aspect developed in his book. The second is really an argument against Dowty's version of a non-primitivist theory; it originates with Vlach and is taken up by the other authors. The problem is that Dowty's analysis of the progressive defines the set of possible worlds too strongly, so that the evaluation world turns out to be a member of the set of inertia worlds in too many cases. Consider (30):

(30) Max was crossing the street.

This is said by Dowty to be true at \(<i,w>\) iff Max crosses the street in an extension of \(i\) in every inertia world with respect to \(<i,w>\). But imagine that Max does not in fact cross the street because a bus, cruising along Main St. at 30 miles per hour, hits him. It seems that, considering the the real world \(w\) during the interval in which Max gets partway across the street, the normal course events is for Max to get hit and not cross the street. Hence, according to Dowty's theory (30) should be false in the situation envisioned, contrary to intuition. We will reexamine this argument in §5.3.2, where it will be suggested that this particular
problem does not arise for the Dowty-style theory represented by (21)-(23).

Now I will illustrate how the Vlach-ter Meulen-Parsons analysis of the progressive is compatible with the view of perfectivity argued for in §5.2. In (27) and (29), e obviously plays the role of s' in (15); it is the potentially uncompleted event. t and r are likewise comparable; they represent the extra parameter with respect to which completeness is determined. We therefore end up with a version of (15) like (31).

(31) \( \text{i-} \text{ing}(\text{VP})_1 \text{M.u.C.r.g.s} \) = that proposition p such that, for any s'\( \in S \), p is true in s' iff, s' holds at the last instant of r and \( \text{VP}_1 \text{M.u.C.r.g.s}(s') = 1 \).

The VP itself in (31) is indifferent as to whether s' holds or culminates. The same semantics given for progressive be in (23), repeated below, will yield an analysis of progressive sentences that is, for our purposes, equivalent to Parsons'. Recall that the function of progressive be is to identify the reference situation with the evaluation situation.

(23) \( (\text{be}_\text{prog}(P))_1 \text{M.u.C.r.g.s} = \text{that } f \in D_{<s,t>} \text{ such that, for any } s' \in S, f(s') = 1 \text{ iff } P_1 \text{M.u.C.s'.r.g.s}(s') = 1 \).

(28) will get the following meaning, again ignoring tense:

(32) \( (28)_1 \text{M.u.C.r.g.s} = \text{that } f \in D_{<s,t>} \text{ such that, for any } s' \in S, f(s') = 1 \text{ iff } \text{crossing the street(} \text{agatha)}_1 \text{M.u.C.s'.r.g.s}(s') = 1 \).

i.e., (...) f(s') = 1 iff s' holds at its last instant and [cross the street(} \text{agatha)}_1 \text{M.u.C.s'.r.g.s}(s') = 1 \).
This formulation differs somewhat from Parsons', as he keeps separate the event and the time at which it holds or culminates. Here, the relevant time is identified with the last moment of the event itself. This difference can be ignored, because it does not have to do with the intuition as to how the progressive should be analyzed, and we have therefore seen how the class of 'primitivist' theories of imperfectivity are compatible with the ideas of §5.2.

5.3.1.3 Landman's Theory

Landman (1991) provides a theory of imperfectivity that is an interesting mixture of the two previous kinds of approaches. For this subsection, let's work with again with Vlach's example (30):

(30) Max was crossing the street.
Remember that Max didn't cross the street because a bus hit him. However, according to Landman, (30) is true because he would have crossed the street if the bus hadn't hit him. But suppose that behind bus #1 was bus #2, also speeding and ready to hit Max. (30) would also be true if he would have crossed the street if bus #1 hadn't hit him and bus #2 hadn't subsequently hit him. And if there was some other peril lurking for Max after bus #2, (30) would still be true if he would have crossed the street if bus #1 hadn't hit him and subsequently bus #2 hadn't hit him and after that the unknown peril hadn't stopped him. This series of counterfactual shifts removing the various dangers that threaten to stop Max's street-crossing forms what Landman calls the
'continuation branch' of Max's street-crossing. Max's street­
crossing may end near the curb in the real world, but its
continuation branch is an extension of it in some other world
where all the perils have somehow been avoided. Or almost all--
Landman points out that sometimes the forces out to stop an
event are just too strong to allow a progressive sentence to be
true. An example of this is (33).

(33) Mary was wiping out the Roman army.

Though the continuation branch of Mary's purported wiping-out
of the Roman army may reach a point at which she has killed a
few dozen soldiers, eventually the possibilities envisioned just get
too absurd, and it never reaches the point of being a complete
obliteration of the legions. In other words, some possible worlds
are too far from the real world to be accessible to the continuation
branch.

The major argument Landman gives in favor of his theory
he call 'the problem of non-interruptions'. This problem is based
on the fact that a progressive sentence will be judged true if the
potentially uncompleted event actually is completed, no matter
how unlikely it seemed beforehand that it would be. For instance,
(33) will be judged true if Mary has in fact wiped out the Roman
army. This fact is difficult for Dowty to account for, because it
would appear that in such a case the real world ought not to be
considered an inertia world. The real world is, if Mary wipes out
the Roman army in it, a quite abnormal, unexpected world.
However, the problem of non-interruptions is not a problem for
Landman, since the continuation branch need never leave the real

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world if Mary's wiping-out never gets interrupted. It is not a problem for the theories of §5.3.1.2 either, however, because the event described by (33) is (primitively) an event of Mary wiping out the Roman army that holds.

Formally the continuation branch of an event $e$ in a world $w$ is a set of event-world pairs. The event of each of these pairs has $e$ as a stage of it; an event $e$ is a stage of $e'$ iff $e'$ contains $e$ as a part and moreover $e'$ can be considered a further development of $e$. Landman defines the continuation branch $C(e,w)$ of $e$ in $w$ in the following way:

1. For every event $e'$ in $w$ such that $e$ is a stage of $e'$, 
   $$<e',w> \in C(e,w)$$

2. If the maximal event $e_m$ such that $<e_m,w> \in C(e,w)$ stops in $w$, then look at the closest world $w'$ where $e_m$ does not stop.
   (a) If $w'$ is not a reasonable world with respect to $<e,w>$, the continuation branch stops.
   (b) If $w'$ is a reasonable world with respect to $<e,w>$, then $<e_m,w> \in C(e,w)$.

3. For every event $e''$ in $w'$ such that $e_m$ is a stage of $e''$, 
   $$<e'',w> \in C(e,w)$$

4. If the maximal event $e_{m'}$ such that $<e_{m'},w'> \in C(e,w)$ stops in $w'$, then look at the closest world $w''$ where $e_{m'}$ does not stop.
   (a) If $w''$ is not a reasonable world with respect to $<e,w>$, the continuation branch stops.
(b) If $w''$ is a reasonable world with respect to $<e,w>$, then $<e_m',w'> \in C(e,w)$.

e etc.

Given the notion of 'continuation branch', (34) provides Landman's semantics for the progressive. PROG denotes a relation between events and properties of events:

$$(34) \ [\text{PROG}(x,P)]^{w,g} = 1 \text{ iff for some event } e' \text{ and world } w', <e',w'> \text{ is part of the continuation branch that starts in } w \text{ with } g(x) \text{ and } [P]^{w',g}(e') = 1.$$ 

So, for example, assuming (35) as the translation of (30) (and it's somewhat simplified from what Landman would give), (36) gives its meaning (ignoring tense):

$$(35) \ \exists e' [\text{PROG}(e', \lambda e [\text{Mary cross the street}(e)])]$$

$$(36) \ [(35)]^{w,g} = 1 \text{ iff for some } e'', w', <e'',w'> \text{ is on the continuation branch begun by } g(e') \text{ in } w \text{ and } [\text{Mary cross the street}]^{w',g}(e'') = 1.$$ 

(36) says that (30) is true iff some event in $w$ grows on its continuation branch into an event in which Mary crosses the street.

Landman's theory of the progressive combines some of the ideas of the two previous types of theories. It shares with Dowty's approach the attempt to define in modal terms what it is for an event of a certain type to be in progress. It also shares with the theories of §5.3.1.2 the assumption that uncompleted events of a given type have a primitive relation with their completed counterparts. This latter point is harder to see.

Primitivism comes in with the relation termed 'stage of' by
Landman, and this relation is necessary in explaining the notion of 'continuation branch'. In order to say when the continuation branch of an event $e$ in world $w$ leaves $w$ and goes to a world in which $e$ does not stop, it is necessary to know what counts as stopping. According to Landman, $e$ stops in $w$ iff in some other world $e$ is a stage of some larger event $e'$. For example, with Max's apparently interrupted street-crossing in the real world as $e$, we know that $e$ stops, and doesn't just continue as an event of him being hit by a car, taken to a hospital, carried back to his house, and whatever else, because his apparent failed walk across the street is not a stage of such an event, but rather is a stage of an event $e'$ in some other world in which he manages to cross the street. Saying that $e$ is a stage of this $e'$ is very close to simply saying that $e$ is primitively an uncompleted street-crossing.

Having seen the connections between Landman's theory and those discussed in §5.3.1.1 and §5.3.1.2, it is clear how to modify (15) to incorporate his approach. $<g(x),w>$ has the role of the evaluation situation $s'$, while $e''$ is the potentially non-actual, completed event—it is to be compared with $s''$. Finally, $<g(x),w>$ also gives the point of view for evaluating imperfectivity. In that it is used to determine what is a reasonable world, it is the parameter with respect to which it is determined whether $e'$ is a potentially uncompleted event of the right type. (37) is the modified version of Landman's theory:
(37) \([-\text{ing}(\text{VP})]\text{M.u.C.r.g.s} = \text{that proposition p such that, for any } s' \in S, \text{p is true in } s' \text{ iff, for some } s'' \text{ on the continuation branch of } s' \text{ with respect to } r,\]
\[\text{[VP]}\text{M.u.C.r.g.s}(s'')=1.\]

In (37) I was able to replace the pairs of an event and a world in Landman's formulation with just a situation, because in the present framework situations, like other entities, exist in only one world.

As with the revised version of Dowty's theory, (37) differs from the source that inspired it in that the intensional function--here, '... on the continuation branch of ... with respect to ...'--has an extra argument. \(r\) is apparently extraneous to the semantics of the progressive; it gives the point, which, it seems, should be the end of \(s'\), at which the continuation branch is allowed to depart from the world of the evaluation situation \(w_s\). However, again it is the function of progressive \(\text{be}\) to identify \(r\) with \(s'\). Recall that we saw in §5.2 that the connection between \(r\) and \(s'\) does not hold in general, since with verbs like \(\text{celebrate}\) \(r\) must be allowed to completely follow \(s'\). (23) repeats the semantics proposed in §5.3.1.1 for progressive \(\text{be}\).

(23) \([\text{be}_{\text{prog}}(P)]\text{M.u.C.r.g.s} = \text{that } f \in D_{s,t} \text{ such that, for any } s' \in S, f(s')=1 \text{ iff } [P]\text{M.u.C.s'.g.s}(s')=1.\]

(38) gives the semantics now predicted for (30).

(30) Max was crossing the street.
(38) \([\mathbf{M.u.C.r.g.s} = \text{that } f \in D_{<s,t>} \text{ such that, for any } s' \in S, \]
\[f(s') = 1 \text{ iff } [\text{Max crossing the street}] \mathbf{M.u.C.s'}.g.s(s') = 1.\]
i.e. (...) \(f(s') = 1 \text{ iff for some } s'' \text{ on the continuation branch of } s' \)
with respect to \(s'\), [\text{Max cross the street}] \(\mathbf{M.u.C.s'}.g.s(s'') = 1\)

This is just the result we want, assuming that 'x is on the
continuation branch of y with respect to z' means: 'if y hadn't
stopped at z, x would have been the outcome'.

The use of the reference situation in (38) is rather more odd
than it is in the reformulation of the other two types of theories.
It is odd because, though it is intended to pick out the moment at
which the continuation branch may shift to another world, this
moment must be able to be defined independently, since the
continuation branch is allowed to shift again to a third world
(recall bus #2). (38) gives a special role to the first counterfactual
shift--a special role that does not really make sense in terms of
Landman's central intuition. However, doing so is necessary if we
are to explain the fact from §5.2 that certain verbs denote an
attitude towards an event whose perspective disallows any shift
at all. So, though Landman's theory is compatible with our goal of
incorporating (15) into a more detailed theory of perfectivity, it
does not let us do so in a very natural way.

5.3.2 The Proposed Theory of Imperfectivity

In this section I will evaluate the ideas about the nature of
perfectivity that came up in the preceding section and try to
present a semantics for -ing that meets the goals stated at the
beginning of §5.3. First, in §5.3.2.1 I will concentrate on giving an analysis of the progressive that has the necessary form of (15) but incorporates as many of the insights of the theories discussed in §5.3.1 as possible. I will also compare it to the views of Dowty, Landman, Parsons, Vlach, and ter Meulen that have been discussed above. Then in §5.3.2.2 I will use this analysis to give a detailed explanation of the facts in §5.2.

5.3.2.1 The Progressive

In this section I will reexamine the arguments for and against the various theories of §5.3.1, in the process developing arguments for the account of the progressive that will be used in this chapter. It will be seen that this preferred account draws somewhat on all three types of theories discussed above. Furthermore, it will integrate naturally with (15), which summarizes what is necessary to account for the data of §5.2. The fact that it does so is, I believe, a significant argument in its favor, since those data are quite different from, though clearly related to, the type of data traditionally used in discussions of the progressive.

Dowty’s theory has the advantage of giving a simple and intuitive account of what it is for some uncompleted event to be going on. However, the difficulty brought up by Vlach—that, in too many instances, the definition of 'inertia world' will make the real world one—seems fatal. Apparently it would be impossible to have both (30) (repeated) and (39) true at the same interval, contrary to intuition.
Max was crossing the street.

The bus was driving through the intersection.

I do not believe that this problem arises for the theory of the progressive based on (21), the situation-based reformulation of Dowty's theory. Instead of dealing with whole inertia worlds, the semantics is based on an idea of 'inertial continuations of situations'. It may be that a situation whose natural conclusion is Max crossing the street and another whose natural conclusion is the bus passing through the intersection coexist unhappily in a given world. In order for this kind of answer to work, however, the Dowty-style theory is going to have to draw heavily on the ideas of the second type of theory. What is it that makes the Max-crossing situation be one whose natural conclusion involves getting Max across Main Street? After all, for all retrospective appearances there is no such situation anywhere in the vicinity, but only a Max-getting-hit-by-a-bus situation. And indeed there are many other candidates for what that situation which began looking rather like a Max-crossing situation actually was: It could have been a Max-avoids-bus-#1-but-gets-hit-by-bus-#2 situation, or a Max-gracefully-turns-back-and-intelligently-waits-for-the-light situation, or a Max-gets-hit-taken-to-a-hospital-and-sent-home situation, and so forth. So it must be a primitive fact that it is a Max-crossing situation.

Even if it makes the right predictions with respect to (30), (21) still faces the the problem of non-interruptions brought up by Landman. Because it makes use of the inertia continuations of a situation, in some cases--such as when Mary kills the whole
Roman army—we will have to ignore the actual, surprising completion of an event. The actual completion of the event with Mary wiping out the whole Roman army would not be considered the normal outcome of the early parts of the fight. For this reason I modify (21) so that it is more 'primitivist'.

(40) \([-\text{ing}(VP)]^{M.u.C.r.g.s} = \text{that proposition } p \text{ such that, for any } s' \in S, p \text{ is true in } s' \text{ iff, for all completions } s'' \text{ of } s' \text{ with respect to } r, [VP]^{M.u.C.r.g.s}(s'') = 1.\]

(40) replaces the idea of 'inertial continuations' with that of 'completions'. \(^7\) This latter notion will be defined below. Again we get an analysis of the progressive by combining this semantics for -ing forms with the meaning for progressive be of (23). The semantics that it gives for (24), repeated here, is (41):

(24) Jack is crying.

(41) \([(24)]^{M.u.C.r.g.s} = \text{that } f \in D_{s,1} \text{ such that, for any } s' \in S, f(s') = 1 \text{ iff } [-\text{ing}(\text{cry}(\text{Jack}))]^{M.u.C.s'.g.s}(s') = 1.\]

i.e., \((...) f(s') = 1 \text{ iff for all completions } s'' \text{ of } s' \text{ with respect to } s', [\text{cry}(\text{jack})]^{M.u.C.s'.g.s}(s'') = 1.\]

(40) is the proposal that will be adopted here as the semantics of -ing. I will now go on to compare it, first, to Landman's theory and then to the approaches of Parsons, Vlach, and ter Meulen. In the process, (40) will be further refined and developed.

\(^7\)Notice that I have dropped Dowty's requirement that the completion (here, \(s''\)) extend beyond the in-progress situation or interval (s'). Doing so is necessary to be consistent with the fact, discussed in §1, that with verbs like celebrate the events described by a gerund may already be complete.
The main disadvantage of the primitivist theories of Parsons, Vlach, ter Meulen, and (40) is that they simply claim that the relation between complete and incomplete events of a given type is unanalyzable. This disadvantage is only serious, however, if there is any competing theory that does otherwise. Landman's theory appears to do this, but in fact I believe that all the work of his approach is done by its primitivist aspects. The reasons for this have already been briefly mentioned in §5.3.1.2. In order to define the continuation branch, it is necessary to have a concept of what events in another world a given event is a stage of. With such a concept, it can be defined when an event stops: \( e \) stops in \( w \) iff \( e \) is an initial stage of another event \( e' \) in another world \( w' \). Without it, however, the theory cannot explain when an event stops in a world, but rather like the other theories must take it as a primitive. However, the notion of 'stage-of' brings into Landman's theory a stipulation that, for example, Max's stroll up until the moment he gets hit by the bus is to be considered an incomplete walk across the street, and not an incomplete (though later completed) complex event of getting hit by a bus, going to the hospital, and being sent home.\(^8\) Notice that it cannot be both an incomplete walk across the street and an incomplete, though later completed, event of getting hit by a bus, etc., either, because then the walk would not stop at the appropriate time in the world in which he gets hit.

\(^8\)Though Landman allows that an event may be a stage of two different events, neither of which is a stage of the other, the possibility never seems to arise. In fact, I think that if it did arise in a way that affected the semantics of the progressive, my criticism of his theory would be invalid.
I have argued that Landman's theory is in fact extremely similar to (40). The two make virtually identical predictions and assumptions. Both assume a primitive relation that connects certain incomplete events to other, more fully developed events in other worlds. The only significant difference appears to be that (40) uses a basic notion of completion, while Landman's theory relies on an appropriate series of counterfactual shifts to eventually find a world where we would say the event has been completed. However, using his concept of 'stage', we can define 'completion' in a way appropriate for (40). The diagram may help to see how the definition works.
(42) s' is a completion of s with respect to r iff

(i) the part y of s that precedes the end of r has a counterpart-duplicate y* in ws' and this y* is a stage of s', and

(ii) no reasonable world w contains a situation s'' such that there is a counterpart-duplicate s''* of s' which is a proper stage of s''.

A situation is a proper stage of another if it is a stage of it must not identical to it. The relation of 'stage-of' is the same as that used by Landman: a situation s is a stage of another s' if s' can be considered a more developed version of s. We will only use this relation with minimal--that is quite event-like--situations, and this is helpful since it is it is these situations for which the concept is clearest. Though what an odd situation like that whose parts are my eating breakfast this morning and the collision of the Indian subcontinent into Asia is a stage of is not at all certain.
among event-like situations I think that the concept is intuitive. So, for example, if John jogs three miles, a minimal situation of John jogging for one mile would be a stage of his whole jog.

The formulation (42) may not quite do justice to a pretheoretic notion of 'completion'. In the case of Mary with the Roman army, (42) classes the longest fight she could reasonably put up as the completion of her struggle. I am not sure this prediction correctly reflects our intuition about what completion means in English, but it does work properly in conjunction with (40). Therefore it seems that the present theory relies on exactly the same theoretical primitives as Landman's.

Landman's theory and (40) do not make precisely identical predictions, however. Let us examine (43), which is a version of (40) spelled out for the notion of 'completion'; there is one significant difference between this theory and Landman's:9

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9The formulation in (43) brings up a question with sentences like (i).
   (i) Max was crossing the street when a bus hit him.
   If the completions must be like the real world at the time when the bus hits Max, (i) should be necessarily false. However, it seems that when does not necessarily mean 'at the same time as'. With a telic clause, it can mean 'just before' or 'just after', as shown by (ii) and (iii).
   (ii) When Jill turned the TV off, the reception was poor.
   (iii) When Jill turned the TV off, the room was dark.
   Thus (i) can be seen as meaning something like 'Max was crossing the street just before a bus hit him'. That this approach is correct is supported by (iv):
   (iv) *Max was crossing the street while/when the bus was hitting him.
(43) \([-\text{ing}(VP)]_{\exists M.u.C.r.g.s} = \text{that proposition } p \text{ such that, for any } s' \in S, p \text{ is true in } s' \iff \text{for all } s'' \text{ such that}

(i) the part } y \text{ of } s' \text{ that precedes the end of } r \text{ has a counterpart-duplicate } y^* \text{ in } w_{s''} \text{ and this } y^* \text{ is a stage of } s'' \text{, and}

(ii) no reasonable world } w \text{ contains a situation } s''' \text{ such that there is a counterpart-duplicate } s'''^* \text{ of } s'' \text{ which is a proper stage of } s'''\text{,}

\([-VP]_{\exists M.u.C.r.g.s}(s'') = 1\).

Adopting (43) requires that we bring the relation of 'stage of' into our semantic system as a fourth relation (in addition to 'counterpart', 'precedes', and 'duplicate-counterpart') in the set } S \text{ of situations. (43) says a progressive sentence is true in a situation iff the corresponding nonprogressive is true in every reasonable completion of that situation. Landman's theory, in contrast, says that a progressive is true of an event iff the corresponding nonprogressive is true of that completion that will be reached by a series of counterfactual shifts that apply whenever the event stops. The only way these two approaches could differ would be if a single incomplete event could be reasonably completed in two different ways, but where Landman's series of counterfactual shifts leads to only one of those ways. Here is the kind of scenario that would be involved: Sam is walking down the road towards town, going to visit either Millicent or Judy. He hasn't decided who to visit yet, but there is a terrible thunderstorm, and if the storm continues he will visit Judy because she lives much closer. Otherwise he will visit.
Millicent. Unfortunately the storm is so bad that the bridge into town is washed out, so Sam has to go home without having visited anyone. The storm lasts all day. In this case do we want to say that (44) is true?

(44) Sam was walking to Judy's house.

In the closest world in which the bridge is not washed out, the storm is only slightly less bad and still lasts all day; thus in this world Sam goes to visit Judy. So Landman's theory predicts that (44) is true. (43) in contrast predicts that (44) is false, because there are reasonable worlds where the rain lets up and Sam goes to visit Millicent. My judgment is that (44) is probably false in the situation envisioned, and so there is some direct evidence that the present theory should be favored over Landman's.

The final point I would like to recall is that Landman's theory does not integrate well with the discussion of §5.2. Explaining the facts in that section involves adding a parameter to the semantics of -ing that represents the point at which one is allowed to consider merely possible ways the event could have come out. In Landman's theory, it does not make sense to give a special privilege to the first counterfactual shift of the continuation branch, because it is really just one of what is potentially a whole series of shifts. In contrast, (40) gains from its basis in Dowty's theory an easy connection with the ideas of §5.2. There is a point at which alternative continuations of the in-progress event may be considered—namely, with the progressive, the end-time of the evaluation situation. This point provides what is intuitively the perspective taken on the event, and it will be
used below to explain the contrast between *enjoy*-class and *celebrate*-class verbs.

Now I will discuss how (40) relates to the approaches of Parsons, Vlach, and ter Meulen. A substantial part of this discussion is based on the critiques of primitivist theories given by Landman. The most significant difference that the theory in (43) has from Parsons' is that it treats the progressive, i.e. *-ing*, as an intensional operator. An example like (45) seems to indicate that intensionality is necessary:

(45) Nancy was building a house.

Because no house need actually be built, even though *build* is an extensional verb, it seems the progressive must set up an intensional context. Parsons counters this argument by saying that there is an actual house being discussed in (45), but it is an incomplete house. This idea is an exact parallel in the nominal domain to his theory of aspect in the verbal; just as a progressive sentence describes an event which is incomplete, certain NP's denote concrete entities which are incomplete. Parsons points out that we can speak of incomplete entities even in nonprogressive sentences, describing the house Jack London was building when he died, which is actually just a foundation and parts of some walls. I find persuasive Parsons' argument that a world like *house* often includes in its meaning both complete and incomplete houses.

Parsons doesn't only argue that a non-intensional analysis of the progressive is possible, but he also claims that examples like (46) show it to be preferable.
(46) John is building a house that he will finish.
With the NP *a house that he will finish* having scope under a
progressive operator, (46) should have a reading synonymous
with (47).

(47) John is building a house.
Parsons points out that (46) has no such reading, instead requiring
that the house be actually finished. In contrast, on his own
extensional treatment (46) and (47) are predicted to be different;
while *a house* in (47) may have in its denotation a forever
uncompleted house, *a house that he will finish* in (46) may not.

Landman criticizes both of Parsons arguments, showing, I
believe, that an intensional analysis of the progressive is
necessary. The argument concerning (46) should be evaluated in
light of (48), which contains an undisputed intensional verb:

(48) John is seeking a house that he will find.
(48) does not have a reading synonymous with (49):

(49) John is seeking a house.
However, if all of *a house that he will find* could have scope under
*seek*, the two should be able to be synonymous. It seems that the
relative clause forces the NP to be treated extensionally.10 In any

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10 Not every relative clause will have this effect. Compare (i) and (ii),
pointed out by B. Partee:

(i) John is building a house that will have plenty of space for his
kids.
(ii) John is building a house that his kids will run around in.
While (i) does not entail that the house gets built, (ii) seems to. Therefore it
seems that the content of the relative clause is crucial for whether it forces
the NP to be treated extensionally. In the case of (46) or (48) , it should be
noted that the relative clause would be redundant if the NP were
interpreted intensionally. Pragmatic principles therefore should favor an
extensional reading. In languages with both indicative and subjunctive
case (46)-(47) do not provide an argument against the intensionality of the progressive.

Landman also points out that, while (46) may reasonably be analyzed in terms of an incomplete individual, in certain other cases there are difficulties. For example, with

(50) God was creating a unicorn when He changed His mind.

we could imagine this sentence to be true even if the creation process involves a series of steps which bring into existence a complete unicorn, all of a sudden, at the end. Up until the last moment, there would be no, even partial, unicorn. Such a case indicates very strongly that the progressive must be considered to set up an intensional context.

I turn next to examining Vlach's proposal. Vlach's analysis, like the present one, comes in two steps. First, there is an operator 'Proc' with the following definition:

(51) $\text{Proc}[S \ NP \ VP]$ is true just when the process denoted by $[NP's \ VP-ing]$ is going on.

The second step is giving a meaning $'[NP's \ VP-ing]'$. If $[S NP VP]$ is a process sentence, $'[NP's \ VP-ing]'$ denotes the process that is going on just when $[S NP VP]$ is true.' However, if $[S NP VP]$ is an achievement or accomplishment sentence, $'[NP's \ VP-ing]'$ denotes the process which leads directly to the truth of $[S NP VP]'$. Thus (50) can be expanded to (51):

mood relatives, the choice of mood often determines whether the NP is extensional or intensional.

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(51) If \([s\ NP\ VP]\) is a process sentence, \(\text{Proc}[sNP\ VP]\) is true just when \([s\ NP\ VP]\) is true.

If \([s\ NP\ VP]\) is an achievement or accomplishment sentence, \(\text{Proc}[s\ NP\ VP]\) is true just when the process which leads directly to the truth of \([s\ NP\ VP]\) is going on.

To a large extent, (50) is an informal version of my proposal. A general semantics for gerunds is given, and the meaning of the progressive is given in terms of that. What the progressive does is locate the process denoted by the gerund at a time. However, (43) represents an improvement over Vlach's analysis for the following reason: As noted by Landman, the component 'the process which leads directly to the truth of \([s\ NP\ VP]\)' seems to run afoul of the imperfective paradox--in the case of Max crossing the street, no process leads directly to the truth of \(\text{Max crosses the street}\). Furthermore, if we were instead to spell out (40) in terms of an weaker notion--such as 'the kind of process which typically leads to the truth of \([s\ NP\ VP]\)'--we would still have to deal with the rather problematical notion 'leads directly to'.

Despite the difficulties that there are with Vlach's theory, he is right to point out the relations between perfective and imperfective aspect and the different aspectual classes of verbs. In particular, his idea that gerunds always denote processes and that the progressive locates these processes in time seems correct. However, problems arise because he attempts define which process is associated with a given -ing form solely in terms of

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what is going on in the world of evaluation rather than in terms of alternate possible continuations.

Finally, we turn to a brief examination of ter Meulen's semantics for the progressive. ter Meulen, like Vlach and Parsons, gives the semantics of the progressive in terms of a notion of 'incomplete event'. Whereas Parsons treats the relation between incomplete and complete events as a pure primitive and Vlach attempts to define the incomplete events in terms of what they 'lead to', ter Meulen claims that an incomplete event is just like a complete one except that one of the component individuals of the event is itself incomplete. For example, (45) (repeated) denotes an incomplete building event because it denotes a building event which involves an incomplete house.

(45) Nancy was building a house.

Her system is essentially set up this way: Besides the domain of individuals there is a domain of 'stuff'. This stuff is the matter of which ordinary individuals, like people or rocks, may be made. A function h maps each individual onto the stuff it is made of. At different times the same individual may be made of different stuff. Furthermore an individual may be made of different amounts of stuff at different times. It is even possible that sometimes an individual is made of no stuff at all.

ter Meulen treats events as defined entities; an event is a pair whose first member is a tuple consisting of a n-ary relation and n individuals and whose second member is truth value--for example:

(52) «<eat', John', that-meat'>, true>
The meaning of a VP is essentially a function from individuals to events. Thus, for ter Meulen, the VP in (53) will have the meaning (54).

(53) Nancy builds the house.
(54) \( \lambda x[<\text{build}', x, \text{the-house'}>, \text{true}] \)

An incomplete event is one where one of the component individuals may be incomplete. This is represented by making at least one of the individuals in the event be stuff rather than an ordinary individual. The VP in (45) will thus have the meaning (56).

(56) \( \lambda x[<\text{build}', x, h(\text{the-house'})>, \text{true}] \)

Thus (45) describes a building event where what is being built is a potentially not-fully-realized house.

There are several problems with ter Meulen's proposal. The most obvious involve cases where no individual involved in the event seems to be incomplete. (57) gives one example:

(57) Mary was sleeping.

This particular example may not be such a big problem. ter Meulen could respond that, since (57) is true just when (58) is true, her theory need only be loosened somewhat.

(58) Mary slept.

Instead of claiming that an event described by a progressive always involves a potentially incomplete individual, she could say that it may or may not involve one, depending on the kind of verb in question. When no incomplete individual is involved, it turns out that the truth conditions of progressive and non-progressive sentence are identical. The price that is paid is that no semantic
account of the differences between (57) and (58) is now possible. However, even this response will not work for (59).

(59) John was filling up the bucket with the water.

(59) is not equivalent to (60), even though neither John nor the bucket nor the water is 'incomplete'.

(60) John filled up the bucket with the water.

The only thing incomplete in (59) is the filling event. However, on ter Meulen's theory the event is not an individual to which the function h may apply.

Another problem with ter Meulen analysis is that it will count as equivalent (61) and (62):

(61) Cynthia was making the ring.

(62) Cynthia made the gold.

Let us assume that making the ring involved shaping the lump of gold into the right shape. Thus the stuff that makes up the ring is the gold: \( h(\text{the ring}) = \text{the gold} \). From this it follows that the VP's in both (61) and (62) denote (63):

(63) \( \lambda x [ \langle \langle \text{make} \rangle, \text{Cynthia}, \text{the-gold} \rangle, \text{true} \rangle ] \)

However, (61) could be true while (62) is certainly false.

In sum, though ter Meulen correctly points out the connection that holds in many cases between incomplete individuals and incomplete events, it seems wrong to try to define what an incomplete event is in terms of it. Instead, we need to speak about the events themselves. Doing so in the way I have proposed (or in the way Landman does) should let us capture ter Meulen's insight anyway. It is a fact about the nature of building events that their progress is marked by the gradual coming into
existence of what is built. Thus, though we cannot conclude from (45) that a house has been built, we do know that part of a house has been. One way of making this reasoning precise would involve formulating meaning postulates for verbs of creation like build. However, doing so now would divert us from our main line of argument.

5.3.2.2 The Aspect of Gerunds and the Progressive

In this section I will show how the analysis of progressive -ing forms arrived at in the last section, most fully spelled out in (43), lets us give an account of the data in §5.2. As we will see, (43) is able to be part of the semantic analyses of these two, rather different, constructions because it gives us a natural dimension along which to 'adjust', on an observational level, its aspectual properties. This dimension is the relationship between the gerund's evaluation situation and its reference situation; changing the connection between these two can switch the -ing form from being imperfective to perfective. This idea will set us up for subsequent sections, where we will see that the meaning in (43) is even more flexible than that. Using other relations between evaluation situation and reference situation will let us understand the aspect of free adjuncts, gerunds with while, before, and after, and the VP-ing that occurs with aspectual verbs.

First we will examine again (11a), an example of a perfectively interpreted gerund.

(11a) I celebrated building a house.
The informal reason given in §5.2 for why this gerund is imperfective is the following: An -ing form of a VP denotes a set of events which may be uncompleted. Whether or not an event is completed is always determined with respect to some point of view, and in the case of an embedded gerund that point of view is taken to be the evaluation situation of the clause as a whole. In general, then, in the following configuration

(64) \[ \text{vp} \text{v* [np \text{vp-ing}]} \]

the point of view for determining the perfectivity of \text{vp-ing} is the situation associated with \text{v*}. \text{Celebrate} denotes an attitude towards an event which was completely prior to the celebration; therefore, in (11a) the point of view taken on the situations in the denotation of \text{building a house} is external and retrospective. From such a point of view, they will only be considered to be house-building situations if they are situations in which a house does get built. We might say that once a situation is over it will only appear to be a complete house-building if it is indeed a complete house building. Now we will go on to give some formal content to this idea.

In order to simplify the exposition I will not cast the discussion in the terms of the system of Chapter 2. Instead I will use a simpler, set-theoretic notation. In §5.5 an official formulation will be given. Furthermore, until §5.5 I will not discuss the interactions of the semantics with tense, since this introduces various complications. (65) represents the meaning for -ing forms given in (43).
(65) \([-\text{ing(}VP\text{)}]\text{M}u\text{.}C\text{.}r\text{.}g =

\{s': \text{for all } s'' \text{ such that }

(i) \text{the part } y \text{ of } s' \text{ that precedes the end of } r \text{ has a counterpart-duplicate } y^* \text{ in } w_{s''} \text{ and this } y^* \text{ is a stage of } s'\text{, and }

(ii) \text{no reasonable world } w \text{ contains a situation } s''' \text{ such that there is a counterpart-duplicate } s''^* \text{ of } s'' \text{ which is a proper stage of } s''\text{, ,}

s''\in [VP]\text{M}u\text{.}C\text{.}r\text{.}g \}

(My) building a house will have the following denotation:

(66) \[\text{my-building-a-house}\text{M}u\text{.}C\text{.}r\text{.}g =

\{s': \text{for all } s'' \text{ such that }

(i) \text{the part } y \text{ of } s' \text{ that precedes the end of } r \text{ has a counterpart-duplicate } y^* \text{ in } w_{s''} \text{ and this } y^* \text{ is a stage of } s'\text{, and }

(ii) \text{no reasonable world } w \text{ contains a situation } s''' \text{ such that there is a counterpart-duplicate } s''^* \text{ of } s'' \text{ which is a proper stage of } s''\text{,}

s''\in [I\text{-build-a-house}]\text{M}u\text{.}C\text{.}r\text{.}g \}

(66) \text{does not take into account the presuppositions of the gerund. Incorporating this part of the gerund's meaning will be put off until §5.5. The sentence (11a) has an LF schematically like (16) and the translation of (17).}

(16) \([S [NP\text{PRO building a house}] [S I \text{celebrate } t_1]]\]

(17) \[\text{my-building-a-house}\text{[}x_1\text{]} \& \text{celebrate(me)}(x_1)\]

The interpretation of (17) is (67).
(67) \[\text{my-building-a-house}[x_1] \&
\text{celebrate(me)}(x_1)]_{\text{M.u.C.r.g}} = \{ e : g(x_1) \in [\text{my-building a house}]_{\text{M.u.C.r.g}} \& e \text{ is a situation in which I celebrate } g(x_1) \}

Given (66), (67) expands to:

(68) \[\text{my-building-a-house}[x_1] \&
\text{celebrate(me)}(x_1)]_{\text{M.u.C.r.g}} =
\{ e : \text{for all } s' \text{ such that}
(i) \text{ the part } y \text{ of } g(x_1) \text{ that precedes the end of } e \text{ has a counterpart-duplicate } y^* \text{ in } W_{s'} \text{ and this } y^* \text{ is a stage of } s', \text{ and}
(ii) \text{ no reasonable world } w \text{ contains a situation } s'' \text{ such that there is a counterpart-duplicate } s'^* \text{ of } s' \text{ which is a proper stage of } s'',
\text{ e is a situation in which I celebrate } g(x_1) \}

Notice that the reference situation r from (66) has been identified with e, the clause's evaluation situation. This follows from the revised semantic rule (9), given here again in both 'official' and 'unofficial' formats.

9.

official: \[\alpha[x_u]]_{\text{M.u.C.r.g},s} = \text{that function } f \in D_{<s,t>} \text{ such that, for any } s' \in S, f(s') = 1 \text{ iff } [\alpha]_{\text{M.u.C.r.g},s}(g(x_u)) = 1, \text{ and } f(s') = 0 \text{ otherwise.}

unofficial: \[\alpha[x_u]]_{\text{M.u.C.r.g}} = \{ s : g(x_u) \in [\alpha]_{\text{M.u.C.r.g}} \}

A simplified version of (68) is (69):
The crucial part of (69) is (i). It requires that the merely possible completions $s'$ of $g(x_1)$ must not be in worlds which differ from $w_{g(x_1)}$ until after the time of $e$. However, $e$ is the celebrating situation and in the usual case the celebrating situation completely follows the building situation. In such a case $s'$ cannot be an extension of $g(x_1)$ because $g(x_1)$ comes to a halt before the time of $e$. From this it follows that $g(x_1)$ must itself be a completed event of building a house.

There is one circumstance in which the above reasoning does not hold and in which the event complement of celebrate could therefore be incomplete. If $g(x_1)$ were a kind of event which could be temporally discontinuous, it may be that it ceases before $r$ but that in some other world (a duplicate-counterpart of) it resumes after $r$, eventually getting completed. This world would still be just like $w_{g(x_1)}$ up through the time of $r$. It is not at all clear that such discontinuous situations exist at all, and it would be possible to stipulate either that there are no such situations or that they are never the basic situations which satisfy a predicate. However, before going on I would like to briefly examine what kinds of data bear on whether such a stipulation is correct.

It seems that complete house-buildings are not the sort of event that can be discontinuous, even if work only goes on, say, from nine to five for the month of March. One cannot say
(70) ??I built that house from nine to five for the month of March.

A process VP like work on a house does allow such a sentence:

(71) I worked on that house from nine to five for the month of March.

However, with a process VP we can’t ask whether the VP is interpreted perfectively or not. I don’t know of any accomplishment verbs which may describe temporally discontinuous events, and I think that if we force one to, it turns into a process verb:

(72) During the hours of nine to five in March, I built a house.

(73) During summer weekends, we climbed Savoy Mountain.

(72) either means that a whole house was built each day or that I worked on--but didn’t necessarily ever complete--a house during those hours. It can’t mean that I built a whole house, only working on it from nine to five during March. That is, it cannot mean what (74) means:

(74) Working during the hours of nine to five in March, I built a house.

Likewise, (73) could be true if we climbed Savoy Mountain each weekend or if each weekend we went a little higher on the mountain (camping but not climbing weekdays). (73) cannot require that we reached the summit but once, moving upwards only on weekends--i.e. it can’t be equivalent to (75).
(75) Ascending on weekends, we climbed Savoy Mountain in the summer. We therefore have strong evidence that accomplishment predicates never denote discontinuous situations. We might want to extend this conclusion and say that no situations which are in the denotations of atomic sentences are temporally discontinuous. (71) could be analyzed as describing a series of similar building events just as (70) may. However, the more limited conclusion is all we have direct evidence for; fortunately, it is enough to make the reasoning concerning gerunds with celebrate complete.

By examining (12a), we will see why a gerund complement of enjoy can be interpreted imperfectively.

(12a) I enjoyed building a house.

(66), repeated here, gives the meaning of the gerund:

(66) [my-building-a-house]\text{M.u.C.r.g} =

\{s': \text{for all } s'' \text{ such that}
\begin{align*}
\text{(i) } & \text{the part } y \text{ of } s' \text{ that precedes the end of } r \text{ has a counterpart-duplicate } y^* \text{ in } w_{s''} \text{ and this } y^* \text{ is a stage of } s''', \text{ and} \\
\text{(ii) } & \text{no reasonable world } w \text{ contains a situation } s'''' \text{ such that there is a counterpart-duplicate } s''^* \text{ of } s'' \text{ which is a proper stage of } s''', \\
& s''''e[I \text{ build a house}]\text{M.u.C.r.g}\}
\end{align*}

Exactly parallel to the case with celebrate, (76a) gives the initial step in the interpretation of (12a), with (76b) fully articulating the meaning of the gerund.
(76a) \[[\text{my-building-a-house}[x_1] \& \\
enjoy(\text{me})(x_1)]\]^{M.u.C.r.g} = \{e : g(x_1)\in [\text{my-building-a-house}]^{M.u.C.r.g} \& e \text{ is a situation in which I enjoy } g(x_1)\}

(76b) \[[[\text{my-building-a-house}[x_1] \& \\
enjoy(\text{me})(x_1)]\]^{M.u.C.r.g} = \\
\{e : \text{ for all } s' \text{ such that} \\
(i) \text{ the part } y \text{ of } g(x_1) \text{ that precedes the end of } r \text{ has} \\
a \text{ counterpart-duplicate } y^* \text{ in } w_{s'} \text{ and this } y^* \text{ is a} \\
\text{stage of } s', \text{ and} \\
(ii) \text{ no reasonable world } w \text{ contains a situation } s'' \\
\text{such that there is a counterpart-duplicate } s'^* \text{ of} \\
s' \text{ which is a proper stage of } s'\}, \\
s' \in \{\text{I build a house}\}^{M.u.C.e.g} \} \& \\
e \text{ is a situation in which I enjoy } g(x_1)\}

\text{i.e. } \{e : \text{ for all reasonable completions } s' \text{ of } g(x_1) \text{ with respect} \\
to } e, s' \text{ is a situation in which I build a house and I} \\
enjoy \text{ } g(x_1) \text{ in } e\}

Recall that enjoying situations, in contrast to celebrating situations, always temporally overlap the situation enjoyed. In light of this, clause (i) of (76b) is crucial; } e \text{ is the enjoying situation, while } g(x_1) \text{ is the situation enjoyed--the potentially uncompleted house-building. } g(x_1) \text{ will be in the denotation of the gerund building a house iff every one if its reasonable completions } s' \text{ that may differ from } e \text{ after the time of } e \text{ is a situation in which the house gets built. Since the time of } e \text{ is}
before \( g(x_1) \) stops, it is possible that those reasonable completions end differently from \( g(x_1) \) itself. In particular, even if \( g(x_1) \) comes to an end with the house still not built, the house still can get finished in all those \( s' \). Thus, when the verb *enjoy* embeds a *building a house*, incomplete house-buildings may be in the gerund’s denotation.

Before going on with the discussion of other *-ing* forms, I would like to outline how the aspectual contrast between *enjoy*-type and *celebrate*-type verbs also comes out in quantificational contexts. Doing this forces us to face up to an aspect of adverbial quantification that we have been able to largely ignore up until now. So far, we have only considered cases when an adverb quantifies over a variable introduced by some NP, either a regular indefinite like *a donkey* or a gerund. However, there are cases in which the situation that serves as some expression’s evaluation situation must be quantified over. Consider (77):

(77) When John jogs, Mary always smiles.

What this says is that every basic situation of John jogging can be extended to a situation of Mary smiling (cf. Berman (1987)). We will therefore need a meaning for *always* like the following:

(78) \( \text{always}_\omega(\alpha)(\beta) \mathbf{M,u,C,r.g} = \{ s : \text{for all } <g',s'> \text{ such that } g'<\omega>g \text{ and } s'<w_s, \text{ if } s'\in\{\alpha\} \mathbf{M,u,C,r.g'} \text{, then for some } s'' \text{ such that } s''<s', s''\in\{\beta\} \mathbf{M,u,C,r.g'} \} \)
This version of *always* quantifies not only over the selected variables, but also over evaluation situations. In the case of (77), where there are no indefinites to quantify over, it will result in the following meaning:

\[(79) \{s : \text{for all } s' < w_s, \text{ if } s' \text{ is a situation in which John jogs, then for some } s'' \text{ such that } s' < s'', s' \text{ is a situation in which Mary smiles}\}\]

Notice that, even though (79) involves universal quantification over situations in the denotation of *John jogs*, it cannot be the case that really every one of these is considered. For each intuitive jog that John takes, there will be many different situations in which he jogs—the first five minutes of his jog, the first ten minutes, the second five minutes, everything that goes in in the year surrounding his jog, everything that goes on in the twentieth century, the whole world. The quantification must therefore be limited to a certain subgroup of the situations in which he jogs, namely those that contain as much of John's jogging as possible without containing anything extraneous.

Now let us turn to (80).

\[(80) \text{John always celebrates jogging to town.}\]

\[(81) \text{John always enjoys jogging to town.}\]

We have had to take consideration of quantification over evaluation situations because it is necessary that for each jogging to town, the reference situation for the gerund should be the

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\[11 \text{This version will be revised somewhat in } \S 4. \text{ It lacks a treatment of the quantified variable assignments that results in existential closure for free variables in the nuclear scope.}\]
associated celebration or enjoyment. According to the old meaning for *always*, the reference situation would turn out to be a summation of all the celebrations/enjoyments together, and this fact would disallow making the necessary distinction between (80) and (81). However, with the meaning for *always* in (78), the contrast comes out in the same way as with non-quantified sentences. Consider (82), the meaning for (80):

\[(82) \{s : \text{for all } c \in I \text{ and } s'<w_s, \text{ if } c \text{ is a situation of John jogging to town from the point of view of } s', \text{ then for some } s'' \text{ such that } s'<s'', s'' \text{ is a situation of John celebrating } c\}\]

The point of view on the gerund again turns out to be the celebration situation. Hence, this point of view is retrospective and the gerund is interpreted perfectively. As was the case with (79), there must be some contextual limiting of which situations s' are considered, since there are very many situations from the point of view of which c is a jogging to town (e.g. any situation which follows the celebration). However, as we saw above, this limiting is independently needed anyway.

The meaning for (81) is (83):

\[(83) \{s : \text{for all } a \in I, \text{ and } s'<w_s, \text{ if } a \text{ is a situation of John jogging to town from the point of view of } s', \text{ then for some } s'' \text{ such that } s'<s'', s'' \text{ is a situation of John enjoying } a\}\]

(83) is just like (82), except that the enjoyment situations will temporally overlap the jogging situations. Thus, it is possible for
s' to give an internal perspective on the gerund, and so the gerund may be interpreted imperfectively.

With this section we have concluded the argument begun in §5.2, namely, that by formulating a semantics of perfectivity that inherently takes into account a perspective, given by the reference situation, we can explain the aspectual contrasts among gerunds. We have also seen that aspect in gerunds and with the progressive is a unified phenomenon, with a single semantics for -ing made use of in both cases. When a verb embeds an -ing form, the aspect that results depends on the relation the verb sets up between its evaluation situation and that of the VP-ing itself. Progressive be represents a kind of limiting case, where the relation between those two situations is identity. Enjoy and celebrate represent fairly clearly the cases where the two situations overlap and do not overlap, with many other verbs not being so strict about the relation; however, the present theory predicts that once the relation is established in a particular case, the aspect of the gerund is determined. That this is so was argued in relation to remember in §5.2. Next we will be interested in seeing how the proposed meaning can be used with other VP-ing constructions as well.

5.4 Gerunds and the Semantics of Other -ing Forms

In this section we will see how the semantics of gerunds given above can be utilized in analyzing free adjuncts (§4.1), gerunds with while, before, and after (§4.2), and aspectual verbs (§4.3). In each subsection, the theme will be to understand how
the -ing form's reference situation and evaluation situation must be treated in order to derive the proper aspectual and temporal consequences for the semantics. Whereas the last sections concentrated on the relation between these two parameters of interpretation when the -ing form is an ordinary NP argument of a verb (the gerunds) or when it is the principal verb of a clause (the progressive), here we examine three other cases: when it is an adjunct, when it is the argument of a subordinator, and when it is a special kind of argument, more closely related to infinitival complements than NP objects. To the extent that they can be successfully treated as well, it will be evidence that the type of meaning argued for in §5.2 fits into a wide variety of syntactic/semantic contexts.

5.4.1 Free Adjuncts

5.4.1.1 Stump's Analysis

Stump (1985) discusses many of the most significant facts about the semantics of free adjuncts. (84) exemplifies a variety of these forms:

(84)
(a) Walking to the store, Mary always smiles
(b) Walking to the store, Mary smiled at me.
(c) Having a friendly attitude, Mary always smiles.

(84a) illustrates the fact that a free adjunct may restrict an adverb of quantification in much the same way as a when-clause can. (84a) may be synonymous with (85).

(85) When she walks to the store, Mary always smiles.
(84b), in contrast, shows that a free adjunct need not have this use. Again like a when-clause, it may pick out a particular instance and thereby have a factive interpretation:

(86) When she was walking to the store, Mary smiled at me.

(84c) illustrates the fact that certain free adjuncts, those derived from individual-level predicates, may not restrict an adverb of quantification. (84c) only has a factive reading like that of (84b); it has an interpretation similar to (87), not (88).

(87) Because she has a friendly attitude, Mary always smiles at me.

(88) When she has a friendly attitude, Mary always smiles at me.

From this type of evidence, Stump concludes that adjuncts derived from stage-level predicates, so-called 'weak adjuncts', may either be interpreted factively or as a restrictor of an operator,\(^\text{12}\) while those derived from individual-level predicates, the 'strong adjuncts', must be factive.

Stump also shows how the aspectual semantics of free adjuncts can be unified with that of the progressive. Utilizing Dowty's analysis of imperfectivity, he is able to treat the -ing forms of free adjuncts and those in progressives as identical. Though I have argued for a different treatment of imperfectivity, below I will argue that my approach is able to give a very similar

\(^{12}\)Stump shows that weak adjuncts may restrict modals and frequency adverbs as well as adverbs of quantification. Here I will concentrate on the latter case, since we have already discussed the semantics of the adverbs in preceding chapters. Of course it is to be hoped that the approach taken to the contrasts between strong and weak adjuncts will extend to modals as well.
and appropriate semantics for free adjuncts. Given that gerunds and progressives have already been seen to be analyzable with the semantics for -ing of §5.3, we will therefore have given a unified semantics for three of the major VP-ing constructions. Later on, we will consider two more, gerunds subordinated by elements like while or after and the VP-ing that occurs with aspectual verbs.

The first thing I will do in this section is provide a brief synopsis of Stump's analysis of free adjuncts. Stump uses a traditional interval semantics. After his ideas are translated into the situation-based theory, it will be modified in several ways that, while preserving Stump's basic insight, result in a better explanation to the contrasts of (84). Then we will come back to the question of aspect, dealing with issues specific to the analysis of -ing forms given in §5.3. These questions involve seeing how to assure the right relationship between the adjunct's reference situation and its evaluation situation: taking care of this is crucial, since it is the connection between these two situations which, I have argued, determines the aspect of an -ing form.

Stump's analysis makes a three-way distinction among free adjuncts, dividing them into stage-level adjuncts that serve to restrict an adverb of quantification or a modal, stage-level factive S-modifiers, and individual-level factive S-modifiers. The form that restricts an adverb can be considered the most basic. The adjunct in (84a) has the translation (89), which involves several concepts that haven't yet been discussed in this dissertation:
\[(89) \lambda t \forall t_1 [M_n(t,t_1) \& AT(t_1, \exists x_s[R(x_s,x_i) \& \text{walking-to-the-store}(x_i)])]\]

Stump's treatment incorporates Carlson's (1977) analysis of the stage-level/individual-level contrast. A stage-level predicate like walking to the store denotes a property that holds of temporally bounded stages of an individual—in the case of (84a), a temporal slice of Mary. The relation R in (89) connects the stages of an individual to the individual itself; \(R(x_s,x_i)\) means that the denotation of \(x_s\) is a stage of that of \(x_i\). Individual-level predicates, in contrast, denote relations that hold of individuals, not stages.

The other unfamiliar feature of (89) is \(M_n\). \(M_n\) denotes a contextually filled-in relation between times. If, as is likely with (84a), it is taken to be identity, (89) denotes the set of times at which a stage of \(x_i\) walks to the store. There are cases, however, in which it seems that the relation should not be identity; according to Stump's analysis, in (90), similar to one of his examples, the adjunct should denotes something like the set of John's late-morning-to-early-afternoon intervals on the same day of which he left Kansas City in the morning.

(90) Leaving Kansas City in the morning, John always reaches St. Louis at noon.

(90) says that all of those intervals denoted by the adjunct are times at which he reaches Kansas City at noon.

The meaning that a stage-level predicate has as an S-modifier can be seen as based on its meaning as a restrictor.
Though Stump does not build up the meanings in exactly this way, the factive adjunct in (84b) can be derived from (89) in this way:

(91) \( \lambda P \lambda t [K(L)(^P(83)(t)) \ (^P\hat{P}(t))] \)

(92) \( \lambda P \lambda t [K(L)(^\exists t_1[M_n(t,t_1) \ & \ AT(t_1,\exists x_5[R(x_s,x_1) \ & \ walking-to-the-store(x_i)]) \ (^\hat{\exists} \ P(t))]) \)

\( K(L) \), whose parts we need not concern us with, is another relation whose value is filled in by context. It relates the proposition expressed by the adjunct and that expressed by the main clause (namely \( P(t) \)); in the case of (84b), a likely candidate to be filled in is simultaneity. This would make (84b) have a meaning similar to (86). Stump discusses the fact that \( K(L) \) can be taken to denote a wide variety of other relations: cause, rationale, concession, etc. That the choice among these seems to be determined by pragmatic factors shows that the relation between a factive adjunct and its main clause should be treated in the flexible manner Stump does.

(92) is able to form a proposition in the following way: First it is applied to the matrix \( S \), which also denotes a set of times. Finally, the time variable \( t \) is existentially bound, resulting with (84b) in the assertion that at some past time Mary walked to the store and smiled at me.

As was discussed above, individual-level free adjuncts cannot act to restrict an adverb of quantification. The factive individual-level adjunct in (84c) gets the translation (93).

(93) \( \lambda P \lambda t [K(L)(^\exists t_1[M_n(t,t_1) \ & \ AT(t_1, having-a-friendly-attitude(x_i)]) \ (^\hat{\exists} \ P(t)))] \)
Again, $K(L)$ relates Mary's having a friendly attitude and the proposition expressed by the matrix clause in a contextually fixed way. With (84c), that relation is likely to be taken to be cause: Mary always smiles because she has a friendly attitude. However, as Stump discusses, other relations are possible.

The interpretation of the adjunct in (84b) is intuitively based on that of (84a). In (84a) it denotes a set of times $T$ which is used to restrict the quantifier, while in (84b) we end up with the assertion that, for some time $t$, the proposition that $t$ satisfies $T$ and the proposition that $t$ satisfies the main clause are related in some contextually specified way. In the case of the individual-level adjunct, only the latter use is possible. A question that arises about Stump's analysis is why this should be (cf. Partee (1991)). An individual-level adjunct is not allowed to have a meaning like (94), which would perhaps be expected for having a friendly attitude.

$$(94) \lambda t \exists t_1(M_n(t, t_1) \& AT(t_1, \text{having-a-friendly-attitude}(x_i)))$$

The unavailability of this translation, and the syntactic category assignment that would go along with it, makes it impossible to derive a restrictive meaning for the individual-level adjunct. However, we would like to have more of a reason for this unavailability, and trying to give such a reason will be the task of §5.4.1.3.

As a prelude to giving a revised theory of free adjuncts that can meet the goal just mentioned, I will now examine how we should incorporate Stump's ideas into the present framework. A
direct translation of his analysis into our situation semantics results in the following meaning for the stage-level restrictor adjunct:

(95) Stage-Level Restrictor
\[ \{ s : \exists s' [ M_n(s, s') \& s' \in [ VP-ing(x_1) ] ] \}\]

In (95), situations have simply replaced times. It is less clear how to reformulate the analysis of factive modifiers. Consider again the general schema of Stump's analysis of these forms.

(96) \[ \lambda P \lambda t [ K(L)(^\vee P-ing(t)) ( ^\neg P(t) ) ] \]

Notice that \( K(L) \) relates two propositions, each of which is gotten by applying a temporal abstract to a time. With (95), however, what plays the role of a Stump's temporal abstract is a proposition, and specifying a particular situation will not result in a proposition but rather in a truth value. This is because in this framework there is no distinction which corresponds to that between times and worlds: the situation encodes the relevant temporal information while also being the type of thing that makes up propositions. There are a couple of strategies we could follow at this point. One would be to modify (95) to (97).

(97) Stage-Level Restrictor
\[ \lambda s'' [ \{ s : s'' < s \& \exists s' [ M_n(s'', s') \& s' \in [ VP-ing(x_1) ] ] \} ] \]

For a given \( s'' \), which corresponds to (96)'s \( t \), (97) yields the set of situations which include \( s'' \) if \( s'' \) is related by \( M_n \) to a VP-ing situation. With such an interpretation, meanings can be given to the factive modifiers.
(98) Stage-Level Factive Modifier
\[ \lambda P \alpha s''''[K(L)([[s : s''''<s & \exists s'[M_n(s'',s') & s''\in[VP-ing(x_i)]))] (P(s'''))] \]

(99) Individual-Level Factive Modifier
\[ \lambda P \alpha s''''[K(L)([[s : s''''<s & \exists s'[M_n(s'',s') & \exists x_s[R(x_s,xi) & \\
\ s''\in[VP-ing(x_s)]])]]) (P(s''))] \]

(98) and (99) assume that we can give the matrix clauses, represented by P, meanings like that of (97)—functions from situations to sets of situations. Granting such an assumption, (97)-(99) give what I will call the 'Stump-style theory'.

5.4.1.2 A Situation-Based Account

We have seen that incorporating Stump's analysis into the situation-based framework results in a quite complex meaning even for the restrictor adjuncts. Furthermore, it continues to have the explanatory shortcoming of failing to give a reason why stage-level and individual-level adjuncts should behave differently. Now I would like to suggest an analysis that, I believe, improves on the Stump-style one by meeting the following goals:

(i) It utilizes the normal meaning for -ing forms given above.
(ii) It treats modifier adjuncts and restrictor adjuncts identically, both semantically and syntactically.
(iii) It treats stage-level and individual-level adjuncts uniformly.
(iv) It explains why modifier adjuncts are always factive.
Furthermore, as will become clear in the next subsection, this analysis will make free adjuncts seem very similar to the -ing forms with subordinators like before, after, etc.

The central ideas of this analysis can be seen by looking at the following structure, which I propose is the correct Logical Form for all sentences involving free adjuncts.

(100)

Q represents an adverb of quantification or a modal, and it will not be present\(^\text{13}\) with the factive adjuncts. The -ing form is a gerund, which at S-structure is the object of a null preposition R; R denotes a vague relation between events and propositions; within its range of meanings are such notions as precedence, concession, cause, etc. At LF the gerund—whether it is based on a stage-level or an individual-level predicate—has undergone QR and adjoined to the S. There, if there is no quantifier, it will automatically receive a factive meaning just like the non-quantified S-adjoined argument gerunds of Chapter 3. It will not have to be stipulated that R induces factivity, because, in the

\(^{13}\)A quantifier may be present in the clause when there is a factive adjunct, but it will not be in this syntactic relation to the gerund at LF. A factive gerund is compatible with a quantifier if it adjoins above it, giving \(\text{ls gerund ls Q ls...lll.}\)
absence of the quantifier Q or other operator, the structure that
the gerund enters into at LF assures, due to general interpretive
mechanisms, that it is factive. On the other hand, if a quantifier is
present and the adjunct is based on a stage-level predicate, it may
be bound, resulting in an interpretation as a restrictor. Why only
stage-level predicates may be bound will be discussed below.

It is a fact crucial in what follows that when Q is present and
the adjunct is being quantified over, R must denote a temporal
relation such as 'during', 'before', or 'just after' and not one like
'because' or 'despite'. I do not know why this is. Perhaps R
always denotes a temporal relation, with ideas like cause and
concession coming in through pragmatic factors. In any case, this
restriction on what R can mean when it is in combination with Q
should be kept in mind.

The reason why individual-level -ing forms cannot be
restrictors cannot be seen from (100). I will propose that they are
not appropriate to serve as restrictors because of the kinds of
propositions they denote. They denote sets of situations which it
does not make sense to quantify over. I will come back to this
point after having outlined the rest of the analysis in more detail.

In discussing further the ideas just mentioned, I will
examine the interpretations received by the three sentences in
(84), repeated here:

(84)
(a) Walking to the store, Mary always smiles
(b) Walking to the store, Mary smiled at me.
(c) Having a friendly attitude, Mary always smiles.
(84a) enters into the Logical Form (101).

\[
(101)
\]

The interpretation of this structure is quite straightforward. A partial translation tree is given in (102). I will ignore tense until §5.5.

\[
(102)
\]

\(x_i\) represents the PRO subject of the gerund; through control it is identified with Mary. The interpretation of (102) is roughly (103):
(103) $\{s : \forall s'' s''[s'<w_s & s''[WTS(x_j)[x_i]]M.u.C.r.g(s'/xi)] \rightarrow \text{for some } s''', s''<s''' & s''[R(x_i)(\text{smiles}(\text{mary}))]M.u.C.r.g(s'/xi)]$

$\{s : \forall s'' s''[s'<w_s & s''[WTS(x_j)]M.u.C.s''.g \rightarrow \text{for some } s''', s''<s''' & s''R(s')(\text{smiles}(\text{mary}))M.u.C.r.g(s'/xi)]}$

(1 have used 'R' both in the object language and the metalanguage to stand for the vague relation between events and propositions.)

(103) denotes the set of situations $s$ such that every minimal situation of Mary walking to the store in the world of $s$ is $R$-related to the proposition that she smiles. If we take $R(s')(p)$ to denote $\{s : s \in p & s' \text{ temporally overlaps } s\}$, it will essentially mean that when Mary walks to the store, she always smiles.

Also note that (103) results in an imperfective reading of the gerund. The reference situation of the gerund is $s''$, the evaluation situation of Mary smiles. We have just stipulated a meaning for $R$ that, in this case, assures us that the walking situations and the smiling situations temporally overlap; the state of affairs is therefore identical to that with enjoy, discussed above. The situations in the gerund's denotation need not be completed walking-to-the-store situations, but merely ones that, if completed as would be normal from the time of the smiling, would end up with Mary at the store. The gerund is like a little progressive, with the matrix clause providing the time at which merely possible continuations may be contemplated.

Stump pointed out the imperfectivity that many free adjuncts show and also predicted it by using the same -ing with
adjuncts as with the progressive. In this way the present theory follows Stump's. However, because on Stump's theory the -ing imposes imperfectivity all by itself, and not in conjunction with additional facts about the gerund's reference situation, there is a difference between the approaches. The present analysis predicts that, if R were to enforce a retrospective perspective on the gerund's events, the gerund would be perfective. I believe this to be correct:

(104) Walking to the store in the morning, Mary is always here by noon.

Here $R(s')(p)$ should denote something like \{s : s$\in p$ & s' precedes s by a few hours\}. With such an R, the point of view s on the gerund will completely follow the walking-to-the-store situations, just as was the case with the complement of celebrate, and they will therefore have to be complete walks to the store.

Now we can move on to discuss (84b).

(84b) Walking to the store. Mary smiled at me.

(105) gives a translation tree for this sentence:
(84b) will denote the set of situations s such that g(x) is a situation of Mary walking to the store and s is a situation in which g(x) is R-related to the proposition that Mary smiled at me. If R(s')(p) denotes, as before, \{s : s \in p \& s' temporally overlaps s\}, the example will denote

\[
(106) \{s : g(x) \in \{\text{WTS}(x_j) \text{M.u.C.s.g & s is \text{smiles-at-me(mary)}}, \text{M.u.C.r.g & g(x) temporally overlaps s}\}
\]

This is the set of situations s such that g(x) is a situation of Mary walking to the store and s is a situation of Mary smiling at me which overlaps g(x). Notice that the gerund gets a factive interpretation by virtue of two facts: First, if g(x) is not in the denotation of the gerund, (106) will be the empty set, and, second, g(x) must be in the same world as s because s serves as the gerund’s reference situation. Any situation in the gerund’s denotation exists in the world of the reference situation, though it need not be completed in that world. Hence (84b) can only be true in a situation if some event of Mary walking to the store.
occurs in the world of that situation. (Note that, because the reference situation is the clause's evaluation situation, we are considering reference situations from many different worlds; we are therefore not limiting consideration to walking-to-the-store events from a single world.)

As with (84a), the adjunct (84b) gets an imperfective interpretation if $R$ denotes temporal overlap. In contrast, if $R$ means 'after' or something more complicated like 'because and after', the adjunct will come out perfective. Thus in this case the aspect of the gerund is heavily dependent on the context in which the sentence is uttered, as context establishes the interpretation of $R$.

Example (84c), repeated here, is treated just like (84b).

(84c) Having a friendly attitude, Mary always smiles.

For reasons to be discussed below, the adjunct may not serve to restrict the adverb of quantification; instead, it is an independent conjunct outside the scope of always. We therefore end up with the translation tree (107):
In the case of (84c), the most natural interpretation of $R$ is as 'because'--i.e. $R(s')(p) = \{s : s \in p \& s'$ is a cause of $s\}$. Thus, this example denotes the set of situations $s$ such that $g(x_i)$ is a situation of Mary having a friendly attitude and $s$ is a situation of Mary always smiling (in some contextually given set of circumstances $P$) because of $g(x_i)$. More formally, we have

$$\text{(108)} \{s : g(x_i) \in HFA(x_i)^M.u.C.s.g \& s \in \{\text{always}(P)(\text{smiles(mary)})^M.u.C.r.g \& g(x_i) \text{ is a cause of } s\}$$

Again, the gerund receives a factive reading because (i) some $g(x_i)$ must be in the gerund's denotation if (108) is not to be the empty set and (ii) the reference situation for the gerund is $s$. The situations in a gerund's denotation must exist in the world of the reference situation; hence, any situation $s$ in (108) must coexist with a $g(x_i)$ in the gerund's denotation in the same world.
5.4.1.3 Stage-Level and Individual-Level Predicates

In this section I will investigate the question of why only stage-level predicates are able to serve as a restrictor of an adverb of quantification. Since all gerunds denote sets of possible situations, we will not be able to extend Kratzer's (1989b) approach to the contrast. Discussing quantificational readings with if and when clauses, she suggests that only stage-level predicates have an event argument and that this is why it is impossible to have a quantification-over-events reading when the if/when clause contains an individual level predicate. Instead, the natural approach to the problem within the context of this dissertation is to attempt to see whether the kind of situations in the denotations of individual-level predicates are, for some reason, unsuitable for quantification. One type of view along these lines is that the event or situation associated with an individual-level predicate is not repeatable.\(^\text{14}\) Thus, there is no reading for (84c) with quantification over situations of Mary having a friendly attitude because there is only one such situation. Quantification would not make sense. While this simple approach will not turn out to be tenable for all cases, I believe that it has the right character and that it is most likely correct for some.

Before going on with the main line of thought, I would like to lay out some of the main points of Carlson's (1977) theory of the relation between stage- and individual-level predicates. I believe that some of Carlson's ideas, in combination with Kratzer's

\(^{14}\)This idea is due to Sandro Zucchi, Henriette de Swart, and Helen de Hoop.
theory of genericity discussed in Chapter 4, can give us insight into the unique behavior of individual-level -ing forms. Carlson divides the set of predicates into three groups: the stage-level, the object-level, and the kind-level predicates. The latter two classes jointly make up the individual-level predicates. There exist basic members of each of the groups, as exemplified in (109):

(109)

basic stage-level: run, be in the room, smoke
basic object-level: love Mary, be a human being, resemble Myron Adams
basic kind-level: be widespread, get larger as you go north from here

Carlson postulates two generalization operators G and G'. G denotes a function from stage-level predicate meanings to individual-level predicate meanings (object-level plus kind-level), while G' denotes a function from object-level predicate meanings to kind-level predicate meanings. This setup is illustrated by (110):
An example of a true stage-level predicate is the one-event reading of (105).

(111) John smoked.

Example (111) considered as a past habitual, in contrast, involves *smoke* as an object-level predicate, it having been generalized by G. The generic (112) also involves the generalized meaning of *smoke*, but this time it has, according to Carlson,\(^\text{15}\) a kind-denoting subject:

(112) Italians smoke.

In (113) we have an example of a sentence with a true basic object-level predicate, while (114) shows this same predicate in a use where it is generalized by G':

(113) Fido has four legs.
(114) Dogs have four legs.

The relation between a generalized and ungeneralized version of a predicate is, according to Carlson, somewhat vague. It is not primarily a linguistic question what it is that relates *have four legs*, the predicate's meaning in (113) to G'(*have four legs*), its meaning in (114). If in any relevant sense the basic object-level property of having four legs can be said to generally hold of any kind, G' will encode that generalization. Likewise, it need not be entirely clear what it is about John that makes the habitual reading of (111) true, or what it is about Italians that makes the generic (112) true. All that G tells us is that some kind

\(^{15}\)This is disputed by Wilkinson (1986) and Gerstner and Krifka (1987). Discussion of their criticisms follows.
of law-like fact is being expressed, and it is up to some non-linguistic theory to tell us what constitutes that fact.

Wilkinson (1986) and Gerstner and Krifka (1987) have criticized Carlson's theory by claiming that (112) and (114) are best analyzed by means of quantification in an unselective binding framework, perhaps with a true Carlsonian analysis as a second option for (112) and (114). Thus, (112) is claimed to be semantically most parallel to (115), which has a Logical Form roughly as in (116).

(115) Italians always smoke.

(116) past([always] Italians) [smokes]

This type of view should be quite familiar, and it has been used extensively in this dissertation. The main argument for Wilkinson's and Gerstner and Krifka's view is that Carlson's analysis does not extend well to singular indefinites, which nonetheless show up in many of the same structures as bare plurals:

(117) An Italian always smokes.

An Italian cannot be kind-denoting, as it cannot occur with basic kind-level predicates:

(118) *An Italian is widespread.

cf. (119) Italians are widespread.

An unselective binding analysis of (117) extends quite naturally to (115) and (112).

Further evidence against Carlson's account comes from the fact that kind-denoting definite NP's often do not occur where his theory predicts they should:
(120a) The dog chases cars.

If (120b) involves quantification, and not predication of a kind, the lack of a generic reading for (120a) is predicted. On the other hand, note that when the generic is derived from a basic object-level predicate, a clearly kind-denoting subject is possible:

(121) The dog has four legs.

This is the reason why, as was mentioned above, (114) probably must be considered by Wilkinson and Gerstner and Krifka to have two analyses--one based on a predication of a kind and the other based on quantification.

While these criticisms of Carlson's approach may at first seem quite impressive, it is important to realize that they only affect a small part of his theory. Essentially they say that Carlson is wrong to postulate that G can turn a stage-level predicate into one that can take a kind-denoting subject; if G could do that, (120a) should be acceptable. They therefore postulate an alternative analysis for (120b) in terms of quantification, parallel to (117). At this point, unless one does something special, this quantificational analysis extends automatically to (114). However, (114) continues to receive a Carlsonian treatment as well.

Even if we accept all of Wilkinson's and Gerstner and Krifka's points, then, we end up with the following picture: The operator G can turn stage-level predicates into object-level ones, making habituals. G' can turn object-level predicates into kind-level ones. If we have both G and G', a basic stage-level predicate could be made kind-level through the application first of G and
then of $G'$; thus an example like (120a) should be possible. It should thus be noted that such examples are sometimes grammatical:

(122) The lion chases antelope.\(^{16}\)

In (122) the predicate's translation is: $G'(G(\text{chase antelope})$. The differenced between (122) and (120a) seems to be that (122) expresses a property of the species that is part of their natural way of living, while (120a) does not. Carlson notes that generics with definite NP's are restricted to such properties, and in the present system this fact can be attributed to the semantics of $G'$. The use of $G'$ is the only way a generic with a definite NP can be formed from a predicate that is not basically kind-level, and it results in a property which expresses something about the natural mode of existence of the kind. Thus, Wilkinson's and Gerstner and Krifka's argument that stage-level predicates cannot be converted into kind-level ones really only shows that the conversion cannot be done directly.

Bare plurals as the subjects of object-level predicates can be quantified over by a null generic adverb of quantification, which I will call $G''$, and such sentences are often identical in form to a predication of a kind by a generalized version of the object-level predicate. This is the view of the distribution of generalization operators that I will accept in what follows.

We now have the following types of individual-level predicates: basic object-level, basic kind-level, basic stage-level

\(^{16}\)This example is due to E. Bach.
generalized by G. object-level generalized by G'. Furthermore, there are quantificational sentences involving G" and an object-level predicate. With this more detailed analysis of the varieties of individual-level predicates, we can turn our attention back to their semantic nature. The position that I will advocate has two main components:

(i) Stage-level predicates and individual-level predicates do not differ according to the sort assigned to their subject—in fact, I will assume that stages do not exist as members of the universe of discourse—but rather they differ in the nature of the set of situations they denote.

(ii) Individual-level predicates are semantically heterogeneous: what they have in common is that their meanings disallow quantification in examples like (84c).

Some sentences with individual-level predicates denote situations of indefinitely long temporal extension. These resist quantification for a reason very close to that suggested by Zucchi, de Swart, and de Hoop, who claimed that individual-level predicates lack quantification-over-events readings because their situations are not repeatable. Other sentences involving individual-level predicates are generics in Kratzer's sense (cf. Chapter 4):¹⁷ they are true of every situation in a world in which they are true, and in this way are not unrepeatable but rather too

¹⁷Kratzer (1989a) observes that sentences with individual-level predicates are frequently generic.
repeatable. If one tries to quantify over the situations in a generic's denotation, one quantifies over a huge number of irrelevant situations.

The first variety of individual-level predicates are the basic object-level and kind-level predicates. According to the view I would like to advocate, what ties these together is simply that they denote situations which are, in the typical case, of indefinitely long duration. The way I would like to put this, which makes clear its particular relevance to the semantics of -ing forms, is to say that they lack any natural notion of completion. Stage-level predicates, in contrast, are always associated with a notion of completion: for build a house, the obtaining of a finished house, for notice the fish, coming to be aware of the fish, and for walk, merely ceasing walking.\(^\text{18}\) (Here I am using an intuitive notion of 'completion' and not the formal one defined in §5.3.2.1 as part of comparing the present theory with Landman's.) (84c) is an example of this kind, as are the following:

(123)
(a) Loving a woman. John is always happy.
(b) Resembling Myron Adams. William frequently cries.
(c) Being from Lawrence. Pam is often made fun of.

Let us consider (123a). It would not be quite right to say that the situations in the denotation of \(x\) love a woman are not repeatable, since John can certainly love several women, at the same time or

\(^{18}\text{Note that a completion is quite different from a culmination.}\)
in succession. If this weren't the case, (124) would lack a quantificational reading:

(124) When John loves a woman, he is always happy.

Thus, there is a difference between free adjuncts and when-clauses with individual-level predicates. The former disallow quantification entirely, while the latter only disallow it when the situations are not intuitively repeatable. Our task is to discover why there is the stronger requirement on individual-level adjuncts.

I am proposing that there is a more basic reason why, in many circumstances, clauses with individual-level predicates do not denote repeatable situations: the situations in their denotations lack a natural notion of completion. Thus, once they begin, they go on indefinitely—at least in the default case, as they frequently can be coerced into being treated as stage-level, repeatable, predicates. In the case of (123b), say, a situation in the denotation of resembling Myron Adams goes on as long as William does. The same goes for a gerund like loving Mary. However, the fact that loving situations lack any natural notion of completion does not prevent John loves a woman from denoting a set of perfectly distinct situations; even if each situation is (pessimistically) assumed to go on until John's death, each woman he loves will result in a separate basic situation to quantify over.

Now we can see why there is a stronger restriction of individual-level free adjuncts than on individual-level when-clauses. The very semantics of -ing forces the situations in the denotations of individual-level adjuncts (as well as argument
gerunds) to be given a notion of completion. The semantics for 
(John) loving Mary is, intuitively, the set of situations all of whose 
normal completions are situations in which John loves Mary. Thus 
some concept of completion must be imposed on these loving 
situations. However, because the situations in the denotation of a 
basic individual-level predicate lack a ready notion of completion, 
only in very special circumstances will the semantics of an 
individual-level gerund make sense.

The basis for the explanation of why individual-level 
gerunds may not be quantified over comes from the nature of the 
circumstances in which the semantics of an individual-level -ing 
form makes sense. The principle I will pursue is the following: 
The only time an individual-level -ing form is well defined is 
when its reference situation is a whole world. The reason that 
such a reference situation is a necessity is that it will obviate the 
need to figure out what a completion of a being-from-Lawrence 
situation or a loving-Mary situation would actually be like. With 
the whole world as reference situation, every candidate situation 
for being a reasonable completion will be identical to the actual 
situation where Pam is from Lawrence of John loves Mary. Thus 
we can forget the whole issue of completion and just take the 
gerund to be semantically identical to an untensed clause.

It is not the case that this is the only approach to what is 
special about individual-level predicates that would work. Other 
ideas for what the reference situation for an individual-level 
gerund must be could work as well. For instance, if the reference 
situation for (123a)'s adjunct merely had to last up until the end
of John's life, quantificational readings would also be impossible. However, because the two approaches have the same results in the cases we will be looking at, I will illustrate the reasoning only for the one that says that the reference situation must be a world. Further work must be done to consider possible differences among approaches.

A theory which claims that individual-level adjuncts are special because they cannot be true with respect to a very local reference situation is supported by the following contrast:

(125)  
A: John can touch the ceiling.  
B: Well, that's true in your house but not in mine.

(126)  
A: Having three foot long arms, John can touch the ceiling.  
B: ??Well, that's true in your house but not in mine.

(126) shows that sentences with individual-level adjuncts are not easily able to be true in subparts of worlds. Since the reference situation of the adjunct is the evaluation situation of the whole sentence, we see that the reference situation for the adjunct is not allowed to be local enough to be in a house. Either hypothesis suggested above—that it must be a whole world or as long-lasting as John's life—would predict this result.

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19In this way they are like counterfactuals in Kratzer's system. The fact that both constructions frequently express causal relations is perhaps not accidental.
Now we are in a position to see why individual-level adjuncts may only occur as factive modifiers and cannot be quantified over. Consider again (123):

(123a) Loving a woman, John always smiles.

If this were to get a reading with quantification over situations of loving a woman, the semantics would be as follows:

(127) \( \{ s : \forall s' \forall s''[s'' \prec_{ws} s' \& s'' \in [\text{loving-a-woman}(John)]^{M.u.C.s''.g} \rightarrow \text{for some } s''' , s'' \prec s''' \& s''' \in R(s')(\text{\{(smiles(John))\}^{M.u.C.r.g}}) \}

This meaning is exactly parallel to (103). Notice the quantification over \( s'' \); this \( s'' \) serves as the reference situation for the gerund.

We have just said that the reference situation for an individual-level \(-ing\) form must be a whole world. Thus (127) is the set of situations in a world such that for every situation \( s' \) of John loving a woman, that world is in the denotation of \( 'R(s')(\text{\{(smiles(John))\}^{M.u.C.r.g}} \). Now, recall that with quantificational sentences \( R \) must denote one of the temporal relations 'during', 'before by ten minutes', 'after', etc. If, as with (84a), we were to defined \( R \) by \( 'R(s')(p) = \{ s : s \in p \& s' \text{ temporally overlaps } s' \} \), (127) would merely be the set of situations in a world \( w \) such that either John loves no woman in \( w \) or John smiles at least once in \( w \). There is no real room for quantification, since if any situations satisfy the antecedent, all we need is one to satisfy the consequent, and it need bear no special relation to the antecedent's situations. If \( R \) denoted temporal precedence in one direction or the other, things would be even worse. No situation precedes or follows a whole world. I claim that no allowable
choice of R does any better and that for this reason the quantificational reading will not make sense when the situations quantified over are whole worlds. This provides an explanation for why adjuncts formed from basic individual-level predicates cannot serve as restrictive clauses.

I would like to emphasize that there is a difference between (123a) and (124). (124) suggests that a more simple notion of 'repeatability' is what is important for determining whether a finite clause can be a restrictor. Since John can love more than one woman, there may be more than one basic situation in the denotation of the when-clause. Because this possibility does not rescue the free adjunct, there must be a more strict restriction at work. I have suggested that the requirement on an adjunct is stricter because it is an -ing form, and -ing forces us to pick a reference situation with respect to which the idea of 'completion' makes sense. With individual-level adjuncts, it only makes sense in a few cases.

We cannot give precisely the same kind of reasoning with adjuncts formed from non-basic individual-level predicates. (128) gives a couple of examples.

(128)

(a) Having four legs, dogs can run fast.
(b) Smoking, Marion is frequently happy.

Neither of these, when the adjunct is individual-level, allows it to be a restrictor. For example (128b) cannot mean 'Marion is happy

\[20\] Note that (124) cannot involve quantification over women, because there is no anaphor for a woman in the nuclear scope.
during many of the periods of her life when she is a smoker'. One significant difference between basic and non-basic individual level adjuncts, which suggests that they should be treated somewhat differently, is that the former can be pushed into stage-level interpretation, while the latter cannot. While (129) at first glance lacks a reading with the adjunct as restrictor, because in general one does not repeat owning this house,

(129) Owning this house, John is always happy.

it is possible to get the reading by imagining that John repeatedly buys and sells the same house. In contrast, *smoking* in (128b), so long as it has the habitual, individual-level, reading, can under no circumstance be a restrictor. The reason that I will propose for the contrast between (129) and the examples in (128) is that the latter denote generic propositions in Kratzer's sense. There is no simple shift from a generic to a non-generic denoting a set of repeatable events, while there is such a natural shift for the clauses with basic individual-level predicates, which merely denote events which are intuitively of quite extended duration.

Recall (from Chapter 4) that, within Kratzer's (1989a) situation theory, generic statements are those which are true in every situation in a world in which they are true. A clear case, where it is easy to test the properties in counterfactual reasoning, is the -ing form in (130).

(130) A king ruling this country, it is always quite stable.

As Kratzer points out, because *A king rules this country* is generic, it licenses the following reasoning.

(131) If this man weren't the king, someone else would be.
(131) is true because any proposition we add to the antecedent will lump the proposition that a king rules this country, so every collection of premises we take in conjunction with \textit{this man is not the king} will entail that someone else is. Because a generic proposition is true in every situation in a world, we certainly can't base any reasoning about its distribution on the idea that it is only true in relatively permanent situations. In particular, plenty of the situations in a generic's denotation will have a natural notion of completion associated with them—for instance, the situation of Max's halfway walk across the street will be in the denotation of \textit{a king rules this country} (if it is true in the world of Max's walk), and its completion is a possible situation in which he walks all the way across the street. Hence, we are going to need a different theory for examples like (130).

The reason I propose for why quantification over situations is impossible in (130) is that the proposition denoted by the adjunct contains too many situations for quantification to make sense. At first glance, (130) should denote something like (132)

\begin{equation}
(132) \forall s' \forall s'' \exists s'''(s'<w_s \land \text{a king rules this country in } w_s) \rightarrow \exists s''''(s'<s'''' \land s'''' \in R(s'\{s'' : \text{the country is stable in } s''\}))
\end{equation}

Since completely irrelevant situations in Antarctica in the year 43 b.c. are in the domain of quantification, there will be no useful and informative meaning for \(R\) that can let this sentence be true.

One point that might be brought up is that it seems that generics need not be true in every situation in a world in which they are true, but can be limited to being true in every situation
in some subpart of the world. Kratzer gives the following example:\textsuperscript{21}

(133)

A: Swans are black.
B: Well, that's true in Australia but not here.

(133) suggests that \textit{swans are black} is true in every situation in Australia. The proposition that swans are black would then only be lumped by a proposition that is true due only to basic situations in Australia. Thus, an example with a quantifier like (134) would not have to quantify over so many distant and irrelevant situations:

(134) Being black, swans are usually beautiful.

However, there will still be too many situations in the denotation of \textit{being black}. A situation consisting merely of a young child in Perth for a half hour on 2/28/92 will be in the domain of quantification, as will a very large number of equally irrelevant situations. Thus, limiting the generic to a certain location is not going to make quantification possible.

We have seen why it should be impossible for a true generic, such as the adjunct in (130), to serve as a quantifier restriction. What is left to do is see to what other cases this explanation can extend. I would like to suggest that all the sentences proposed by Carlson to contain a generic operator, \textit{G} or \textit{G'}, are generics in Kratzer's sense. As we saw above, the are essentially three cases to consider. First, there are habituals.

\textsuperscript{21}In unpublished lecture notes.
object-level predicates derived using G from stage-level ones. Second, there is the derivation, with G', of kind-level predicates from object-level ones. Gerstner and Krifka argue that these should have an alternative treatment involving quantification by G'' as well. And finally there is the controversial derivation of generic sentences with indefinite subjects from basic stage-level predicates; Wilkinson and Gerstner and Krifka claim that these should involve the generic adverbial quantifier G'', while Carlson uses G' to create a true kind-level predicate. However, it is not important for our purposes to establish which view of these last two cases is correct (or if both are); all we need to know is whether the resulting propositions are generic in Kratzer's sense.

Let us first consider the derivation of kind-level predicates from object-level ones, for instance:

(135) The dog has four legs.

It seems that this sentence does support counterfactual reasoning, showing that it is generic in the relevant sense.

(136) If the kind of animal we are discussing were *canis familiaris*, it would be a kind of animal that has four legs.

The counterfactual in (136) completely about kinds, rather than individual dogs, in order to be certain its truth is based on a kind generic, rather than an indefinite generic like (114) or (137):

(114) Dogs have four legs.

(137) A dog has four legs.

(114) and (117) do not support the truth of (136) except to the extent that they entail (135).
Next let us consider generic sentences based on stage-level predicates:

(112) Italians smoke.
(138) An italian smokes.

Recall the fact that a definite, kind-denoting subject is impossible with these predicates.

(139) #The italian smokes.

This indicates that (112) and (138) do not involve predication of a kind, but rather generic quantification over individuals. The counterfactual in (14) can be true on the basis of (112)/(138).

(140) If you were an italian, you would smoke too.

The proposition expressed by (112)/(138) sentences must be considered in every set of premises added to the antecedent of (140). Only if (112)/(138) are true in every situation in the world of evaluation--i.e. only if they will be lumped by every other premise--can we be assured that this will be the case.

The final type of example we need to consider is the most difficult. A habitual, like (111), is only about a single individual.

(111) John smokes.

Carlson analyzes this kind of example with G, which changes *smokes* from a stage-level to an object-level predicate. An alternative analysis, suggested for example by Gerstner and Krifka, is that (111) involves quantification over a set of situations. Whichever approach is correct, the same kind of counterfactual-reasoning test used above will show that (111) is generic. At first glance, one might think that (111) should be able to make a sentence like (141) true:
(141) If you were John, you would smoke. However, since we know from Kripke (1972) that you are John is necessarily false (if you're not talking to John) if taken as a real identity statement, we are led to the conclusion that the antecedent of (141) means something a bit different. Intuitively, it means something like 'if you were like John', in which case the truth or falsity of (141) does not directly have to do with (111).

A better way to approach the habituals may be through (142).

(142) That dog barks at the mailman.
Then we can consider

(143) If you were the mailman, that dog would bark at you. If (142) were not generic, it would be possible to add (144), a true statement, to the antecedent of (142).

(144) That dog does not bark at you.
This possibility would make the would counterfactual (143) false. However, if (144) lumps (142) because (142) is generic, it will not be possible to consistently add (144) to you are the mailman. Hence, (143) can come out true.

We have seen that there is good reason to believe that all the sentences postulated by Carlson to contain a generic operator (G or G'), including those reanalyzed by Gerstner and Krifka and Wilkinson as involving quantification, are very strong lumpers—i.e. that they are generic in the way discussed by Kratzer. Our theory of the semantics of -ing forms predicts that such propositions can not serve as restrictors for adverbs of
quantification because they are true in too many situations. Taken together with the discussion of basic individual-level predicates of above, we have an explanation for why no individual-level -ing forms are able to be a restrictive clause.

Before going on, I would like to defend briefly the division of individual-level predicates into two classes. As was pointed out above, basic individual-level predicates can be shifted fairly easily into functioning as a stage-level predicate, while habituals and derived generics cannot.

(128b) Smoking, Marion is frequently happy.
(129) Owning this house, John is always happy.

While (129) can get a reading with the adjunct as a restrictor if one imagines John repeatedly buying and selling the same house, (128b) cannot receive such a reading by thinking of Marion repeatedly quitting a taking up again smoking. I believe that the reason for this is as follows: The process for forming a stage-level predicate from an individual-level one involves taking the minimal situations which can satisfy it and mapping them onto a related kind of situation which are not of indefinite duration. The following definition will convert an individual-level one-place property into a related stage-level property.

(145) For any property P, \( \text{Stage}(P) = \{ R \mid \text{for any individual } a, R(a) = \{ s : \text{for some } s' \in P(a), s \text{ is a shortened version of } s' \} \} \)

In the case of (129) this process is straightforward; while owning are usually very long, it is certainly possible to imagine what shorter ones are like. The adjunct in (128a), in contrast, does not
lend itself at all to the shift. The basic situations which satisfy it are quite heterogeneous—they are all the situations in a world in which Marion smokes. There is no way to figure out, merely from the nature of the minimal situations, what a shortened habitual smoking situation should be. (Though one could recover the fact that being a smoker is at issue by considering the set of possible worlds the adjunct is true in.) Instead, we'll get a shortened version of every situation in every world in which the generic is true (if that is even possible). Therefore, by assuming that the shift from individual-level to stage-level predicate is done by mapping the basic situations which satisfy the original predicate to other, shorter situations, the contrast between (128a) and (129) will be predicted.

This concludes the discussion of the stage-/individual-level contrast. I hope to have indicated why stage-level -ing forms can be quantified over while individual-level ones cannot. Some aspects of the discussion were based on the stage-/individual-level distinction itself, while others had specifically to do with the semantics of VP-ing. The fact that the general approach could be made to interact properly with the proposed analysis of -ing is evidence in its favor, as we saw that the restrictions on when an adjunct can be a restrictive clause are more severe than those on when a when-clause can. There are a number of questions which remain open, however. Most important, more work must be done to see exactly what type of situations can serve as the reference situation for an individual-level gerund. In the discussion above, I assumed that it had to be a whole world, but noted that some
lesser requirement—such as that it had to last as long as the denotation of the predicate's subject—would work as well.

Another area that need clarification is the precise semantics of sentences involving G, G', and G''. I argued that they were all generic in a way that predicts non-quantifiability, but it would be desirable to understand their meanings well enough to actually state denotations which give the required output. However, that task would have to be part of a more detailed investigation of genericity that we can undertake here.

5.4.2 Gerunds with Explicit' Subordinators

After the discussion of free adjuncts, the analysis I would like to propose for gerunds with such subordinators as *when*, *while*, *before*, *three hours before*, and *after*, is quite straightforward. Consider again (100), the generalized representation of sentences with free adjuncts at LF:

(100)

```
S
  NP_i
(Q)  
     S
        VP-ing
         PP
          p NP_i
            \ / i
             R t_i
```

I would like to suggest that an example such as (146) has the same structure:

(146) Before walking to town, John always calls his mother.
except that before takes the place of R. Therefore (146) will mean: for all situations s which are walkings to town by John, before s John calls his mother. (147), with a free adjunct may have this interpretation as well:

(147) Walking to town, John always calls his mother

However, (147) is compatible with John calling his mother while or after walking to town as well. In general, the explicit subordinators have specific meanings in the general range covered by R.

Sentences with explicit subordinators have the aspectual properties that we would predict. In (146) the reference situations for the gerund are the calling situations; these precede the walks to town. For this reason the gerund should be predicted to be imperfective, since the semantics for -ing will cause a situation to be in the denotation of the gerund if it is a complete walking to town in its merely possible completions. The same situation obtains with (148).

(148) While building a house. Mary looked up.

(148) does not require that Mary ever complete the house. This fact is as expected, since the reference situation for the gerund is not after the building situation.

The opposite prediction is made in the case of an example like (149), however.

(149)

(a) After walking to town. John always calls his mother.

(b) After building a house. Mary looked up.
In each of these cases, the gerund is perfective. *After* states that the walking and building situations follow the situations associated with the matrix clause. In the case of (b), because the gerund's reference situation—the looking up—completely follows the evaluation situation of the the gerund, a situation will not be in the gerund's denotation merely because it is completed in some other possible world. All the relevant completions must be just like the real world up until the time of the reference situation, and so for a situation to satisfy the gerund it must already be a complete house-building. Thus, when a subordinator imposes an external perspective on the gerund, a perfective reading should—and does—result.

5.4.3 Aspectual Verbs

This section discusses the semantics of such aspectual verbs as *start*, *stop*, *resume*, *keep*, and *continue* in light of the ideas about -ing forms and infinitives developed throughout this dissertation. What I hope to show is that those ideas, when taken together with the work of von Wright (1963), Dowty (1979), and ter Meulen (1990), provide an analysis of the differences between infinitives and gerunds as the complements of aspectual verbs.

The main idea of von Wright, brought into a Montague Grammar framework and made more precise by Dowty, is that aspectual verbs state that there is a change or lack of change in the existence of events at a time. For instance, (150) or (151) is true at a time if there is a change from the absence to the presence of an event of John washing the dishes at that time.
(150) John started washing the dishes.
(151) John began washing the dishes.

(152), instead, is true at a time t iff there was an event of John washing the dishes before t and there was no change at t to the absence of that event.

(152) John kept washing the dishes.
Finally, an example like (153) is true iff there is a change from the presence to the absence of an event of John washing the dishes.

(153) John stopped washing the dishes.
This treatment of the aspectual verbs is quite intuitive; however, there are other important aspects to the meanings of aspectual verbs, as ter Meulen shows.

ter Meulen discusses the requirements that different aspectual verbs place on what was going on before the change or non-change. While, for instance, von Wright and Dowty would say that both (152) and (154) require that an event of washing the dishes exist both before and after the time described by the sentence, ter Meulen has a more subtle story.

(154) John continued washing the dishes.
Keep in (152) presupposes that an event of John washing the dishes exists before the time described by the sentence and asserts that that event also goes on after the time. Continue in (154) presupposes the same thing but instead asserts that an event of John washing the dishes—potentially a different one—also exists after the time. Finally, resume in (155) again presupposes that an event of John washing the dishes exists before the time of resuming, but further requires that that event
have stopped; (155) asserts that the same event comes into existence again.

(155) John resumed washing the dishes.

ter Meulen hypothesizes that an aspectual verb can take an infinitival complement if it describes an event-external change. That is, if the verb does not require that the same event exist both before and after the time described, then an infinitive will be possible. The contribution that I hope to make here is to show that the semantics of infinitives given in Chapter 4 will allow us to predict this effect. In ter Meulen’s analysis, the correlation between the availability of an infinitive and the fact that a verb did not require that the same event exist both before and after the change is merely stipulated. Here, we have treated infinitives as denoting a set of situations whose initial segment is (a duplicate-counterpart of) the reference situation; if the reference situation for complements of aspectual verbs is the situation associated with the aspectual verb itself (as it has been with every previous type of embedding verb) then it will be impossible for a situation in an infinitive’s denotation to have existed prior to the aspectual verb’s situation.

Let us consider the semantics of (150), repeated here, and (156).

(150) John started washing the dishes.

(156) John started to wash the dishes.

Recall that infinitives are of type <s,<s,t>>: they have this type because they denote functions from reference situations to propositions, it being the nature of a subordinate clause to be,
intuitively, a proposition lacking a reference situation. In order to accommodate an infinitive argument, _start_ will have the following meaning:

\[(157) \ \text{start denotes that } f \in D^{<s, <s, t>, <e, <s, l>, >} \ \text{such that, for any } \ h \in D^{<s, s, l>, >} \ \text{and } c \in I, \ f(h)(c) = \{s : \text{it is not the case that there exists an } s' \in h(s) \ \text{immediately before } s \ \text{and there exists an } s'' \in h(s) \ \text{immediately after } s\}\]

Notice that _c_ does not play a role in the meaning of _start_. It merely serves to control the subject of the complement, just as the subject of the progressive did.

Given the interpretation that gerunds have received so far, the meaning in (157) will not be able to combine with that of a gerund. According to what has been said before, gerunds simply denote propositions, not propositional functions. This type for gerunds has worked so far because they have always made the current evaluation situation their reference situation via a general rule. Now, in order to use a gerund with (157), we will need to abstract over the gerund's reference situation. However, as will become clear in the next section, it will actually be convenient to treat all gerunds as propositional functions, where the situation argument that this function takes serves as the reference situation, rather than as simple propositions. I will leave until §5.5 discussion of how this is going to work; for the time being, I will simply identify the reference situation of a gerund with the evaluation situation of its embedding verb without concern for how it happens. It should be noted right away, however, that treating gerund's in this way will make them more like the other
subordinate propositional expressions--infinitives and *that* clauses--which denote propositional functions over the reference situation as well.

A gerund as the argument of an aspectual verb, as in (158), will translate as shown in (159). Then, given (159), (150) has the meaning in (160).

(158) \[ \text{V} \text{P} \text{V} [\text{NP}_i \text{ VP-} \text{ing }] \]

(159) \[ \text{V}'(\text{NP}_{i'}) \]

(160) \{ s : it is not the case that there exists a minimal situation of John washing the dishes (from the point of view of s) just before s and there exists a minimal situation of John washing the dishes (from the point of view of s) immediately after s \}

The parts of (160) in parentheses show that the point of view on the gerund, i.e. the reference situation, is taken to be the starting situation. Recall that the point of view situation provides the time at which merely possible continuations of the dish-washing may be taken into account. Thus (160) does not require that the dish-washing events be completed in the actual world.

(160) is just the type of meaning that Dowty or von Wright would assign. Now let us consider (156), which contains an infinitive.

(156) John started to wash the dishes.

The meaning of the infinitive is given in (161), with an interpretation for all of (156) in (162). The reference situation \( r \) in (161) is identified with the starting situation.
(161) \{s : s has as its initial segment a duplicate-counterpart of r and s contains a situation of John washing the dishes\}

(162) \{s : it is not the case that there exists immediately before s an s' which contains as its initial segment a duplicate-counterpart of s which contains a situation of John washing the dishes and there exists immediately after s a situation whose initial segment is a duplicate-counterpart of s and which contains a situation of John washing the dishes\}

One significant difference between (160) and (162) is that (162) will allow some gap between the starting situation s and the commencement of John's washing of the dishes, as pointed out by Quirk et al. (1985), §16.40. A gap is possible because (162) merely requires that some situation in the denotation of (for John) to wash the dishes exist immediately after s. According to the present theory of infinitives, a situation can be in the denotation of the infinitive if it merely is 'growing into' a situation of John washing the dishes. (163a) could be true if Mary was only making preparations to listen to the CD at 5 p.m. (say by turning the stereo on), while (163b) requires that the music actually be playing.

(163a) Mary started to listen to the CD at 5 p.m.

(163b) Mary started listening to the CD at 5 p.m.

Such contrasts support the present analysis of infinitives, in particular the treatment of infinitives with aspectual verbs as being covert for infinitives.

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The meaning in (162) will also require that the dishwashing be completed in the actual world. The prediction seems incorrect, as can be seen more clearly with (164).

(164) John started to climb the mountain at four p.m. but failed to reach the top because it got dark at seven. Thus the meaning of \textit{start} must be adjusted so that it does not require the completion of the events in its complements' denotations. This is straightforward to do with the analysis of imperfectivity used throughout this chapter.

(165) \textit{start} denotes that \(fe D^{<<s.,<s.,l>>}.<c.,<s.,l>>} such that, for any \(he D^{<s.,<s.,l>>}\) and \(ce l. f(h)(c) = \{s : \text{it is not the case that there exists an } s' \in h(s) \text{ immediately before } s \text{ and all reasonable completions } s'' \text{ of } s \text{ are such that } s'' \in h(s)\}\)

Given (165), the meaning of (156) will be (166):

(166) \(\{s : \text{it is not the case that there exists immediately before } s \text{ an } s' \text{ which contains as its initial segment a duplicate-counterpart of } s \text{ which contains a situation of John washing the dishes and all reasonable completions } s'' \text{ of } s \text{ are situations whose initial segment is a duplicate-counterpart of } s \text{ and which contain a situation of John washing the dishes}\}\)

The interpretation (166) does not enforce perfectivity on the dishwashing events. The change of the meaning of \textit{start} is redundant with gerunds, since, as we have seen, they are imperfective anyway.

Now we will examine why (167) is ungrammatical on an aspectual reading for \textit{stop}.
(167) *John stopped to wash the dishes.

If stop has the meaning in (168), the (167) will mean (169).

(168) *stop denotes that f ∈ D<,>,<c,> such that, for any h ∈ D<,> and c ∈ l, f(h)(c) = {s : there exists an s' ∈ h(s) immediately before s and it is not the case that there exists an s'' ∈ h(s) immediately after s}

(169) {s : there exists immediately before s an s' which contains as its initial segment a duplicate-counterpart of s which contains a situation of John washing the dishes and it is not the case that there exists immediately after s a situation whose initial segment is a duplicate-counterpart of s and which contains a situation of John washing the dishes}

Because it says that a situation whose initial segment is a duplicate-counterpart of s exists before s, (169) is an impossible meaning. Remember that 'duplicate-counterpart of' requires more than qualitative identity; it is also a counterpart relation, so it only holds between situations that are intuitively the same situation. Since the dish-washing situations are in the same world as s, (169) requires that s exist before itself. (169) therefore illustrates how we capture ter Meulen's generalization--this same problem will come up whenever an aspektual verb requires that a situation in its complement's denotation (with the aspektual verb's situation as the complement's reference situation) exist before the time described by the aspektual verb itself. Now we will go on to apply this reasoning to keep, resume, and continue.
Keep expresses the lack of change from the existence of a situation. Its meaning can be given as in (170).

(170) keep denotes that \( f \in D_{<s,\langle s,t \rangle, \langle c, \langle s,t \rangle \rangle} \) such that, for any \( h \in D_{<s,\langle s,t \rangle} \) and \( c \in l \), \( f(h)(c) = \{ s : \text{for some } s' \in h(s), s' \text{ exists immediately before } s \text{ and immediately after } s \} \)

The interpretation of (171) is therefore (172):

(171) John kept washing the dishes.

(172) \( \{ s : \text{for some } s' \text{ of John washing the dishes (from the point of view of } s), s' \text{ exists both immediately before and immediately after } s \} \)

There is no problem with (172). In contrast, the meaning of (173) will be (174).

(173) *John kept to wash the dishes.

(174) \( \{ s : \text{for some } s' \text{ which has as its initial segment a duplicate-counterpart of } s \text{ and which contains a situation of John washing the dishes, } s' \text{ exists both immediately before and immediately after } s \} \)

(174) is an impossible meaning, because it requires that a duplicate-counterpart of \( s \) exist before \( s \).

The meaning of resume is quite similar. Resume is true of a situation which has previously gone on, then entered a dormant or inactive phase, and then is becoming active again. (We cannot simply say that the event has stopped and is starting again because of the fact discussed in §5.3.2.2. that basic situations do not have gaps in them.) (175) presents its meaning:

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(175) *resume denotes that \( f \in D_{<s,<s,l>,<e,<s,l>>> } \) such that, for any \( h \in D_{<s,<s,l>>} \) and \( c \in I \), \( f(h)(c) = \{ s : \text{for some } s' \in h(s), s' \text{ is in a dormant phase just before } s \text{ and } s' \text{ is no longer in a dormant phase immediately after } s \} \)

The interpretation of the ungrammatical (176) would be (177):

(176) *John resumed to wash the dishes.

(177) \{ s : \text{for some } s' \text{ which has as its initial segment a duplicate-counterpart of } s, s' \text{ was in a dormant phase just before } s \text{ and } s' \text{ is no longer in a dormant phase immediately after } s \}

However, such an \( s' \) cannot exist before \( s \), because it must have \( s \) as its initial part.

Finally, there is the case of continue. Continue seems at first just like keep. However, ter Meulen argues that continue may have an infinitive complement because of a subtle difference. It is true when an event of the type denoted by its complement has existed immediately before the continuing, and a (possibly different) event of that type exists immediately after. It is this difference that will allow continue to occur with an infinitive.

(178) continue denotes that \( f \in D_{<s,<s,l>,<e,<s,l>>> } \) such that, for any \( h \in D_{<s,<s,l>>} \) and \( c \in I \), \( f(h)(c) = \{ s : \text{for some } s' \in h(s), s' \text{ exists immediately before } s \text{ and for some } s'' \in h(s), s'' \text{ exists immediately after } s \} \)

In the case of (179), the meaning will be (180).

(179) John continued to wash the dishes.
(180) \{s : for some s"<w_s, for some s' which has as its initial segment a duplicate counterpart of s" and which contains a situation of John washing the dishes, s' exists immediately before s and for some s''' which contains as its initial segment a duplicate-counterpart of s and which contains a situation of John washing the dishes, s''' exists immediately after s\}

(180) does not run into trouble with the infinitive because the meaning of \textit{continue} explicitly sets up an alternative reference situation for the infinitive (i.e. s"); this situation must be the initial segment of the first occurrence of a dishwashing, and it may precede the evaluation situation s.

The difference between \textit{keep} and \textit{continue} shows the way in which linguistic data can be used to uncover semantic differences which are too subtle to be intuitively obvious. Given the meaning of the \textit{for} infinitive argued for in Chapter 4, we can explain the difference in compatibility with infinitives as being based on whether the aspectual verb is compatible with the infinitive's future orientation. \textit{Keep} stipulates that the reference situation for its complement be the keeping situation and also that the same situation exist both before and after. In this way it is like \textit{resume}, where the intuition that only one event is under discussion is quite clear. These two aspects of \textit{keep}'s meaning are incompatible with an infinitive. \textit{Continue}, in contrast, is compatible with different--though related--situations existing before and after the continuing, and moreover it only requires that the continuing
situation be the reference situation for the second. Even though in analyzing keep and continue it is not clear a priori whether they involve two distinct situations or one persisting one, our semantic analysis lets us explain part of the distribution of infinitives if they are treated differently in the way indicated.

In this section I have tried to show how the analysis of gerunds and infinitives can be integrated naturally into a theory of aspectual verbs. The analysis not only is compatible with the von Wright/Dowty theory of these verbs, but actually lets us give a theoretical account of the factors governing the distribution of infinitival complements discussed by ter Meulen. I believe that this fact is a significant element in favor of the present analysis, since, as far as I know, no other formal theory of the semantics of infinitives has a way of making these predictions.

5.5 Formalization of the Claims of §§5.2-5.4

By giving analyses of the following seven sentences, we will cover in a formal way the major points of this chapter.

(24) Jack is crying.

(12a) I enjoyed building a house.

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22 Continue may be compared to cease, which does allow an infinitive even though the infinitive's situation precedes the ceasing.

(i) John ceased to talk to Mary.

I do not discuss cease in detail because the form exemplified in (i) has a quite archaic feel, at least in American English, and thus perhaps does not involve a normal for infinitive. However, if it does use a for infinitive, it is possible to give a meaning to cease that makes (i) possible. Cease must shift the infinitive's reference situation back to before the evaluation situation, just as continue does. This more complex meaning that is necessary when it takes a for infinitive could explain why cease+infinitive is much more marked than cease or stop+gerund.
(80) John always celebrates jogging to town.

(181) Having a friendly attitude, Mary is happy.

(150) John started washing the dishes.

(167) *John stopped to wash the dishes.

First a preliminary note: In what follows, I will ignore the presuppositions of gerunds because the contrast between definite POSS-ing gerunds and indefinite ACC-ing's was discussed in detail in Chapter 3. In (150) and (167) it is impossible to have a subject of the -ing form, so we cannot tell whether to classify them as POSS-ing's or ACC-ing's. I will assume that either is available, with the choice depending on the discourse context. An adjunct like that in (181) can apparently only be an ACC-ing, as seen by the contrast in (182)-(183).

(182) Jim having a friendly attitude, Mary talks to him.

(183) *Jim's having a friendly attitude, Mary talks to him.

We therefore predict that the situation discourse referent introduced in (181) by having a friendly attitude must be novel. Note that this requirement is different from a claim that the fact that Jim has a friendly attitude is new information. We have seen indefinite gerunds in factive positions before. In Chapter 2 factive ACC-ing's were seen in subject position and as the complements of factive verbs. The presupposition of (181) is simply that a new situation of Jim having a friendly attitude is being introduced that will potentially be available for anaphora.

The first example we will look at is (24).

(24) Jack is crying.

The semantics for the progressive be is given in (184).
$(184)$ $[be]^{M,u,C,r,g,s} = \text{that function } k \in D_{<e,e,<s,t>}> \text{ such that for any } p \in I \text{ of sort } +<e,e,<s,t>>, k(p) = \text{that function } f \in D_{<e,<s,t>>} \text{ such that for any } c \in I, f(c) = \text{the } D_{<s,t>} \text{ such that for any } s' \in S, h(s') = 1 \text{ iff } [\neg p](s')(s') = 1.$

Note first of all that the subject argument of $be$ is semantically inactive. It merely serves to control the subject of the gerund. Second, a new aspect of the meaning is that $be$ takes as its first argument the individual correlate of a function of type $<s,<s,t>>$; this is entity of sort $+<s,<s,t>>$. The verb takes an individual correlate, rather than the function directly, for reasons discussed in Chapter 2. '$\neg p$' then is the function which this entity is the correlate of. Then, by applying this function to the reference situation twice, it will turn out that the progressive sentence is true in a situation $s'$ if the gerund is true in $s'$ when its reference situation is $s'$ as well.

The basic meaning discussed in this chapter of the gerund $(Jack)$ crying, with respect to $M, u, C, r, g,$ and $s,$ is given in $(185)$. 

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(185) *crying* denotes that function $f \in D_{<s,t>}$ such that, for any $s' \in S$, $f(s') = 1$ iff
for all $s''$ such that
(i) the part $y$ of $s'$ that precedes the end of $r$ has a
counterpart-duplicate $y^*$ in $w_{s''}$ and this $y^*$ is a
stage of $s''$, and
(ii) no reasonable world $w$ contains a situation $s''''$
such that there is a counterpart-duplicate $s'''''$ of
$s''$ which is a proper stage of $s''''$.

$s''$ is a basic situation in which Jack cries.

However, as noted in the preceding section, gerunds are no longer
going to be treated as denoting simple propositions, but rather as
denoting propositional functions. This will make them like the *for*
infinitives and *that* clauses discussed in Chapter 4. We will see in
the discussion of (12a) and (80) that the analyses of eventive
gerunds from Chapter 3 are not harmed by this move. The
propositional gerunds like (186) treated there will require this
kind of meaning as well.

(186) John denied eating the apple.
The goal of the analysis of (186) was to show how it could be
virtually synonymous with (187).

(187) John denied that he ate the apple.
At the time, we assumed that the *that* clause denoted a
proposition. Now that I have argued that the *that* clause denotes
a propositional function, the gerund should have such an
interpretation as well.
The revised semantics of *crying* is thus as in (188), summarizing all of (i)-(iv) in (185) with the phrase "*s" is a completion of s' with respect to r."

(188) *(Jack) crying* denotes that function f ∈ D_{<s, <s,t>} such that for any r ∈ S, f(r) = that h ∈ D_{<s,t>} such that for any s' ∈ S, h(s') = 1 iff for every s" which is a completion of s' with respect to r, s" is a basic situation in which Jack cries.

Let CR be the function given in (188). Then the whole sentence (24)'s meaning is shown in (189).

(189) *Jack is crying* denotes that function f ∈ D_{<s,t>} such that for any s' ∈ S, f(s') = 1 iff for some s"<s' s" is present and CR(s")(s") = 1 = iff for some s"<s'. s" is present and for every s"" which is a completion of s" with respect to s", s"" is a basic situation in which Jack cries.

= iff for some s"<s', s" is present and for every s"" such that

(i) the part y of s" that precedes the end of r has a counterpart-duplicate y* in w_{s"}" and this y* is a stage of s""", and

(ii) no reasonable world w contains a situation s""" such that there is a counterpart-duplicate s"""* of s"" which is a proper stage of s""", s"" is a basic situation in which Jack cries.

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(24) is true of a situation if it contains a present situation all of whose reasonable completions are situations in which Jack cries. This is the desired interpretation.

Next we will look at (12a).

(12a) I enjoyed building a house.

This is the same type of example as (139) of Chapter 2. I will not show how the translation of (12a) is arrived at, since the discussion in Chapter 2 adequately illustrated that. However, the interpretation of the gerund is now different from what was assumed in Chapter 2—it now denotes a propositional function rather than a simple proposition. In what follows we will see how the new meaning fits into the original analysis. The translation of (12a) will be (190).

(190) \text{past} (\text{enjoy}(\text{me})(x_1)) \& \text{ing}(\exists y \text{house}(y) \& \text{build}(j)(\text{me})) | x_1 |

The gerund's translation in (190) has the meaning (191).

(191) \text{ing}(\exists y \text{house}(y) \& \text{build}(j)(\text{me})) \) denotes that function \( f \in D_{<s,<(s,t)>)} \) such that for any \( r \in S \), \( f(r) = \) that \( h \in D_{<s,t>} \) such that for any \( s' \in S \), \( h(s') = 1 \) iff for every \( s'' \) which is a completion of \( s' \) with respect to \( r \), \( s'' \) is a basic situation in which I build a house.

Because the gerund now denotes a function which is the result of abstracting over the reference situation, the semantic rule 9, which evaluated expressions of the form \( \Phi[x] \) must be revised again. The revision of this rule earlier in this chapter was designed to make the gerund's reference situation be the evaluation situation of the clause as a whole. However, examples
like (24) or (150) show that this shift of the gerund's reference situation must be able to occur even when rule 9 is not involved. This is why the gerund has an interpretation of a propositional function. The new rule is the following:

9. If $\alpha$ is of type $<s,<s,t>$, $[\alpha[x^u]]_{M,u,C,r,g,s} = $ that function $f \in D_{<s,t>}$ such that, for any $s' \in S$, $f(s')=1$ iff $[\alpha]_{M,u,C,r,g,s}(s)(g(x^u))=1$, and $f(s')=0$ otherwise.

Or equivalently,

9. If $\alpha$ is of type $<s,<s,t>$, $[\alpha[x^u]]_{M,u,C,r,g,s} = $ that function $f \in D_{<s,t>}$ such that, for any $s' \in S$, $f(s')=1$ iff $[\forall \alpha]_{M,u,C,r,g,s}(g(x^u))=1$, and $f(s')=0$ otherwise.

'$\alpha[x^u]$' is either true of every situation in $S$ or of no situations. It is true of every situation if $g(x^u)$ is in the result of applying $\alpha$ to the current evaluation situation $s$. Since the argument $\alpha$ takes functions as the gerund's reference situation (i.e. its point-of-view situation), '$\alpha[x^u]$' is true of every situation if $g(x^u)$ is in the gerund's meaning when $s$ is its reference situation.

The interpretation of the whole of (12a) is given in (192).

(192) that function $f \in D_{<s,t>}$ such that for any $s' \in S$, $f(s')=1$ iff for some $s''<s'$, $s''$ is past and $s''$ is a basic situation of me enjoying $g(x_i)$ and for every $s'''$ which is a completion of $g(x_i)$ with respect to $s''$, $s'''$ is a basic situation in which I build a house.

Since the enjoyment situation $s''$ temporally overlaps the situation $g(x_i)$ of building a house, $g(x_i)$ need not be a complete house-building. $g(x_i)$ can be in the denotation of the gerund if all its
completions s'' are complete house-buildings. Thus we predict the imperfectivity of the gerund in (12a).

The next example we will look at is (80), whose translation should be (193).

(80) John always celebrates jogging to town.
(193) pres(always (jogging-to-town(j)[x_i]) (jogging-to-town(j)[x_i] & celebrate(j)(x_i)))

I have filled in the first argument of always with the gerund's meaning; recall that this happens pragmatically (cf. Chapter 3). In (193) tense has scope over the quantification; this is necessary if quantification over the gerund's reference situation is to go smoothly, but it does not follow from the interpretive mechanisms discussed so far. For tense to have scope over the adverb is quite surprising given the LF's I have been assuming, following Heim (1982), in which the adverb of quantification adjoins to the S at LF. However, if we do not raise the adverb, the system we have will result in the translation we want, namely (193). The most natural surface position for this kind of adverb is below tense:

(194) John has always enjoyed jogging.

Thus if we interpret the adverb without moving it at LF, the required scope relation will be expected. Given that the adverb is getting its first argument from context, there is no problem with using the rules and meanings we have so far to interpret always in place. (80) has an analysis tree like (195).
The meaning for *always* we have been using in this chapter is the following:

(78) \[ \text{always} \omega (\alpha)(\beta)^{M,u,C.r.g} = \{ s : \text{for all } <g',s'> \text{ such that } g'<\omega>g \text{ and } s'<w_s, \text{ if } s' \in i\alpha \cap M,u,C,r,g', \text{ then for some } s'' \text{ such that } s'<s'', \text{ then } s'' \in i\beta \cap M,u,C,r,g' \} \]

(78) must be revised somewhat so that it meets two requirements set out in Chapter 2: it should existentially close indefinites which
are not bound higher up or which don't introduce a new discourse referent and it should only utilize assignments in the context:

(196) \[ \text{always}_\omega(\alpha)(\beta)]M.u.C.r.g.s = \text{that } f \in D_{<s,t>} \text{ such that for any } s' \in S, f(s') = 1 \text{ iff for all } <g',s''> \text{ such that } <g',s''> \in C \text{ and } g'<\omega>g \text{ and } s''<\omega, s, \text{ if there exists a } g''<N>g' \text{ such that } <g'',s'> \in C \text{ and } [\alpha]M.u.C.r.g''.s(s'') = 1, \text{ then for some } <g''',s'''> \text{ such that } <g''',s'> \in C \text{ and } g''''<N>g' \text{ and } s''<s''', [\beta]M.u.[C@[\alpha]M.u.C.r.g'''.s'].r.g'''.s(s''') = 1. \]

Recall that \( g'<\omega>g \) means that \( g' \) agrees with \( g \) on all variables whose indices are not in \( \omega; \) \( g''<N>g' \) means that \( g'' \) agrees with \( g' \) on all indices except those that are in \( N, \) and the indices in \( \omega \) (as well as any other indices that shouldn't be existentially bound) are never in \( n. \) The gerund in (193) has the meaning:

(197) jogging-to-town(j) denotes that function \( f \in D_{<s,<s,t>} \) such that, for any \( s' \in S, f(s') = \text{that } h \in D_{<s,t>} \text{ such that, for any } s'' \in S, h(s'') = 1 \text{ iff for every } s'' \text{ which is a completion of } s' \text{ with respect to } r, s'' \text{ is a basic situation in which John jogs to town.} \)

The whole of (80) has the interpretation:
(198) John always celebrates jogging to town denotes that 
\( f \in D_{<s,t>} \) such that for any \( s' \in S \), \( f(s') = 1 \) iff 
for all \( <g',s''> \) such that \( <g',s''> \in C \) and \( g'<\omega>g \) and \( s''<w_s, 
\) if there exists a \( g''<N>g' \) such that \( <g'',s'> \in C \) and for 
every \( s''' \) which is a completion of \( g''(x_i) \) with respect 
to \( s'' \), \( s''' \) is a basic situation of John jogging to town, 
then 
for some \( <g''',s'''> \) such that \( <g''',s'''> \in C \) and \( g'''<N>g' \) and 
\( s''<s''' \). 
\( s''' \) is a basic situation of John celebrating \( g'''(x_i) \). 

This quite complex meaning works this way: There is universal 
quantification over pairs \( <x,y> \) of a situation \( x \) of John jogging to 
town and one \( y \) which serves as the gerund's reference situation. 
\( x \) is a situation in which John jogs to town from the point of view 
of \( y \). Each of these pairs is such that \( y \) can be expanded to some 
situation which is a basic situation of John celebrating \( x \). (This is 
where a problem could arise if tense only had scope over John 
celebrates \( t \). If the gerund's second argument were tensed, it 
would contain whole worlds, and it would be too easy for \( y \) to be 
expanded into a situation that celebrates it.) Because each \( y \) 
completely follows each \( x \), as the former is intuitively the 
celebration and the latter the jogging, \( x \) will have to already be a 
jogging-to-town situation. Thus the gerund is interpreted 
perfectively.

Next we will examine a factive, individual-level free adjunct:

(181) Having a friendly attitude, Mary is happy.
This sentence has an analysis tree like that in (107). With HFA the translation of having a friendly attitude, (181)'s translation is (199).

(199) \((HVA(\mathbf{m}))[x_1] \& \text{pres}(R(x_i)(\text{happy}(\mathbf{m})))\)

Let us assume that \(R\) has the following meaning:

(200) \(R\) denotes that function \(f \in D_{<e,<<s,>,<s,>,>>}\) such that for any \(s \in I\), \(f(s) = h \in D_{<<s,>,<s,>,>>}\) such that for any \(p \in D_{<s,>,}\), \(h(p) = k \in D_{<s,>,}\) such that for any \(s' \in S\), \(f(s') = 1\) iff \(p(s') = 1\) and \(s'\) is caused by \(s\).

The interpretation of (181) will then be the following:

(201) Having a friendly attitude, Mary is happy denotes that function \(f \in D_{<s,>}\) such that, for any \(s' \in S\), \(f(s') = 1\) iff for every completion \(s''\) of \(g(x_i)\) with respect to \(s'\), \(s''\) is a basic situation of Mary having a friendly attitude and for some \(s''' <s', s''\) is present and \(s'''\) is a basic situation of Mary being happy and \(s'''\) is caused by \(g(x_i)\).

Because the adjunct was formed from an individual-level predicate, a situation \(s'\) that satisfies this \(f\) will have to have special characteristics. The situation \(s'\) serves as the reference situation for the adjunct, so \(s'\) must be such that it makes sense to talk about completions of situations of having a friendly attitude with respect to it. In §5.4.1.3 it was argued that assuming that the reference situations for individual-level adjuncts had to be a whole world would entail that they could not serve as restrictors of an adverb of quantification (though it was noted that other assumptions might work as well.) Following that assumption,
(201) is the set of worlds w such that g(x_i) is a situation of Mary having a friendly attitude and w contains a basic present situation of Mary being happy.

The last two examples we will consider involve aspectual verbs. The first is (150).

(150) John started washing the dishes.

The translation of (150) is (202).

(202) \text{past(start}+(\text{washing-the-dishes})(j))\text{)}

If we give the meaning in (203) to start, the interpretation of (150) will be (204).

(203) start denotes that f \in D_{<e,<e,<s,t>>} such that for any p \in I of sort +<s,<s,t>>, f(p)= h \in D_{<e,<s,t>>} such that for any c \in I, h(c)= k \in D_{<s,t>} such that for any s \in S k(s)=1 iff it is not the case that there exists an s' \in S such that s' immediately precedes s, s'<w_s, and [-p](s)(s')=1 and for all reasonable completions s'' of s with respect to s, [-p](s)(s'')=1.

(204) John started washing the dishes denotes that f \in D_{<s,t>} such that for any s \in S, f(s)=1 iff for some s'<s, s' is past and it is not the case there exists an s'' \in S such that s'' immediately precedes s', s''<w_{s'}, and for all r which are completions of s'' with respect to s', r is a basic situation of John washing the dishes, but for all reasonable completions s''' of s' with respect to s', for all r' which are completions of s''' with respect to s', r' is a basic situation in which John washes the dishes.
This is true of situations that contain a present situation \( s \) which does not immediately follow any situation of John washing the dishes (where the -ing form is interpreted with \( s \) as its reference situation) but which does immediately precede such a situation. The meaning in (204) is redundant in that both the interpretation of \textit{start} and that of -ing cause the gerund to be imperfective. However, \textit{start} by itself must result in imperfectivity because of examples like (164), in which an infinitive's situations need not be completed. Thus the redundancy is unavoidable.

The final example is (167)

(167) *John stopped to wash the dishes.

(205) \textit{stop} denotes that \( f \in D_{<e, <c, \langle s,t \rangle>} \) such that for any \( p \in I \) of sort \( +<s, <s, t> \), \( f(p) = \) that \( h \in D_{<e, <s, t>} \) such that for any \( c \in I \), \( h(c) = \) that \( k \in D_{<s, t>} \) such that for any \( s \in S \) \( k(s) = 1 \) iff there exists an \( s' \in S \) such that \( s' \) immediately precedes \( s \), \( s' < w_s \), and \( \neg p|(s)(s') = 1 \) and there does not exist an \( s'' \in S \) such that \( s'' \) immediately follows \( s \), \( s'' < w_s \), and \( \neg p|(s)(s'') = 1 \).

\textit{Stop} has a meaning that is the reverse of \textit{start}'s--it is true of a situation which immediately follows but does not immediately precede a situation that satisfies its complement. The infinitive in (167) has this meaning:

(206) (for John) \textit{to wash the dishes} denotes that \( f \in D_{<s, <s,t>} \) such that for any \( s \in S \) \( f(s) = \) that \( h \in D_{<s,t>} \) such that for any \( s' \in S \), \( h(s') = 1 \) iff \( s' \) has as its initial segment a duplicate-counterpart of \( s \) and John washes the dishes in \( s' \).
(167) will now mean

(207) *John stopped to wash the dishes denotes that \( f \in D<s,t> \)
such that for any \( s \in S \), \( f(s) = 1 \) iff
for some \( s'<s \) is past and there exists an \( s'' \in S \) such
that \( s'' \) immediately precedes \( s' \), \( s''<w_s' \), and \( s'' \) has as its
initial segment a duplicate-counterpart of \( s' \) and John
washes the dishes in \( s'' \) but there does not exist an
\( s''' \in S \) such that \( s''' \) immediately follows \( s' \), \( s''<w_s' \), and
\( s''' \) has as its initial segment a duplicate-counterpart of
\( s' \) and John washes the dishes in \( s''' \).

This is an impossible meaning because it asserts that some
situation \( (s'') \) whose initial segment is a duplicate-counterpart of \( s' \)
precedes \( s' \). Remember that the duplicate-counterpart relation
requires more than qualitative identity. It requires that the two
situations be counterparts. Since in the present case the two exist
in the same world, for them to be counterparts they must be one
and the same. Thus (207) requires that some situation whose
initial segment is \( s' \) precede \( s' \). This aspect of (167)'s meaning
makes it a contradiction.

This concludes the formalization of the ideas put forward in
this chapter. I have shown how each of the major constructions
discussed is analyzed and illustrated the revised meanings for
-\emph{ing} forms and adverbial quantifiers. The new analysis for -\emph{ing}
forms considers them to denote propositional functions rather
than propositions. With this change they are quite like infinitives
and \textit{that} clauses. All three constructions denote functions of type
\( <s,<s,t>> \) such that, when they are applied to a situation, that
situation serves as the reference situation for the resulting proposition. Thus we now have a uniform analysis of all subordinate propositional expressions. In general a subordinate propositional element denotes a proposition lacking a reference situation. Since the reference situations is used to connect a proposition with what embeds it, a subordinate clause or gerund denotes a function which needs to be connected to some embedding element. Thus the analysis of these expressions gives a formal account of what it is to be semantically subordinate.

We have also seen in this section how the aspectual shifts discussed throughout the chapter follow from the semantics of -ing forms. A VP-ing like running will be perfective if its reference situation follows the situations in its denotation, the running situations, and imperfective otherwise. The reference situation of an adjoined -ing form is taken to be the clause's reference situation, and whether it follows the running situations is determined by the meaning of the rest of the sentence. The presence verb like enjoy will result in an imperfective reading while one like celebrate can give a perfective interpretation.

Finally the discussion of (150) and (167) has shown why infinitival complements are impossible with certain aspectual verbs. ter Meulen argued that infinitival complements are impossible with aspectual verbs which require that a situation in their complement's denotation exist before the change expressed by the aspectual verb itself. With the meaning for infinitives given in Chapter 4, this result follows automatically from standard analyses of the meanings of aspectual verbs.
CHAPTER 6
CONCLUDING REMARKS

This dissertation has primarily been an argument for the idea that the members of different syntactic classes of propositional expressions denote different kinds of propositions. These characteristic semantics values were formulated in a version of situation semantics developed by Kratzer (1989a), and I would like to remark in this chapter on how the particular background theory that was assumed contributed to the analyses that were eventually achieved. After that, I'll point out some of the many open areas of inquiry that remain. But before I take up these tasks, allow me to summarize the main points of the preceding chapters.

Chapter 2 presented an outline of a general theory of grammar. Because of the fact that many of the subsequent analyses depended on the interaction of syntax, semantics, and pragmatics, it was necessary to take up quite a wide variety of questions there. Then, in Chapter 3, an analysis was given of a substantial part of the semantic variability of gerunds. Vendler (1967) argued that gerunds either denote sets of events or propositions; I showed how both of these cases can be treated under the idea that gerunds denote sets of minimal situations. Such a set is a proposition, but the fact that only quite small situations are in it means that it can also quite easily play the role
of a set of events. The analysis also naturally extends to cases of internally quantified gerunds, as in (1).

(1) I enjoyed always eating MEXICAN food with Suzanne. Such examples show that a common-sense idea of 'event' is not adequate even for 'eventive' gerunds. The notion of 'situation' provided by situation semantics is such that (1) automatically denotes the right set of semi-eventive generic situations.

Chapter 4 approached the question of how to treat the primarily irrealis clause types in English: infinitives and subjunctives. This chapter illustrates an important aspect of the approach taken by the dissertation as a whole. Rather than saying that infinitives and subjunctives have fairly ordinary propositional meanings but have special uses which correlate with their appearing in characteristic kinds of semantic contexts, I argued that the meanings these elements have are quite particular and entail that they appear in the types of positions they do. Chapter 4 also allowed me to introduce a general analysis of subordination; I argued that, rather than simply denoting propositions, as is usually assumed, subordinate propositional expressions actually denote propositional functions, functions from a reference situation (cf. Reichenbach (1947)) to a proposition. *For* infinitives then were argued to denote a function f such that, at a given reference situation r, f(r) denotes the set of situations which begin with r and extend into the future into situations in which the to infinitive is true. In example (2), then,

(2) Phili hoped for Julie to go to Santa Fe.
the infinitive denotes a function which is applied to the hoping situation, resulting in the set of situations which begin with Phil's hoping and extend forward until Julie is in Santa Fe.

Subjunctives are quite different. The meaning of that in (3) is applied to the demanding situation, giving--if the demanding situation is one in which something is obliged, as it is--the set of situations in which Jane is here.

(3) Jill demanded that Jane be here.
If the embedding verb did not provide a an obliging situation, the result would be the empty set. The subjunctive in (4) is more interesting.

(4) Phil wishes that Lisa's car were working.
The embedded clause denotes a function which is applied to the wishing situation. It then denotes the set of situations in which Lisa's car is working, but it presupposes that every one of those situations is incompatible with the wishing situation. Because of the way presuppositions project in attitude sentences, this results in (4) presupposing that Phil believes that Lisa's car is not working.

With the meanings for infinitives and subjunctives just outlined, I was able to explain the selectional properties of a variety of attitude verbs. In particular, we can see why believe and claim do not take infinitives and why hope, wish, want, and desire each selects for the precise combination of clause types it does.
Chapter 4 then examines how the proposed meanings for infinitives and subjunctives proposed work in conditionals like those in (5)-(6).

(5) For her to win would be great.
(6) If she were to win, it would be great.

I argue that the correct interpretations and presuppositions are obtained, and this in turn supports the idea that the theory applies to all for infinitives and subjunctives.

Finally, Chapter 5 returned to the semantics of gerunds. In Chapter 3, the analysis had not made use of the reference situation, and in this way it did not fit into the general account of subordination from Chapter 4. However, in Chapter 5 contrasts like that in (7) and (8) show the need to use the reference situation in the analysis of perfectivity.

(7) Nick celebrated climbing the mountain.
(8) Nick enjoyed climbing the mountain.

The gerund in (7) is perfective because the reference situations, the celebration situations, completely follow the climbings; in contrast, that in (8) is imperfective because the enjoyment situations temporally overlap the climbings. By incorporating the reference situation, it is possible to formalize the traditional idea that the difference between perfective and imperfective clauses is one of perspective—in (7), the reference situation provides an external perspective on the gerund’s situations, while in (8) it provides an internal perspective. After formalizing this intuition about why (7) and (8) differ, using ideas from Dowty (1979) and Landman (1991), Chapter 5 goes on to show how the resulting
meaning for *-ing* can be used not merely with gerunds, but also with the progressive, free adjuncts, *-ing* forms with subordinators like *before, after, and while*, and the complements of aspectual verbs.

As was discussed in Chapter 1, there are many different conceptions of the relation between events and propositions. The treatment of gerunds in Chapter 3 requires a theory on which propositions and sets of events are the same thing. Thus it requires a version of situation semantics, such as that assumed here or the one of Barwise and Perry (1983). It is the ideas of Chapter 4 that make the contrast between Kratzer's situation semantics and SA stand out. First, as discussed in Chapter 1, the fact that SA lacks a straightforward part-whole relation raises questions concerning the analysis of infinitives. It will be necessary to claim that there is a constraint or set of constraints which provides enough mereological structure on the set of abstract situations to allow one to refer to things like the set of situations which begin with Phil's hoping and extend forward until Julie is in Santa Fe. Of course it may be possible to have an 'involves' relation which gives all the requisite structure, though I feel it is counterintuitive to conceive of 'part-of' as a constraint rather than as an intrinsic fact concerning the situations. It will be necessary to explain, for instance, how reality constrains the abstract hoping situation of (9) to be involved in the larger abstract situation $p$ which the infinitive denotes.

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1 Recall that I have been referring to Barwise and Perry's theory as 'SA'.
The same kind of issue arises from the analysis of imperfectivity in Chapter 5. Here we have an existing SA analysis to guide us, however; Hinrichs (1983) presents an outline of how to analyze the progressive in SA. He uses the idea that intuitively incomplete events can be linked to merely possible completed ones through the 'involves' relation. This fact emphasizes that constraints play the role in SA which 'part-of' plus modal notions play in our version of situation semantics.

The analysis of the subjunctive in Chapter 4 also points out a, closely related, difference between the theories. The analysis of the counterfactual subjunctive relies on the notion of two situations being incompatible with respect to some context C. Two situations s and s' are incompatible with respect to C iff no situation in C contains a duplicate-counterpart of both s and s' as a part. Let us use (4) above as an example; there the reference situation for the subjunctive is the wishing situation. If the wishing situation and Lisa's car working are incompatible then the infinitive denotes the set of situations of Lisa's car working. Again, in SA constraints will have to do the same job. A counterfactual subjunctive will presuppose that there is a constraint by which the reference situation, the wishing (10), and the situation (11) of Lisa's car working are incompatible.

(9) <<hopes, Phil, p>, true>

Here a constraint must be used to analyze a modal notion.

(10) <<wish, Phil, (11)>, true>

(11) <<works, Lisa's car>, true>
There are therefore considerable differences between how SA would state the basic ideas of this dissertation and how I actually stated them. It seems to me that Kratzer's version of situation semantics provides a straightforward and elegant framework for making the kinds of analyses that I have. It is not clear whether SA can do the same.

Despite all the pages in Chapter 3-5, I have just begun to explore the range of facts relevant to this project. In particular, I have barely started exploring the variety of classes of verbs which embed propositional expressions, and it is the differences among such classes that has provided most of the evidence concerning the semantics of the expressions themselves. Furthermore, in trying to say something about gerunds, infinitives, and subjunctives, I have said less than must eventually be done concerning indicatives. Working out an adequate semantics of tense and of the perfect would strengthen Chapter 4's discussion of the differences among indicatives, infinitives, and subjunctives. It also remains to be seen how well the present ideas can be extended to other languages, in particular those with richer mood systems. While I would not necessarily expect that languages tend to share with English the precise meanings for the various expressions, the general approach to the variety should have cross-linguistic validity. For the present, however, I have tried to give a treatment of a small part of English as the beginning of this larger project.
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