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Events in the
Semantics of English

Terence Parsons

A Study in
Subatomic Semantics

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Chapter 1

Introduction

This book explores a topic in “subatomic semantics,” a term I shall shortly explain. The thesis under investigation is that semantics of simple sentences of English require logical forms that are somewhat more complex than is normally assumed in investigations of natural language semantics. In particular, the semantics of a simple sentence such as ‘Brutus stabbed Caesar’ requires a form of at least the following complexity:

For some event e ,
 e is a stabbing, and
 the agent of e is Brutus, and
 the object of e is Caesar, and
 e culminated at some time in the past.

This form, which is typical, is dominated by an existential quantification over events. Since no such quantification is explicitly indicated in the sentence ‘Brutus stabbed Caesar’, I call it an “underlying” quantification. A main theme of the theory I investigate is that such underlying quantification over events (and states) is ubiquitous in natural language. This is a theoretical hypothesis which is to be justified by its fruitfulness in explaining a wide range of semantic characteristics of natural language. My goal is to describe these characteristics and to articulate a theory that explains them.

1.1 Background

In dictionaries and grammar books we are likely to find definitions such as these:

noun: A word that stands for a person, place, or thing.

verb: A word that expresses an action or state.

That explanations of this sort are so common suggests that they contain some insight. I am interested in giving that insight a useful theoretical characterization.

The semantics of nouns, as opposed to verbs, has received a great deal of scrutiny. We now know that the way in which nouns "stand for things" is a matter of some subtlety and complexity. A proper noun, such as 'Kim' or 'Samantha', refers to its bearer, which is indeed a "thing," but common nouns such as 'table' or 'giraffe' do not stand for things of this sort; they stand for *kinds* of things. We do use common nouns to refer to particular things but only when the nouns are coupled with definite articles or demonstratives: '*the* table', '*that* giraffe'. In addition, and of great importance, we also use them to quantify over things in phrases such as 'some tables' or 'no giraffes'. A large part of the study of modern logic is taken up with the study of complex noun phrases of this sort.

In this book I assume that much the same is true of verbs; ordinary verbs stand for *kinds* of actions or states, and it is a matter of some complexity to formulate a theory of how we use them to talk about particular actions and states.

1.1.1 History of the Idea

The account I shall explore stems originally from the work of Panini, several centuries B.C. According to his account, in a simple sentence such as 'Kim hit the tree with a knife' the verb stands for some particular action, the nouns in the sentence stand for people or things, and the sentence asserts that those things stand in certain relations to the action. For example, Kim is the agent of the action, the knife is the instrument of the action, and the tree is the object of the action. This is very close to the account that I shall discuss, except that my account denies that verbs stand for particular actions. Although the view that verbs, like proper nouns, stand for particular actions can be defended, it is quite awkward when taken seriously in detail.¹

The proposal that verbs should be related in some way to events and states is found scattered throughout the history of philosophy. It is found, for example, in Plato,² and it surfaces in the *Port-Royal Logic*.³ It was effectively squelched early in this century by Frege's ignoring it, and by Russell's insisting on its secondary importance in semantics.⁴

The version I shall investigate takes verbs to be more like common nouns than proper nouns. On this view, the verb 'hit' in 'Mary hit Fred' does not stand for a particular action (a particular hitting); it stands for a kind of action, a kind that has particular hittings as its instances. The sentence as a whole says that *some* action of that kind took place, an action of the kind that had Mary as agent and Fred as object. A simple sentence using 'hit' says that a hitting took place, one using 'eat' says that an eating took place, and so on. This idea was first articulated, so far as I know, by Frank Ramsey, who said, 'That Caesar died' is really an existential proposition, asserting the existence of an event of a certain sort (Ramsey 1927).

Unfortunately, this is about all that Ramsey said on the subject, and it is not certain that his idea is the same as the one explored here. Hans Reichenbach gave an account (1947) in terms of facts (which he also called events), but it is too complex to profitably duplicate here. His account was then considerably modified by Donald Davidson (1967) into a theory in which verbs explicitly stand for kinds of events, so that a sentence containing such a verb states implicitly that an event of that sort takes place.

Davidson's proposal has had less influence in philosophical semantics than it deserves, for three reasons. First, some saw the proposal as a mere detail in Davidson's attempt to show how to formulate a Tarski truth-definition for English. This particular detail worked fairly well for that purpose, so the controversy quickly shifted elsewhere. Second, others saw the proposal not so much as an account of the semantics of natural language but as a clause in Davidson's metaphysics of events and actions. It was judged therefore by its conformity or lack of conformity with preexisting opinions about actions and events—especially about their "identity conditions." Thus the fruitfulness of the theory in accounting for a broad array of data concerning natural language was missed. Third, the theory failed to impress many workers in the semantics of natural language (including me) because we saw its only virtue as yielding an account of the semantics and logic of adverbial modifiers. And here, the theory fails to provide a *general* account; it works well for 'in the bedroom' but fails for 'in a dream', works well for 'happily' but not for 'necessarily', works well for 'immediately' but seems to fail for 'slowly'—or at least this is what Davidson himself suggested, and most others have taken it for granted. The loss of interest in the theory is understandable but mistaken. No

ory of substance will work for all grammatical modifiers, for these modifiers occur in different categories, and they behave differently on one another. And the claim that the account fails for degree adverbs such as 'slowly' is, when carefully examined, far from obvious. Further, plenty of linguistic constructions in addition to adverbial modification can be well accounted for by positing underlying quantification over events. That is the view I articulate in this book.

2 The Theory

theory to be investigated begins by combining Panini's and Davidson's.⁵ The basic assumption is that a sentence such as 'Caesar died'

is something like the following:

some event *e*,
e is a dying, *and*
the object of *e* is Caesar, *and*
e culminates before now.

The symbolism of symbolic logic this becomes

$(\exists e) [\text{Dying}(e) \ \& \ \text{Object}(e, \text{Caesar}) \ \& \ \text{Culminate}(e, \text{before now})]$

↑ ↑ ↑ ↑
FAULT VERB SUBJECT TENSE

Three things blatantly present in the English sentence—subject, verb, and tense—become separate conjuncts constraining the event of Caesar's dying. The verb indicates that the event in question is an event of dying. The subject indicates that Caesar is the object of that event. (The notion of 'object' is discussed in detail in chapter 5 under the rubric 'theme'.) The tense indicates that the event in question is culminated before the time of utterance of the sentence. ('Culmination' is discussed in chapter 3.) Throughout most of the preliminary discussion in these first few chapters I shall ignore tenses; I discuss them more fully in chapters 11 and 12.

In the absence of other sources of event quantification, the event in question is existentially bound, with scope as narrow as possible. Other options are discussed in chapter 11.

This analysis of 'Caesar died' is considerably more complex than the symbolization normally taught in logic books, which (ignoring the event) is simply

where the 'D' represents 'died' and the 'c' represents 'Caesar'. The two proposals are not incompatible, however, for the former can be seen as a more refined version of the latter. If we view the traditional formula 'D(x)' as a crude form that fails to display all the logical structure in question, then a more refined analysis of the logic text formula 'D(x)' is

$(\exists e)[\text{Dying}(e) \ \& \ \text{Object}(e, x)]$.

Assigning this refined structure to the logic textbook account yields the proposal stated above.⁶

The proposed form is, however, considerably more complicated than the traditional symbolization. The topic of this book is whether, and why, the additional complication is necessary. The answer I propose is that the additional structure provides a nice account of various phenomena concerning language, including

- The logic of modifiers: logical relations among sentences such as 'Brutus stabbed Caesar in the back' and 'Brutus stabbed Caesar' (e.g., that the former entails the latter).
- The semantics of perception statements, including the relation between 'Agatha saw Brutus stab Caesar' and 'Agatha saw the stabbing of Caesar by Brutus'.
- The semantics of causatives and inchoatives: Why, if Mary will open the door, the door will open, and why this in turn entails that the door will be open. (In traditional logic these three uses of 'open' are symbolized as three completely independent predicates.)
- Relations between the explicit ways in which we talk about events and our sentences that do not appear to involve explicit reference to events at all. E.g., between 'A flight over the pole by a Norwegian took place in May 1926' and 'A Norwegian flew over the pole in May 1926'. Or between the NP 'every violent destruction of a city' and the VP 'violently destroyed a city'.⁷ Included in this topic is the relation between the semantics of adjectives ('slow') and their corresponding -ly adverbs ('slowly'), and between verbs ('sing') and gerunds used as common nouns ('the singing').
- The relation between "causative" sentences with events as subjects (such as 'Mary's singing broke the window') and the same sentences with agents of events as subjects ('Mary broke the window'). Why, e.g., does the former entail the latter?

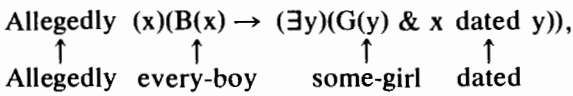
These topics, and a host of others, can be addressed by a theory of underlying events and states. There is a wealth of data in our native

tongue just waiting to be explained; the hypothesis of underlying events and states explains a great deal of it, provided that that hypothesis is suitably developed. There is also a wealth of data about language in old-fashioned grammar books, couched in terms of ‘event’ (or ‘action’) and ‘state’.⁸ Many observations about language couched in this terminology have been ignored as a consequence of recent advances in the study of syntax that assume syntax to be autonomous from semantics. This may be appropriate for those who work in syntax, since the observations I have gathered are mostly semantical or pragmatic in nature. But since this book is in semantics, they often prove fruitful for my task.

1.2 Subatomic Semantics

In formal logic, formulas are divided into two sorts: *atomic* formulas, from which all the rest are generated, and *nonatomic* formulas that are generated from the atomic ones, usually by means of quantification (universal or existential quantifiers: ‘(x)’, ‘(∃x)’), or by combination with connectives (‘&’, ‘∨’, ‘¬’, ‘→’), or by the addition of operators (e.g., modal operators representing ‘necessarily’ and ‘possibly’). This idea has generally been carried over to the study of natural language, and there are now fairly firm customs about what things count as atomic formulas of English, so far as their semantics is concerned. These “atomic formulas of English” are phrases like ‘x is tall’ or ‘x stabbed y’. The literature in philosophical logic is full of discussions about how to combine these atomic formulas with other things so as to produce sentences. The “other things” include the English version of quantification with NPs (‘Every boy’), modification with sentence operators (‘Necessarily’, ‘Allegedly’), amalgamation with connectives (‘and’, ‘or’, ‘not’), and embeddings into that-clauses. The topic of this book lies primarily elsewhere. I want to investigate certain aspects of the *subatomic* structure of the atomic formulas of English that these other studies take as their inputs. I do not dispute that ‘x stabbed y’ is an atomic formula of English, nor do I dispute that it contains two variables and a constant part. I merely want to investigate the structure of the constant part in more detail. This enterprise leaves traditional theories of language mostly untouched and unchallenged. Indeed, I presuppose traditional accounts of quantification, connectives, sentence modification, and so on, as means of getting from the atomic structures I investigate to a more complete theory of English. I do not

doubt, for example, that ‘Allegedly, every boy dated a girl’ has a semantic structure something like



(where ‘Allegedly’ is a sentence operator; I ignore tense for the moment). I am interested instead in whether there is some additional structure for ‘x dated y’, something like

x dates y = (∃e)(e is a dating & x is the agent of e & y is the object of e).

I believe there is. What this additional structure consists in forms my primary subject matter.

I will take issue with one part of the established tradition. The remarkable interest and success in handling portions of the semantics of language in terms of sentential operators, such as in modal logic, have lured people into applying the technique of operators too extensively.⁹ In particular, scope-bearing operators have been used to analyze many things that should be handled differently, including verb modifiers, causatives, and the special characteristics of the progressive and perfect aspects. These matters will be addressed in later chapters.

1.3 Methodology

My methodology regarding events differs from that of the main philosophical tradition. Philosophers typically begin with general hypotheses about events, gleaned from intuition and first principles. The principles include views about, for instance, the identity conditions for events. These general principles are then brought to bear on a theory such as the one I investigate to test its adequacy. This usually results in a conflict between the principles and the theory, and in consequence the theory is rejected.

I have reservations about this type of approach. I usually lack the intuitions that others begin with, and I note that the writers in question rarely agree among themselves as to the truth about events. This gives me the courage to ignore their criticisms, at least temporarily, and to pursue a theory having implications for events that would be rejected by many of the main traditions. (Of course the literature contains a host of interesting examples that the theory will have to explain, and

I cannot ignore the discussions, even if I am unmoved by the methodology.)

My approach is different. I begin with a mass of linguistic data to be explained and with the bare outlines of a theory for explaining it. I try to develop the theory in the best way possible to explain the data. Only at the end of the enterprise am I in possession of generalities about events. Conflicts between the resulting theory and views from the philosophical literature are discussed in chapter 8.

What are the linguistic data on which this theory rests? We are examining a semantic theory that tells us that certain sentences are true (or false) in certain circumstances. As native speakers of the language, we are authorities on whether these sentences really are true or false as the theory says, at least for ordinary sentences, such as 'There is beer in the refrigerator', as opposed to sentences such as 'Two events are identical if and only if they have exactly the same causes and the same effects'. I regard judgments about the former as data, but not judgments about the latter. Existing theories of natural language tell us that if 'Agatha has a clever boyfriend' is true, then so is 'Agatha has a boyfriend'. A theory that makes many correct predictions of this sort has a claim to being taken seriously as a potentially correct theory of language. The theory I shall be considering makes predictions such as this: If 'Mary runs slowly' is true then so is 'Mary runs'. More ambitiously, if 'Mary fells a tree into the truck' is true then so are 'A tree falls', 'A tree falls into the truck', 'A tree will be in the truck'. (The theory does not say that Mary falls, or that Mary ends up in the truck, though the latter *will* follow from 'Mary climbs into the truck'.) A theory of language needs to explain these data. They should be seen as clear consequences of the theory, and then these consequences, as well as all others not envisioned in the formulation of the theory, need to be tested against further data. If the predictions are widespread and correct, then the theory deserves to be taken seriously. This, in a nutshell, is my method.

Unfortunately, things do not work out so neatly, primarily because most sentences are ambiguous. This fact has two consequences for my enterprise. First, since we, as native speakers, can see the ambiguity in a sentence, we thereby have additional data on which to base our theories. But the "data" also become much less datalike. If a sentence is ambiguous, then it makes no sense to call it "true" or "false" without qualification, but only "true on such and such a read-

ing."¹⁰ We are indeed capable of assessing theories on the basis of their consequences for "truth on a reading," and I rely on this technique. But it is considerably more difficult to articulate the methodology being employed when ambiguity is introduced into the data.

1.4 Logical Form

I seek a theory that describes the semantics of sentences of English, that is, the relations between words of our language and things in the world.¹¹ One convenient way of accomplishing this is to find a way to associate "logical forms" with English sentences. These "forms" will be sentences of a formal language that has already received a clear semantical treatment. The semantics of the English sentences in question will then be that of their associated logical forms. This intermediate route from the English to its semantics—via logical forms—is for the sake of convenience only. The semantics of the formal language I use (mostly the ordinary predicate calculus) is already widely known, and so I can presuppose a great deal of familiar work in formal semantics. It also allows me to finesse the problem of ambiguity. The semantics of an ambiguous language such as English is cumbersome to state directly; it is easier to assign unambiguous logical forms to sentences of English based on their various modes of generation.¹² For these two reasons alone I employ logical forms. If you prefer to avoid their use, you need only translate the logical forms into stilted English in the usual fashion. You will then be directly (rather than mediately) stating the semantics of the English sentences under study, suitably disambiguated.¹³

When I attribute a logical form to a sentence, part of the significance is that the sentence and the corresponding logical form are true in the same circumstances (ignoring ambiguity, and assuming identical interpretations of the parts of the sentence and corresponding parts of the form). Thus the whole theory might be reinterpreted in entirely different terms. Instead of thinking of L as the logical form of a sentence S, one could think of L as a sentence in a theory of events. The claim made in associating S with L is, as before, that they are true together. The result of the global association of sentences with forms then can be seen as a detailed articulation of a theory of events; the formulation within logical notation makes precise the logical structure of this theory, and its correlation with English sentences makes the consequences of this theory clearly identifiable in our own native tongue.

Other reinterpretations of the logical forms are possible as well. If I am successful in my enterprise, it should be possible to take the results of this work and convert them into several quite different frameworks.

With regard to many of the issues I address, we are still at the stage of needing *some* theory to account for the data. Once we have one, then we can consider formulating others and arguing about which is better. I do little theory comparison here, since we do not yet have the theories to compare.¹⁴ Thus I shall frustrate many readers for not having shown why my approach is the only correct one. Others will have to address this issue when more competing theories are available.

Chapter 2

The Evidence in Favor of Underlying Events

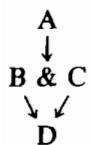
In this chapter I review various kinds of evidence in favor of the underlying event analysis, concentrating on its applications to event sentences, and leaving the issue of state sentences to a later chapter. I begin with no particular preconceptions about the nature of events. My methodology is rather to proceed in a scientific frame of mind: there are data to be explained, and we have in rough outline a theory that might be used to explain it. The final form of the theory will be tailored by the ways in which it meets the test of accounting for the data.

2.1 The First Kind of Evidence: The Logic of Modifiers

The first kind of evidence in favor of the underlying event analysis has to do with the logic of modifiers. Sentences containing grammatical modifiers bear certain logical relations to one another because of these modifiers. The evidence that the underlying event analysis accounts for these relations can be illustrated by the logical relations among these sentences:¹

- A Brutus stabbed Caesar in the back with a knife.
- B Brutus stabbed Caesar in the back.
- C Brutus stabbed Caesar with a knife.
- D Brutus stabbed Caesar.

The evidence that needs accounting for is that sentence (A) entails the conjunction of (B) and (C), but *not* vice versa, and that either of (B) or (C) alone entails (D). In diagrammatic form, the higher sentences in the following graph entail the lower ones, and not vice versa:



These connections (and lack of connections) are exactly the ones predicted by assigning to the sentences in question the forms described earlier:

A' $(\exists e)[\text{Stabbing}(e) \ \& \ \text{Subj}(e,B) \ \& \ \text{Obj}(e,C) \ \& \ \text{In}(e,b) \ \& \ \text{With}(e,k)]$

B' $(\exists e)[\text{Stabbing}(e) \ \& \ \text{Subj}(e,B) \ \& \ \text{Obj}(e,C) \ \& \ \text{In}(e,b)]$

C' $(\exists e)[\text{Stabbing}(e) \ \& \ \text{Subj}(e,B) \ \& \ \text{Obj}(e,C) \ \& \ \text{With}(e,k)]$

D' $(\exists e)[\text{Stabbing}(e) \ \& \ \text{Subj}(e,B) \ \& \ \text{Obj}(e,C)]$

Notice that it is important that (A) ('Brutus stabbed Caesar in the back with a knife') not follow from the conjunction of (B) and (C) ('Brutus stabbed Caesar in the back & Brutus stabbed Caesar with a knife'). Suppose that Brutus stabbed Caesar in the back with an icepick, and in the thigh with a knife. Then both (B) and (C) are true, but (A) may be false. (This is so even if the stabbings are simultaneous.) The logical forms get this right, and for the right reason: the conjunction of (B') and (C') does not require that the two stabbings (the one in the back and the one with the knife) be the same.

The account, of course, needs to be tested against a wide range of data, for it is not obvious that all verb modifiers follow this neat pattern. I cannot survey all the potential problem cases here, but two that are prominent in the literature deserve mention.

First, in many potential counterexamples the modifier in question is actually a sentence modifier. One illustrative example is 'nearly', as in 'Mary nearly hit John'. It is easy to see that if 'nearly' were treated as a predicate of events in this example, then the form would be wrong; it would tell us that if Mary nearly hit John, then there was a hitting of John by Mary that was "near," and this would entail that Mary actually hit John. The solution to this problem is to note that 'nearly' functions here as a sentence modifier, and so the theory under examination does not apply to it. (The distinction between verb-modifiers and sentence-modifiers is discussed in chapter 3.)

Second, the word 'partway' is a classic counterexample in the literature. (See, for example, Stalnaker & Thomason 1973.) If Mary closed the door partway, then it does not follow that she closed the

door, as it would if 'partway' were functioning as a predicate of events in the theory under investigation. Yet 'partway' does not appear to be a sentence modifier either. The solution is to see that 'partway' is actually a modifier of other modifiers, not of verbs. This is evidenced by its occurrence in sentences such as 'Mary pushed the door partway closed', in which 'partway' obviously modifies the adjective 'closed'. But a sentence such as 'Mary closed the door' is of a rather well-studied, complex sort; it is a classic "causative-inchoative" sentence, whose meaning is something like

Mary did something that caused the door to become closed.

It then seems plausible to suppose that 'partway' behaves in its usual way in 'Mary closed the door partway', and that the meaning of the whole sentence is something like

Mary did something that caused the door to become partway closed.

If this account is on the right track, 'partway' is not a verb modifier at all, and so it does not provide a counterexample to the theory. (Causative-inchoative constructions and their modifiers are discussed in chapter 6.)

The logic of modifiers affords a rich and complex pattern of inferences that needs explanation. The theory of underlying events does well for verb modifiers, whereas most other theories do not. I take this as some evidence in favor of the view. The evidence is not conclusive—far from it—but it is evidence nonetheless, and it is supportive. Discussion of the logic of modifiers, including critiques of alternative views, occupies most of chapter 4.

2.2 A Second Kind of Evidence: The Logic of Perceptual Idioms

A certain class of idioms has only recently received attention in the philosophical literature. An idiom of this sort is a sentence whose main verb is a perceptual verb that is followed by a clause having the structure of a simple sentence that is missing its tense. Examples are

A Mary saw *Brutus stab Caesar*.

B Sam heard *Mary shoot Bill*.

C Agatha felt *the boat rock*.

Each of the italicized phrases is just like a simple sentence except that the tense is missing.

The semantics of such sentences must be quite different from popular accounts of the semantics of “perceiving-that” constructions. Sentence (A), for example, differs radically from

D Mary saw *that Brutus stabbed Caesar*.

Not only are (A) and (D) logically independent of one another but their logical behaviors differ. For example, the contents of the that-clause in (D) are in an opaque context, whereas the contents of the italicized phrase in (A) are not. If Caesar is the emperor, then (A) entails that Mary saw Brutus stab the emperor, but (D) does not entail that Mary saw that Brutus stabbed the emperor.

It is fruitless to try to account for such idioms in terms of perception of the *participants* of the events that are perceived. That would be like trying to analyze perception of a melody in terms of perception of the notes constituting it. For example, although it might be plausible to analyze

John saw Mary run
as

John saw Mary & Mary was running (at that time),

the plausibility depends on the fact that ‘see’ is the perceptual verb and running is the activity.² Certainly it is implausible to try to analyze

John felt Mary shuffle her feet
as

John felt Mary & Mary shuffled her feet (then).

This gives neither necessary nor sufficient conditions. On the one hand, one might feel Mary shuffling her feet (for example, in a canoe) without feeling Mary. On the other hand, one might feel Mary (by placing one’s hand on her forehead) while she is shuffling her feet without feeling her shuffle her feet. (The proposed analysis incorrectly entails that if John felt Mary shuffle her feet, then he felt her do X, where X is anything at all that she did at that time.)

The underlying event analysis can easily be extended to account for these sentences by construing them as telling us that the subject perceives a certain *event*, an event of the sort picked out by the embedded clause. Thus (A) would have a form that says

There is a seeing whose subject is Mary and whose object is a stabbing of Caesar by Brutus,
or, spelled out in detail

$(\exists e)[\text{Seeing}(e) \ \& \ \text{Subj}(e, \text{Mary}) \ \& \ (\exists e')[\text{Stabbing}(e') \ \& \ \text{Subj}(e', \text{Brutus}) \ \& \ \text{Obj}(e', \text{Caesar}) \ \& \ \text{Obj}(e, e')]]$.

This is a version of an analysis discussed in some detail by James Higginbotham (1983) and Frank Vlach (1983) in independent papers; each argues that it is superior to accounts based on situation semantics. They both point out that the analysis passes a variety of tests proposed in Barwise (1981) for any adequate analysis of perceptual idioms.³

2.3 Implicit and Explicit Talk about Events

A third kind of evidence in favor of the underlying event analysis lies in the resources it gives us to explain the relationship between certain sentences that contain explicit reference to events and those that do not. For example, sentence (A) contains a phrase that explicitly refers to an event of singing, the phrase ‘the singing of the *Marseillaise*’, whereas there is no explicit reference to any event at all in (B):

- \vdash *explicit reference to an event*
- A After the singing of the *Marseillaise* they saluted the flag
B After the *Marseillaise* was sung they saluted the flag.

Yet these sentences convey almost the same information; the main difference being that a presupposition in (A) seems to be missing in (B): that there was only one singing of the *Marseillaise*.

This example also raises the related question of the relationship between a nominal gerund, such as ‘singing’, used semantically as a noun to designate an event, and the verb ‘sing’ from which it is derived. The underlying event analysis provides the means for a neat solution by proposing that nominal gerunds contribute the *very same* predicates to logical form as the verbs on which they are based.⁴ (In giving English versions of the logical forms of ordinary sentences, I have already been using such gerunds.) With this assumption, the definite description in sentence (A) can be symbolized in the ordinary fashion, assuming as before that the ‘of’ in ‘the singing of the *Marseillaise*’ indicates that the *Marseillaise* is the object of the singing in question. The logical forms are

A’ $(\exists e)[\text{Saluting}(e) \ \& \ \text{Subj}(e, \text{them}) \ \& \ \text{Obj}(e, \text{the flag}) \ \& \ \text{After}(e, \text{SM})]$,
where ‘SM’ is ‘(the e’)(Singing(e’) & Obj(e’, the M))’.

[“After the event that was a singing of the *Marseillaise*, there was a saluting of the flag (by them).”]

B' $(\exists e)[\text{Saluting}(e) \ \& \ \text{Subj}(e, \text{them}) \ \& \ \text{Obj}(e, \text{the flag}) \ \& \ (\exists e')(\text{Singing}(e') \ \& \ \text{Obj}(e', \text{the } M) \ \& \ \text{After}(e, e'))]$.

[“After an event that was a singing of the *Marseillaise* there was a saluting of the flag (by them).”]

On any ordinary account of the logic of definite descriptions, (A') thereby entails (B'), and (B') will entail (A') if supplemented by the claim that there was at most one singing of the *Marseillaise* (by them).

This analysis also accounts for the relationship between certain adverbs ending in 'ly' and the adjectives from which they derive, such as the relationship between 'quietly' and 'quiet' in

C They sang the *Marseillaise* quietly
and:

D The quiet singing of the *Marseillaise* (soothed her ears).

Here again, the proposal that the adverb and related adjective contribute exactly the same predicate to logical form seems to give exactly the right results.⁵

These relationships in form between verbs and the nominal gerunds derived from them, and between adjectives and the 'ly' adverbs derived from them, cannot be seen as some gigantic coincidence; a principled theory is needed to account for them. The underlying event theory does so in a natural manner. In chapter 7 I discuss further this additional evidence in favor of the theory.

2.4 Explicit Quantification Over Events

It is a commonplace in philosophical logic that where there is reference there also is quantification. This suggests that we might fruitfully test for implicit quantification over events (in underlying logical form) by looking for inferences linking it with explicit quantification over events at the surface. Here is an example

- A In every burning, oxygen is consumed.
- B Agatha burned the wood.
- C Oxygen was consumed.

Intuitively, sentence (C) follows from (A) and (B); the problem is to account for why this should be so. On ordinary textbook accounts, there is no quantification in (B) or (C), and no reference to events by any phrase in either of them. Yet somehow the quantification over burnings in (A) is logically related to (B) and (C). The mystery dis-

solves in the underlying event approach. Following the recipes given above, the forms associated with (A) through (C) are

- A' $(e)[\text{Burning}(e) \rightarrow (\exists e')[\text{Consuming}(e') \ \& \ \text{Obj}(e', O_2) \ \& \ \text{In}(e, e')]]$
- B' $(\exists e)[\text{Burning}(e) \ \& \ \text{Subj}(e, \text{Agatha}) \ \& \ \text{Obj}(e, \text{wood})]$
- C' $(\exists e')[\text{Consuming}(e') \ \& \ \text{Obj}(e', O_2)]$

And (C') follows from (A') and (B') in the predicate calculus.

2.5 Robustness

On the basis of the above analyses, it is fair to say that the underlying event account explains many different kinds of semantically important phenomena. I take this to be evidence in its favor.

Each kind of evidence is supportive in its own right, but *the ways in which these phenomena interact with each other are even more important*. Part of the pattern of robustness is that the theory accounts for data in several different epistemically independent domains. The different domains are then seen to interact in fruitful ways. For example, the domains include the logic of modifiers, the semantics of perceptual idioms, and relations between explicit and implicit talk about events. These three applications then interact to explain, for example, how 'Mary saw Brutus stab Caesar violently' entails 'Mary saw something violent'. That is the theory's robustness at work.

Chapter 3

Event Ontology and Logical Form

3.1 Events, States, and Processes

A long-standing tradition in the linguistic and philosophical literature divides simple sentences into categories. The most well-known version categorizes sentences into three major groups: “Event sentences,” “State sentences,” and “Process sentences.” Event sentences are often subdivided into “Accomplishment sentences” and “Achievement sentences.”

The theory under discussion assumes that there are nonlinguistic things in the world corresponding to the linguistic items classified above: there are, in the world, events, processes, and states. It is convenient to have a generic term to stand for all of them; I shall follow Bach (1986) in referring to them as “eventualities.” For many purposes the distinctions among eventualities will not be important, but for a few purposes certain differences will be crucial—that between events and states being most important.

The traditional four-part classification of eventualities is as follows:

Events (Accomplishments) The sentence ‘Agatha made a sandwich’ reports an accomplishment type of event. This sort of event may or may not take an extended amount of time, but it is always meaningful to *ask* “how long” it took. Most events have definite culminations. Even if an event lacks a culmination, it still makes sense to ask whether it “finished”.

Events (Achievements) The sentence ‘She won the race’ reports an achievement. Achievements are events that by their very nature are

instantaneous; for this reason it makes no sense to ask how long the event took or how long it lasted.

States The sentence ‘The dress is pink’ reports a state. States hold for varying amounts of time. It does not make sense to ask how long a state took (though one can ask how long it lasted), nor does it make sense to ask whether it culminated (finished).

Processes The sentence ‘Mary ran’ reports a process. Processes are like events in being “happenings,” but they are like states in apparently having no natural finishing points. In the literature, processes are sometimes called “Activities.”

Further discussion of how to distinguish among these categories is relegated to section 6 below.

For most of this text, the basic items of investigation are Events and States. I generally ignore the distinction between the two kinds of events, Accomplishments and Achievements. Later (chapter 9) I argue that Processes are analyzable in terms of Events, and so I omit discussion of Processes as a separate case, but nothing in the theory prevents Process from receiving special treatment.

3.2 Ontological Assumptions and Logical Forms

Using Bach’s term “eventuality,” I make certain assumptions about eventualities in general, as well as certain special assumptions about events in particular.

3.2.1 Participants

Throughout the text I assume that eventualities have participants of various kinds. A stabbing has an agent (the stabber), and it typically has an object (though not always—you can stab and miss, or just stab “at the air”). In keeping with the terminology in the linguistic literature I use the term “theme” for the object of a stabbing, if there is one.

A knowing, on the other hand, typically does not have an agent, since a knowing is not something that is *done* by someone; in such a case the knower will be called the “experiencer,” and what is known will again be classified as the theme.

These classifications of participants in an eventuality are difficult. They occupy the whole of chapter 5. However, many of the issues I address are independent of the details of such classifications, and for

reason it is best to keep them in the background. In the next two chapters I therefore follow the policy of using the terminology 'Subject' and 'Object' to stand neutrally for *whatever* appropriate relation states the (denotations of the) subject and direct object of a sentence in its underlying eventuality. Thus I shall continue to use 'Subject' and 'Object' in writing the logical forms of

Mary sees the tree

Brutus stabs Caesar

[Seeing(e) & Subject(e, Mary) & Object(e, tree)],
[Stabbing(e) & Subject(e, Brutus) & Object(e, Caesar)].

version of the theory (discussed in chapter 5) does not require the classification of participants in this manner. It views the above types of logical forms as odd ways of writing:

[Seeing(e, Mary, tree)],
[Stabbing(e, Brutus, Caesar)],

to be read 'e is a seeing by Mary of the tree', and 'e is a stabbing of Caesar by Brutus'. In this form, it does not make sense to ask whether Mary and Brutus participate in their respective eventualities in the same or different ways. I think that this version of the theory is inferior to the version I propose, which selects out kinds of participants, but most of my discussion does not rely on this preference.

On any version of the theory, eventualities are meant to be "small" things linked to simple formulas, not "large" things linked with arbitrary sentences. For example, in some theories there is a semantical entity (proposition, fact, situation) corresponding to the sentence

Mary will run or Henry will quit.

In the underlying eventuality view there is no eventuality corresponding to this sentence. The sentence expresses a proposition, and perhaps it also picks out a unique (propositional) fact, but the sentence as a whole does not refer to or quantify over eventualities—only the individual disjuncts making it up do that. It is the disjuncts that have unique participants, not the sentence as a whole. (This is part of what I mean by calling this a study in "subatomic semantics"; the entities studied here apply beneath the level of atomic sentences, and are thus not correlated with molecular sentences.)

3.2.2 Particularity of Events and States

People sometimes distinguish between generic events and states on the one hand and particular events and states on the other. When we condemn "murder" and praise "knowledge" we may perhaps be talking in terms of generic events and states. But when we quantify over events and states in the theory being discussed, particular events are at issue. Suppose we say, for example, that Brutus stabbed Caesar and Laertes stabbed Hamlet; the forms are

($\exists e$)[Stabbing(e) & Subject(e, Brutus) & Object(e, Caesar)],
($\exists e$)[Stabbing(e) & Subject(e, Laertes) & Object(e, Hamlet)].

It is easy to see that these sentences must be satisfied by different events. If a single event satisfied both, then Brutus and Laertes would both be subjects of it, and Caesar and Hamlet would both be objects of it. This event would then satisfy the form attributed to 'Brutus stabbed Hamlet', which is incorrect. This argument rules out the option that both cases deal with the same "generic" stabbing.¹

At the outset I do not assume the particularity of eventualities; I assume only that they should have whatever characteristics they need so that the theory can be developed into a good account of the semantics of English. Their particularity is, then, a consequence of this assumption; eventualities need to be particular in order for the theory to work properly. Because of the structure of sentences such as 'Mary saw Brutus stab Caesar' (along with 'Mary saw the stabbing of Caesar by Brutus'), eventualities will turn out to be perceivable, and, because of examples such as 'Brutus stabbed Caesar in the marketplace at noon', many will turn out to be located in space-time. I do not cite these results because they are desirable or undesirable; I cite them in order to illustrate the ontological character of the theory, and to clarify how these results flow from the theory. Consequences for the identity conditions of events are discussed in chapter 8.

3.2.3 Culmination and Holding

The theory employs a basic distinction between an eventuality's *culminating* and that eventuality's *holding*. This distinction is easiest to explain on a case-by-case basis.

Accomplishment-Events In the case of ordinary (accomplishment) events, the subparts having a special significance for the theory are easy to identify: an event often has both a development portion and a

culmination. For example, if Mary builds a bookcase, then there is a period of time during which the building is going on—the development portion—and then (if she finishes) there is a time at which the bookcase finally gets built, the time of culmination. I do not suppose that every event has a culmination. If Mary begins building a bookcase but is struck by lightning when she has finished three-quarters of the work, then there is an event that is a building, that has her for a subject, that has a bookcase (an unfinished one) as object, and that never culminates. (This view will be important for the analysis of the progressive.)

Achievement-Events I assume that “Achievements,” such as ‘reaching the summit’, are not essentially different from Accomplishment-events. An Achievement culminates when it “happens”; a reaching of the summit by Mary culminates when Mary reaches the summit. The arguable point is whether Achievements have development portions prior to the time of culmination. The popular conception is that they do not; they are, by their very nature, instantaneous events. This is supposed to explain the unacceptability of using Achievement verbs in the progressive, as in

- *Samantha is reaching the summit.
- *Henry is winning the race.

According to the theory I develop in chapter 9, the progressive version of such a sentence is true during the development portion of the event. If Achievements necessarily have no development portions, the oddity of the displayed sentences would be explained. On the other hand, most speakers treat the displayed sentences as grammatical. They are widely used in colloquial language, and perhaps there is nothing deviant about them at all. If so, Achievement sentences are Event sentences that have development portions, and they are not special in any way that is relevant to the issues I discuss. In either case they may be treated theoretically as other Event sentences are treated. Whether Achievements may have development portions is not relevant to their theoretical classification within the theory.²

States I assume that the notion of culmination does not apply to states. At a given time, a state simply holds or it does not.

Processes I discuss processes in chapter 9.

3.2.4 Logical Forms

The two key technical notions I use are those of culminating and holding. I use the notation ‘Cul(e,t)’ to mean that e is an event that *culminates* at time t. When I say that an eventuality e *holds* (at time t), I mean that either e is a state and e’s subject is in state e at t, or e is an event which is in progress (in its development portion) at t. I use the notation ‘Hold(e,t)’ for ‘e holds at t.’³ The logical forms yielded by the theory of underlying eventualities can best be explained by illustration. The sentence

Mary knows Fred
has a logical form that is, roughly
There is a knowing that
 has Mary as its subject, and
 has Fred as its object, and
 holds now.

In symbols:
($\exists e$)[Knowing(e) & Subject(e,Mary) & Object(e, Fred) & Hold(e,now)].

The event sentences I discuss⁴ will typically deviate from this model in three ways. With intransitive verbs, the object clause is omitted. With past and future tense sentences we add something equivalent to quantification over times; this is taken up in the next section. Third, we need to choose between saying that the eventuality in question *holds* at the time in question, or saying that it *culminates* then. If we want to say that Mary built a bookcase, then we shall need to say that there is a past time (a time before now) at which that building event culminates. If we were to say only that there is a past time at which the event holds, then that leaves it open that she has not yet finished. In such a case the English sentence ‘Mary built a bookcase’ is not yet true. The logical form of a simple nonprogressive sentence contains ‘Hold’ if the verb is a state verb; its logical form contains ‘Cul’ if the verb is an event verb. The logical form associated with:

Mary built the bookcase
will be equivalent to:⁵
($\exists e$)[Building(e) & Subject(e,Mary) & Object(e,the bookcase) & ($\exists t$)[t<now & Cul(e,t)]].

This essay in “subatomic semantics” has the goal of providing semantical analyses of formulas that other theories normally treat as atomic formulas of English. Its goal is to analyze phrases such as ‘x stabs y’, ‘x stabs y violently’, ‘x stabs y violently with u’, and so on. The primary outputs of this theory are formulas consisting of variables, verbs, and modifiers. So NPs are dealt with by another part of the semantics. NPs contribute to the logical forms of English sentences primarily (perhaps exclusively) by quantification. The syntactic effect of this process is that the NP in question takes the place of the quantified variable (with later occurrences of the same variable being replaced by pronouns); semantically, it is as if the variable is bound by a quantifier contributed by the NP. For example, one of the readings of ‘Everyone stabs someone’ has the logical form

$$\lambda x(\text{Person}(x) \rightarrow (\exists y)(\text{Person}(y) \ \& \ x \text{ stabs } y)).$$

If we start with ‘x stabs y’ as an atomic formula of English, the sentence can be generated in two steps, first, by combining ‘x stabs y’ with ‘someone’ to get ‘x stabs someone’, and then combining this with ‘everyone’ to get ‘everyone stabs someone’.⁶ Semantically, the first step embeds the logical form of ‘x stabs y’ in the matrix

$$\exists y(\text{Person}(y) \ \& \ \dots \dots \dots),$$

and the second embeds the result in the matrix

$$\lambda x(\text{Person}(x) \rightarrow \dots \dots \dots).$$

This type of process has been familiar ever since Bertrand Russell wrote “On Denoting” in 1905, and although the details may change from theory to theory, something equivalent to it is now commonplace. I take this sort of background for granted. The point of the theory under development is to analyze the inputs to the customary treatment of quantification, so that the structure of ‘x stabs y’ is analyzed. Since ‘stab’ is an event verb, the logical form of this part is

$$\text{stabs } y = \exists e[(\text{Stabbing}(e) \ \& \ \text{Subject}(e,x) \ \& \ \text{Object}(e,y) \ \& \ \text{Cul}(e,\text{now}))].$$

Accordingly, the whole form for ‘Everyone stabs someone’ is

$$\lambda x(\text{Person}(x) \rightarrow (\exists y)(\text{Person}(y) \ \& \ (\exists e)[\text{Stabbing}(e) \ \& \ \text{Subject}(e,x) \ \& \ \text{Object}(e,y) \ \& \ \text{Cul}(e,\text{now}))]),$$

where the theory of underlying eventualities has provided the form for ‘x stabs y’ that is inserted into the form for the rest of the sentence.

Strictly, then, the subject matter of most of this essay is the analysis of *formulas containing variables*, without regular NPs. But since such formulas are so unnatural to read, I usually give examples in which the variables are replaced by proper names or definite descriptions. I talk as if the theory yielded ‘Brutus stabs Caesar’, though it actually (directly) yields ‘x stabs y’. Nothing of import rests on this. I avoid example sentences containing quantificational NP’s (such as ‘every dog’) wherever possible, in spite of occasional awkwardness in doing so, to spare the reader unnecessarily complex logical formulas.

3.3 Tenses and Times

For a relatively complete account of even the simplest sentences of English, the system of underlying eventualities needs to be amalgamated into a theory of tense, aspect, and temporal modifiers. By ‘tense’ I mean Simple Past (‘Mary left’), Simple Present (‘Mary leaves’), and Simple Future (‘Mary will leave’). “Aspect” includes the Progressive form of the verb, as opposed to the Simple form: ‘be leaving’, as opposed to ‘leave’; aspect also includes the Perfect form of the verb: ‘has left’. Temporal modifiers include such things as ‘at noon’, ‘yesterday’, ‘during the war’, and so on.

Tense, aspect, and temporal modifiers are interrelated topics of great complexity, and I have tried to compartmentalize their exposition for the sake of comprehension. They are ignored throughout the next several chapters (chapters 4 through 8), which are devoted to the issue of underlying eventualities. By employing a simplified version of tense logic (or by ignoring it altogether), and by avoiding examples containing aspects and temporal modifiers, I set these topics aside until chapters 9 through 12. All sentences will therefore be in the Simple Past, Present, or Future and will lack temporal modifiers. These are the simplest examples that constitute full-fledged English sentences. The Progressive has a chapter of its own (chapter 9), as does the Perfect (chapter 12); the details of tenses and of temporal modifiers are covered in chapter 11.

The simplest notation for tenses is the operator notation from standard tense logic. The assumption behind this notation is that ordinary formulas of predicate logic are to be assigned truth-values relative to moments of time. In application, a formula without any tense operator is thought of as being evaluated relative to the present time, so that an unadorned formula such as

Clever(Mary)

means “Mary is clever *now*.” The operator PAST may precede a formula, in which case the whole formula is construed as being true now just in case the part following the PAST is true at some previous time. Likewise, a formula may be preceded by FUT, in which case it is true now just in case the part governed by FUT will be true at some time later than now. (In conventional tense logic these operators can be embedded in one another’s scopes, but that never happens in English, so I shall not use them.)

I shall be working with the following sorts of logical forms:

Brutus stabbed Caesar = PAST($\exists e$)[Stabbing(e) & Subject(e , Brutus) & Object(e , Caesar) & Cul(e)]

Brutus stabs Caesar = PRES($\exists e$)[Stabbing(e) & Subject(e , Brutus) & Object(e , Caesar) & Cul(e)]

Brutus will stab Caesar = FUT($\exists e$)[Stabbing(e) & Subject(e , Brutus) & Object(e , Caesar) & Cul(e)]

(where the ‘PRES’ is redundant, and could simply be omitted). The first is true if there is some time in the past when there is a stabbing, whose subject is Brutus, whose object is Caesar, and which culminates then. The second is true if there is a stabbing of that sort that culminates now (at the moment of utterance). And the last is true if there is some time in the future when there is a stabbing of that sort that culminates then. This account of tenses must be slightly revised (see chapter 11) in order to correctly accommodate more complex constructions.

3.4 More Details about Tenses

There are certain objections in the literature to the use of tense operators to symbolize tenses. One is due to Anthony Kenny (1963) who objects to a certain corollary to the use of tense operators. The corollary is that if Pres(S) is true now, then Past(S) will be true at some later time. His proposed counterexample is that ‘Alf is walking to the Rose and Crown’ does not entail the future truth of ‘Alf walked to the Rose and Crown’. This particular objection is easy to answer, since the latter sentence is not the past tense version of the former; the former is in the progressive, and the latter is not. The past tense of the former sentence is ‘Alf was walking to the Rose and Crown’, and

this *should* be true at a later time if Alf is now walking to the Rose and Crown.⁷

Since different kinds of simple English sentences behave differently with regard to tense, and the proposed version of tense logic supplies uniform operators to govern all of them, here is how the treatment works in simple examples.

3.4.1 Past

The past tense of an event sentence requires that the event in question culminate at some past time. A sentence such as ‘Mary made lunch’ starts being true as soon as the culmination of the lunch making has passed. Likewise, the past tense of a state sentence seems to work correctly, since ‘Mary knew Fred’ is true now if she knew him previously, and is otherwise false. However, an additional dimension of state sentences that this account does not capture is that in certain circumstances it would be odd to say that Mary knew Fred if she still knows him now. This I take to be a matter of conversational maxims, to be accounted for within the study of the pragmatics of language use. It would be incorrect to build into the logical form of ‘Mary knew Fred’ that she does not know him now, since the implication is not operative in many circumstances, and since even when it is operative it does not make ‘Mary knew Fred’ false if she still knows him; it merely makes it misleading.

Another relevant phenomenon is the oddity of the past tense sentence’s being true just because the eventuality in question holds or culminates *sometime* in the past. As Barbara Partee (1973, 1984) has argued, if we are turning onto the freeway to begin our vacation trip and I say ‘I didn’t turn off the stove’ this may be taken to be a true assertion even though I have in fact turned off the stove at many past times. The point is that context limits the interpretation of the past tense operator to apply only to certain relevant parts of the past. This is an important phenomenon in the pragmatics of language use, but it affects the interpretation of our logical forms, not the forms themselves. The ‘PAST’ operator should be read ‘for some relevant time in the past’.

3.4.2 Present

The logical form of present tense state sentences seems to be unproblematic; ‘Mary knows Fred’ is true now if the relevant state of knowing holds now. The present tenses of event sentences, however, raise

problems. There is something decidedly odd about saying, all by itself, 'Mary builds a house' or 'Agatha wins the race'. Fortunately, our treatment correctly captures this oddity.

In general, verbs can be interpreted in two or more different ways: the so-called "reportive" use, and the "habitual" or "iterative" use. These different uses appear in all tenses. 'Mary drank wine with her lunch' can be construed as reporting a specific incident that took place in the past; this is the "reportive" reading. But it can also be construed as telling us what she habitually did during her years in the corporate world. In the past tense, a simple unmodified sentence taken out of context tends to be taken in its reportive sense, but in the present tense that same construction may almost force the habitual reading. One has to strain to interpret 'Mary drinks wine with her lunch' as a report of a specific drinking. The best examples of the reportive use of present tense event sentences are found in the speech of on-the-scene newscasters, for whom it is not at all odd to say "And the Maryland delegation goes two to one for the Democrats!"

The logical forms proposed above explain these facts perfectly. According to those forms, a present tense event sentence construed in the reportive sense can be true only at one specific instant—the time the event culminates. Such a sentence, then, can be used truly only in certain very special circumstances: the speaker must usually be observing the scene in order to be sure of getting the time right, and the sentence cannot be used in anticipation of the culmination or in the recapitulation⁸—it must be used exactly once and at exactly the right time. Such uses are rare.

My purpose is to capture the reportive readings of sentences, not the habitual or iterative readings, because I suspect that the reportive use is basic. I have not thought through the complexities of the other uses, so my account is limited accordingly, but not in ways that are relevant to the issue of underlying eventualities. Some of my examples of event sentences in the simple present tense (as opposed to the progressive) may therefore look odd. Nonetheless, the logical forms attributed to them will be correct, in spite of the oddity.

3.4.3 Future

The future versions of state sentences share the implication of past tense versions that the state is not going on at present; 'Mary will know Fred' tends to suggest that she does not know him now. The

proposed logical forms are not for that reason defective; the account is merely missing a pragmatic component that would explain the implication.

There may be an additional implication in the case of future event sentences. 'Mary will make lunch' may imply that she has not yet started. This implication too is not captured by the proposed logical form, which is true if Mary has already started making lunch and will finish it in the future.

In addition, future tense sentences need their future times limited to "relevant" times, as much as do past tense sentences.

On some views, my appeal to times in logical forms is unduly superficial. Kamp (1980) and Bach (1986) defend the Whiteheadian view that the time-frame itself should be defined or constructed in terms of more basic relations among eventualities. I do not see this as an objection to the theory I am discussing. In appealing to times, I remain neutral on the question of whether they can be recovered from an analysis of relations among eventualities. I remain neutral about the issue of ontological priority of times over eventualities or vice versa.

3.5 States, Propositions, and Facts

The purpose of this section is to elucidate the notion of "state" by comparing it with the notions of "proposition" and "fact."

3.5.1 Objects of Belief (Propositions)

I assume that the "objects" of belief are whatever it is that that-clauses refer to when preceded by the verb 'believe', and I use the customary term 'proposition' for these things. I do not try to clarify what propositions are, but I accept a broadly Fregean view of them.⁹ Other constructions that behave similarly to that-clauses also refer to propositions; whether-clauses in constructions such as 'Kim wonders whether Sammy loves her' are examples.

That-clauses create opaque contexts; that is, singular terms in that-clauses may not generally be replaced by co-referential singular terms that preserve reference of the that-clause. The proposition that Mary knows Fred is a different proposition from the proposition that Mary knows the king, even if Fred is the king. This must be so, because Agatha might believe the former without believing the latter.

I assume also that it is possible to quantify into propositional that-clauses. I accept the usual view that ‘Agatha believes that Mary knows the king’ is ambiguous between a *de dicto* reading

Agatha believes the proposition: Mary knows the king
and a *de re* reading

The king is such that: Agatha believes the proposition that Mary knows him.

If Fred is the king, then the *de re* readings of ‘Agatha believes that Mary knows the king’ and ‘Agatha believes that Mary knows Fred’ are equivalent. Both the *de dicto* and the *de re* readings are always possible, though context often favors one or the other.

3.5.2 Facts

Although “facts” are discussed a great deal in metaphysics and in philosophical logic, there is a wide variety of views about what they are. I take this to reflect variant usages of the term ‘fact’. At one end of the spectrum, facts are seen to be very much like propositions. At the other end, they are seen to be very much like the kinds of states appealed to in this book.

The best illustration of the propositional interpretation of facts is that of Frege (1918), who held that facts simply *are* propositions—they are true propositions. Reflection on the occurrence of that-clauses used in contexts presupposing the truth of the sentence contained in the clause gives rise to this view. An example is

Mary regrets that she insulted Bill

Sometimes these constructions can be paraphrased using the word ‘fact’, as in

Mary regrets the fact that she insulted Bill.

For this reason it is sometimes assumed that in these contexts that-clauses refer to facts. If so, then these facts must be very much like propositions in at least two respects. First, that-clauses that contain different but co-referential singular terms must be able to pick out different facts. Mary may regret that she insulted Bill without regretting that she insulted the person who is slandering her behind her back, even if Bill is that very person. Second, facts can be found that correspond to complex sentences. Mary may regret the fact that either Bill or Mary stole the gems; if she does not know which of them did

it, the object of her regret is a disjunctive fact, just as belief can take a disjunctive proposition as its object.

At the other end of the spectrum, the notion of fact identifies facts in part by their constituents and as corresponding only to simple clauses. On this conception, the fact that Mary insulted Bill and the fact that she insulted the person who is slandering her are the very same fact, if Bill is the person slandering her. And there is no “fact” that either Bill or Mary stole the gems; there is a proposition that either Bill or Mary stole the gems, and either or both of its disjuncts may refer to facts, but the disjunction as a whole is of the wrong sort to pick out a fact.

For clarity I refer to the first type of facts as “propositional facts” and the second as “material facts.” There are other conceptions of facts in between, but this contrast will be sufficient for my purposes here. The “states” utilized in the present theory are similar to material facts, and are very unlike propositional facts.

States of affairs are like facts, except that there are “false” states of affairs and no “false” facts. I think that ‘state of affairs’ covers the same spectrum as ‘fact’. States, as used here, are very unlike the propositional conception of states of affairs, but like the material conception.

3.5.3 States

States, if there are any, have different identity conditions than propositions or propositional facts. States have unique “participants.” If Agatha’s knowing Fred is to be construed as a state, then this is the very same state as the state of Agatha’s knowing the king, if Fred is the king. And it is the very same state as the state of the queen’s knowing Fred if Agatha is the queen.

States differ from propositions and propositional facts in corresponding only to simple (state) sentences, whereas propositions and facts can correspond to complex ones. Each of the following deals with a single proposition or fact:

Mary believes that either Sam knows Henry or Mary knows Bill.

Mary regrets that either Sam knows Henry or Mary knows Bill.

But if we try to talk about

The state of either Sam’s knowing Henry or Mary’s knowing Bill,
we do not produce a reference to a disjunctive state; we get instead a disjunctive singular term that refers either to the state of Sam’s know-

ing Henry or to the state of Mary's knowing Bill. (This is on a par with our understanding of a term such as 'Kim or Sammy'. This term, if it refers at all, refers either to Kim or to Sammy; it does not refer to a disjunctive individual composed of the two of them.)¹⁰

3.6 Tests for Distinctions Among the Categories

A number of philosophers and linguists have attempted to articulate criteria that might allow us to categorize eventualities. The tests I review are all formulated in terms of categorizing linguistic items, not eventualities, though some are convertible into direct tests for eventualities.

The idea of classifying eventualities into events, processes, and states originated with Gilbert Ryle (1949), and was carried on by Anthony Kenny (1963), who attributed the original idea to Aristotle. For this reason, this classification is commonly called "Aristotelian." Kenny proposed various tests, both syntactic and semantic, for classifying eventualities. It is sometimes unclear whether the classification is meant to classify things in the world or pieces of language. When pieces of language are being classified, sometimes verbs, sometimes VPs, and sometimes whole sentences are so classified. I am primarily concerned to classify nonlinguistic things—eventualities. I see a fairly clear distinction between events and states, and I see less clarity (along with less importance) about how processes fit in. Since I assume that verbs pick out basic kinds of eventualities (events and states), the distinction of event and state is also reflected by a corresponding linguistic distinction between kinds of verbs. (Adjectives and nouns, also relevant, are discussed in chapter 10.)

After Kenny, the primary mover in this area was Zeno Vendler (1967), who extended Kenny's ideas. More recently, there has been a great deal of discussion of these notions in the linguistic literature. Dowty 1979, for example, contains a sophisticated development of these ideas, amalgamated into an ambitious program for a semantic theory of English.¹¹ Bach (1981) and others also discuss these categories.¹²

3.6.1 Use of the Progressive

A test that is supposed to divide Processes and Accomplishment-Events on the one hand from States and Achievement-Events on the other is the felicitous use of sentences in the progressive. Accomplish-

ment-Event sentences and Process sentences are said to occur in the progressive, as in

Sally is making a birdbath.

Sally is running,

whereas State and Achievement-Event sentences are not supposed to occur grammatically in the progressive, as illustrated by

*This book is being pink.

*Martha is reaching the summit.

Some of the problems with this test shed light on the proposed distinction, while others tend to undermine it.

Problem 1 In general it is thought that copular sentences are state sentences, yet some of them easily take the progressive:

John is being silly (. . . being a fool).

This apparent exception to the generalization actually sheds light on the distinction when coupled with the thesis that there exists in English a special use of the verb 'be', sometimes called the 'be' of action. If we are judging John's character, and we say that he is silly, then there is something peculiar about saying in the same vein that he is *being* silly. On the other hand, if we are commenting on his behavior at a party, it is quite appropriate to say that he is being silly. We mean that he is *acting* silly. This interpretation makes it plausible to think of the sentence as reporting an (accomplishment) event or a process, and so this is not a counterexample to the proposed test of classification. The need for a special use of 'be' occurs in several contexts. That there is such a use has a fair amount of plausibility.¹³

Problem 2 Some state sentences occur in the progressive. An example is

You will be wanting to turn right at the next corner.

'Want' is supposed to be a paradigm state verb, one that does not take the progressive. This happens with a small class of state verbs, and it undermines the idea that use with the progressive shows conclusively that a sentence is not a state sentence.¹⁴ However, in those few cases in which a state sentence is used in the progressive, the progressive version differs little in import from the nonprogressive version.¹⁵ Interpreted in this way the test may be helpful in distinguishing state sentences from all the rest.

Problem 3 Paradigm Achievement-Event sentences commonly occur in the progressive. The verb 'win' is supposed to be an achievement verb, but

She is winning

is so common as to suggest that there is something seriously wrong with any test requiring this to be ungrammatical. Our vocabulary may, of course, have two words 'win', one an achievement verb and another a process verb. Perhaps one meaning of 'is winning' is simply 'is ahead'. (But this would be odd, for there is no use of *nonprogressive* 'win' that means, for example, 'leads'.) Other examples are

Grandpa is dying.

The train is arriving now.

We often seem to use paradigm Achievement verbs as if they were ordinary Accomplishment-event verbs. The progressive test is not terribly helpful in making this distinction.

In summary, the test distinguishing Accomplishment-Event and Process sentences from Achievement-Event and State sentences seems to be helpful in isolating state sentences from the rest. State sentences are unusual in the progressive, and when their progressive forms occur, they differ little in meaning from their nonprogressive counterparts.

3.6.2 How Long?

A second test assisting the categorization is that it makes sense to ask "how long" in connection with a State or Process, but not with an Event. These are supposed to be data:

State: (OK) How long was the book pink?

Process: (OK) How long did Mary run?

Accomp: (Bad) How long did Mary make a birdbath?

Achieve: (Bad) How long did Mary win the race?

On the other hand, if we can ask how long something "takes" we get the opposite results:

State: (Bad) How long did it take the book to be pink?

Process: (Bad) How long did it take Mary to run?

Accomp: (OK) How long did it take Mary to make a birdbath?

Achieve: (OK) How long did it take Mary to win the race?

Note that it is fine to say "How long did it take Mary to run to the store?", and even "How long did it take Mary to run" if this is elliptical

for some thing like ". . . to the store." Except for these peculiarities the test seems to work pretty much as intended.

This test might be convertible into a direct test for eventualities. Events and Processes (as opposed to States) would *take time*, whereas States (as opposed to Events and Processes) would *last* through time. (What to say about Achievement-events, which are supposed to be automatically instantaneous?)

3.6.3 Occurrence with Pseudo-Clefts

A test that perhaps distinguishes State constructions from all the others is the deviance of State sentences that contain constructions linguists call "pseudo-clefts":

State: (Bad) What John did was know the answer.

Process: (OK) What John did was run.

Accomp: (OK) What John did was make a birdbath.

Achieve: (OK) What John did was win the race.

This test might be converted into a method for distinguishing States (as opposed to State sentences) from other eventualities: eventualities other than States are things that are *done*; States are not *done*.

3.6.4 Progressive Entails Perfect (vs. Negation of Perfect)

A famous test proposed by Kenny is that Events are supposed to satisfy this formula:

If x is V-ing then x has not V-ed,

whereas Processes are supposed to satisfy the contrary condition:

If x is V-ing then x has V-ed.

For example, these are supposed to be true:

i Accomplishment-Event: If x is building a birdbath then x has *not* built a birdbath.

ii Achievement-Event: If x is reaching the summit then x has *not* reached the summit.

iii Process: If x is running then x *has* run.

The fascinating thing about (i) and (ii) is that they seem so close to saying something insightful and true in spite of the fact that they are both false. If x has built a birdbath, x may have built many birdbaths before, and if x is reaching the summit x may have reached that summit many times before.¹⁶ The insight lying behind the faulty formulation, as Emmon Bach (1981, 71) points out, is that if x is building a birdbath

When *that particular building* is not yet over, and if *x* is reaching the summit then *that particular summit reaching* is not yet over. It is interesting that we need recourse to events even to state clearly what the test is.

It is questionable whether (iii) is true when *x* has just started running. What seems to lie behind this test is that the eventualities picked out by process verbs are homogeneous in some sense needing articulation; any given “large” running seems to consist of many smaller runnings. A variety of other tests is discussed in the literature, many of them replete with counterexamples.¹⁷

3.6.5 Summary of Semantic Tests

I assume that there is a distinction between States, on the one hand, and typical Events, on the other. I accept the “pseudo-cleft” test as a rough guide to distinguishing State sentences from all others, and I accept the “how long” test as distinguishing State sentences from Event sentences. My basic items of investigation are Events and States. For the most part I ignore the distinction between Accomplishments and Achievements and (until chapter 9) the special status of Processes.

What is it *in language* that gets categorized by the traditional list of categories? Sometimes tests that are couched in terms of classifying *verbs* seem better oriented to the classification of VPs (or of simple sentences), for two reasons. First, all the tests make perfectly good sense when applied to these larger phrases. And second, when the tests are applied to VP's, the results do not depend on the verb alone. A well-known sort of example is that the “How Long?” test and the “Progressive Entails Perfect” test both tend to classify ‘Mary ran’ as a Process:

Grammatical: How long did Mary run?

Mostly True: If Mary is running then Mary has run.

Yet they seem to classify ‘Mary ran to the store’ as a non-Process:

Ungrammatical: How long did Mary run to the store?

True: If Mary is running to the store, then Mary has *not* run to the store (unless she ran there previously).

The category switch that results from appending modifiers to the verb is a major issue in Aristotelian classification schemes.¹⁸ The theory I develop can solve that problem (see chapter 9). But this shows that the tests articulated are properly seen as classifications of VPs or of

simple sentences, not of verbs by themselves. But it is also apparent (by surveying examples) that the basic distinction between State and Event can also be viewed as a classification of verbs—since the addition of other items to their VPs never changes one of *these* to the other.

The semantical theory under development requires that eventualities be divided into States and Events. It is a fundamental assumption of this work that such a distinction makes sense, but whether the assumption is justified depends on how well the theory works overall.

4.1 Classification of Modifiers

Syntactically, adverblike modifiers take three forms in language:

1. adverbs themselves, single words that occur in modifier position in sentences. Examples are: 'probably', 'gently', 'softly', 'allegedly', 'well', 'foolishly', 'there', 'crosswise', 'partway'.
2. prepositional phrases, consisting of a (one- or two-word) preposition followed by a noun phrase. Examples are: 'in the bank', 'over the river', 'through the woods', 'out of the box', 'after the deluge', 'at the target', 'onto the bus', 'according to the report', 'in her dreams', 'with a knife', 'with hay', 'out of necessity'.
3. subordinate clauses, consisting of a subordinating "conjunction" and a clause. Examples are: 'after Mary left', 'while John slept', 'if Sam doesn't come', 'as we hoped', 'because he perceived the danger to his right flank'.

The third class, subordinate clauses, requires special treatment (see chapter 11). The differences between the first two classes are unimportant from the point of view of their semantic function as modifiers.¹ Although there are semantically different kinds of modifiers, classified in terms of their semantic functions in sentences, the difference between prepositional phrases and adverbs cuts across the semantical distinctions. Prepositional phrases have structure that adverbs lack, but they contribute the same type of items to logical form. A prepositional phrase carries with it a noun phrase position, which typically contributes structure to the sentence by means of NP quantification. Thus, in parallel with the adverbial modification

Mary ran *quickly*,

we have the prepositional phrase modification

Mary ran *into every house*.

The gross logical form of the latter sentence is

For every house, Mary ran *into it*,

that is,

$(x)[x \text{ is a house} \rightarrow \text{Mary ran into } x]$,

in which the 'into x' occurs in the same position as the 'quickly' in the former sentence. The claim, then, is that

'into x' (or 'into it')

and

'quickly'

have the same modifier roles; the differences in their internal structure do not affect their modifying functions. A prepositional phrase can add considerable complexity to a sentence because of the quantificational structure of the NP that occurs as the object of the preposition; in the example above,

$(x)[x \text{ is a house} \rightarrow \dots]$.

But the part that does the modifying is the remainder of the form—the 'into x'—and this functions no differently than a simple adverb.²

Both the adverb and the prepositional phrase in the example just illustrated contribute to logical form a predicate of an underlying event. Not all modifiers do this, but the parallels between adverbs and prepositional phrases carry over to the other functions as well. For example, both 'allegedly' and 'according to Mary' (or 'in a dream') function as sentence modifiers, but they modify sentences in the same way, in spite of the fact that the prepositional phrase introduces the possibility of additional quantification and the adverb does not.

I classify modifiers into five main categories: Speech-Act Modifiers, Sentence Modifiers, Subject-Oriented Modifiers, VP Modifiers, and Other. The VP modifiers turn out to represent predicates of events according to the theory of underlying events. (I also sometimes call them "verb modifiers".) The bulk of this chapter discusses the semantics of verb modifiers.

Attributives

1 The Problem

In his original paper, Davidson (1967) suggested that the theory of underlying events might be unable to treat "attributives" such as 'slowly' as predicates of underlying events. Since so many verb modifiers turn out to be attributives, this suggests that the theory has a rather narrow application. Most workers in the field have suspected that Davidson was right to worry about this, but I think their worry is misplaced. Attributives can indeed be treated as predicates of underlying events.

Davidson framed the problem as one involving the identity of events. Suppose that Susan took eighteen hours to cross the Channel. Hearing that she crossed slowly. Then we discover that she crossed it by swimming. We judge then that she swam the Channel swiftly. But suppose that the swimming and the crossing are indeed the very same event. Then that event is both slow and swift, an apparent contradiction.

The issue needn't, however, turn on the question of identity of events at all. Suppose we hear that Susan crossed the Channel in eighteen hours, and we judge that she crossed slowly. Then we learn that she crossed it by swimming. Now, thinking of other such crossings, we say that she crossed the Channel swiftly. We have judged in one context that she crossed slowly, and in another that she crossed swiftly. In the first context we are implicitly comparing her crossing to crossings in general. We might even explain: "She crossed slowly because she did it all by herself—she swam!" In the second context we are comparing her Channel crossing with others that are accomplished by swimming, and now we easily say, and without any need to retract our earlier comment, that she crossed swiftly. In the second context, we should even be willing to deny that she crossed slowly. The verbal forms let us contradict ourselves, yet the remarks are not contradictory. Further, since both remarks use the same verb 'cross', the issue of the identity of events (of swimings with crossings) does not even arise. We have changed comparison classes for judging slowness and swiftness: crossings in general, or crossings in water under one's own power.

Two theoretical questions remain. How is the solution to be embodied in a theory of logical form? And what consequences does this solution have for the theory of underlying events?

4.2.2 Two Theories and Their Paradigms

The issue of logical form has been studied in detail for adjectives, so I shall turn for a moment from adverbs to adjectives to survey some of the conventional resources that study has given us.³ Two ways to analyze adjectives are well-understood in the literature: as predicates or as operators.

A paradigm analysis of an adjective as a predicate is a typical prenominal occurrence of 'red', as in

x is a red house = x is a house & x is red.

This analysis is common in logic textbooks, and indeed such adjectives occur naturally in predicate positions in English sentences: 'This book is red'. This predicative occurrence is used to analyze the prenominal occurrence in ' x is a red house'.

Some adjectives cannot be analyzed as predicates and are treated instead as operators. An example is 'former', as in

x is a former president = formerly(x is president).⁴

Adjectives such as 'formerly' *do not occur* in predicate position, and so predicative meaning is not available for analyzing prenominal occurrences.

4.2.3 The Problem Needing Analysis

In addition to paradigm predicates, such as 'red', and paradigm operators such as 'former', *attributives*, such as 'tall', form a third class of paradigms for adjectives. (It includes most "degree adjectives".) Unlike paradigm operators, attributives occur freely in predicates, but unlike paradigm predicates their predicative analysis seems problematic. 'Clever' seems, *prima facie*, to violate both theories. It violates the predicative analysis since someone can be a clever teacher without being a clever parent; but apparently, if 'clever' is a predicate, then from ' x is a clever teacher' (= ' x is clever & x is a teacher') and ' x is a parent' we should be able to infer ' x is a clever parent' (= ' x is clever & x is a parent'). And it apparently violates the operator analysis in that 'clever' occurs alone in the predicate, as in 'Mary is clever', where there is no argument for the operator to operate on.

The assumption needed that lets either account handle attributives such as 'clever' is that 'clever' always means 'clever for an F', where 'F' is somehow supplied from context. (This F must be supplied both for the prenominal and for the predicate occurrences of the word.) On

the predicative treatment, 'x is a clever N' means 'x is an N & x is clever for an F', where F is figured out from context. Sometimes (often, but not always) F is the same as N. In the case of predicative occurrence, we have to guess at the F. On the operator analysis, 'x is a clever N' means 'clever(x is an N that is F)', where this is further analyzed as 'x is N & x is clever for an F'. Often, but not always, F is the same as N. In either case, for predicative occurrences, such as 'Mary is clever' we have to guess at F.

The F cannot always be the same as the noun modified, even in prenominal occurrence. 'He is a tall basketball player' can mean that he is tall for a basketball player *in grade school*, or any of a wide variety of things.⁵

Accordingly, both popular accounts are *equally correct* and *equivalent* in terms of the logical forms they produce. Both accounts need to provide for a parameter, to be fixed by context. Each produces a logical form that is a conjunction, one in which the modifier has an extra place. The "predicative" account displays this directly. The form for the operator account also displays this, but only upon further analysis. When expanded, the operator account turns into the predicative account.

4.2.4 Scope

The operator account is sometimes seen as the more sophisticated of the two, because it allows modifiers to have scope, and so they can take scope over other items in the sentence. This is exactly right in the case of sentence modifiers, such as 'necessarily', since 'necessarily, somebody wins' has a reading in which the necessity takes scope outside the quantifier. But in 'someone is a clever teacher' there is no reading on which the 'clever' takes scope over 'someone'. The introduction of scope is not an advantage of the operator analysis in this context. (See section 4.4.1.)

4.2.5 Attributive Adverbs as Predicates of Events

Since the adverbial analogues of pure paradigm operator adjectives, such as 'formerly', are *sentence modifiers*, they are not at issue in the discussion of underlying events. Attributives are different.

The correct account of 'slowly' within the theory of underlying events is that it is a predicate of events that has a place in it for a contextual parameter. (Or else, it is an operator that has a further

analysis as a predicate with a place for such a parameter.) A correct analysis of 'Brutus walked slowly' is

$(\exists e)[\text{Walking}(e) \ \& \ \text{Subject}(e, \text{Brutus}) \ \& \ \text{Slow}(e, F)]$

where F is the contextual parameter. This gets all of the logic right, so long as we are careful about the parameter. From

Nguyen walked slowly along the quay

we *can* infer

Nguyen walked slowly

provided we keep the contextual parameter fixed. If the former sentence is used to mean

Nguyen walked slowly-for-a-walk-of-his-along-the-quay along the quay,

then when we conclude

Nguyen walked slowly,

this conclusion holds only on the interpretation

Nguyen walked slowly-for-a-walk-of-his-along-the-quay.

In examples throughout this text I suppress the contextual parameter for simplicity, but it should be kept in mind. With its presence, either explicit or implicit, there is no difficulty in treating attributives as predicates of events.

4.3 Group Readings, Scope, and Conjunctions

This section is devoted to a discussion of some miscellaneous issues about the behavior of verb modifiers.

4.3.1 Group Readings and Scope

Certain constructions in English appear to refer to groups. Examples are 'the women' in

The women elected Mary president.

The women were numerous.

The women milled around.

Other NPs do not usually denote groups, but they can do so in certain contexts; examples are 'everyone' in:

Everyone milled around,

and 'Mary and Bill' in

Mary and Bill (together) lifted the piano.

I shall not rehearse the substantial literature on group readings of English NPs. I shall simply assume that sometimes reference to groups is required, and I shall note how this bears on the matter of verb modifiers.

Sometimes reference to groups is an alternative to scope, as an explanation of ambiguity. A classical case is the difference between

Samantha quickly polished each boot,

and

Samantha quickly polished all the boots.

This has sometimes been seen as a scope phenomenon, illustrating the relative scopes of the universal quantifier and the adverb 'quickly', with the proposed readings being

$(x)(\text{Boot}(x) \rightarrow \text{QUICKLY}(\text{Samantha polished } x))$

$\text{QUICKLY}(x)(\text{Boot}(x) \rightarrow \text{Samantha polished } x).$

In the theory under consideration, 'quickly' does not have scope. I see the two readings instead as a contrast between two sentences, one with an individual reading, and one with a group reading:

$(x)(\text{Boot}(x) \rightarrow (\exists e)[\text{Polishing}(e) \ \& \ \text{Subject}(e, \text{Samantha}) \ \& \ \text{Object}(e, x)])$

$(\exists e)[\text{Polishing}(e) \ \& \ \text{Subject}(e, \text{Samantha}) \ \& \ \text{Object}(e, \text{the boots})].$

In the former, there are many polishings, one per boot, and each is said to be quick. In the latter there is a single polishing of the group of boots, and that polishing is said to be quick.⁶ Both sentences might be true, but neither implies the other; each individual polishing might be quick without the polishing of the group's being quick, or the polishing of the group might be quick even though one or more individual polishings was not. In each case, the adverb acts as a predicate of single events.

Groups are also sometimes required as the objects of prepositions. The most natural treatment of:

She wandered among the pines

is

$(\exists e)[\text{Wandering}(e) \ \& \ \text{Subject}(e, \text{her}) \ \& \ \text{Among}(e, \text{the pines})],$

where 'the pines' refers to the group of trees.

This may also be the correct treatment of 'between', as in

She stood between the boys,

or

She stood between Shem and Shaun.

In the former case the object of 'between' is the (two-person) group of boys. In the latter case the object of 'between' is the group consisting of Shem and Shaun. This analysis explains why 'between' always requires an 'and' if used with singular nouns, and why 'between A and B' is always interchangeable with 'between B and A'.

Conjunctions such as 'Shem and Shaun' may also pick out subjects of events, as in

Shem and Shaun lifted the piano

which has, as one of its readings

$(\exists e)[\text{Lifting}(e) \ \& \ \text{Subject}(e, \text{Shem and Shaun}) \ \& \ \text{Object}(e, \text{piano})].$

In this form, 'Shem and Shaun' denotes the two-membered group of boys.

4.3.2 Groups as Objects of Prepositions

The suggestion that a better analysis of 'She stood between Shem and Shaun' is to see 'between' as taking a single (compound) NP as object raises a more general question. Do prepositions ever take more than one object? Nothing in the theory under examination prevents this, but it is not clear that it ever happens. A nice case to look at is the phrase 'from A to B'. Is 'from . . . to . . .' a single complex preposition that takes two objects, or is it a combination of two prepositions, each of which takes a single object? My suggestion that it is the latter explains some interesting phenomena. For example,

x ran from A to B

entails both

x ran from A

and

x ran to B.

The explanation for this entailment cannot be that the former phrase is the conjunction of the latter two, since if Agatha ran from the house and also ran to the barn it does not follow that she ran from the house to the barn. (She might have run to the barn *before* running from the house.) There are a number of ways in which one might try to analyze these phrases so as to get the right connections. Dowty 1979 (213–16)

the best attempt I know of within a conventional framework (including discussion of problems).

A better treatment may be the most natural one in the theory of underlying events. Both 'from A' and 'to B' are taken at face value as verb modifiers and symbolized in the usual way. The sentence 'x ran from A to B' is symbolized as

$(\exists e)[\text{Running}(e) \ \& \ \text{Subj}(e,x) \ \& \ \text{From}(e,A) \ \& \ \text{To}(e,B)]$.

This clearly entails both 'x ran from A' and 'x ran to B', without being entailed in turn by their conjunction. The key is that the 'from . . . to . . .' sentence requires that the very same running was both from A and to B, whereas the conjunction does not require this.

3.3 Conjunctions of Modifiers

In logical form, iterated modifiers of a single verb give rise to conjunctions of predicates of events, each applying to the same underlying event. What about cases of explicit "conjunctions" of modifiers in the English sentence itself? That is, how are we to symbolize a sentence that contains an explicit conjunction of modifiers, as in

Harfield ran into the room, across the floor, and out through the window?

Is this to be treated as having a single underlying event, modified by three modifiers, or as containing three (possibly distinct) underlying events? That is, does the sentence say that there was a running by Harfield that had these three properties: it was into the room, and it was across the floor, and it was out through the window? Or does it say that there was a running into the room, and then a running across the floor, and then a running out through the window?

Little direct evidence in the example bears on this question. We have not discovered enough about the kind of events this theory needs to know much about their persistence through time, and the sentence itself gives little clue. Evidence will have to come from other cases.

We might be able to appeal to our native understanding of a sentence. If we say

Juanita drove to the store and to the university

We probably have in mind one trip consisting of two or more drivings. This suggests that the sentence should have at least one interpretation with a logical form that does not force there to be only one driving.

More direct evidence for this hypothesis arises from other cases. Consider

x ran from A to B.

This is not entailed by (at least one reading of)

x ran from A and to B.

A natural explanation of this lack of entailment is that the former sentence contains one reference to an underlying event, and the latter contains two; the form of the former is

$(\exists e)[\text{Running}(e) \ \& \ \text{Subj}(e,x) \ \& \ \text{From}(e,A) \ \& \ \text{To}(e,B)]$,

and that of the latter is:

$(\exists e)[\text{Running}(e) \ \& \ \text{Subj}(e,x) \ \& \ \text{From}(e,A)] \ \&$

$(\exists e')[\text{Running}(e') \ \& \ \text{Subj}(e',x) \ \& \ \text{To}(e',B)]$.

(This kind of test does not apply to the previous sentence because 'Juanita drove to the store to the university' is not grammatical.)

Another example, discovered by John Wallace (1966), depends on a case like this:

Mary hit the 8-ball into the side pocket and the 9-ball into the corner pocket.

If this were construed as containing a single underlying event, then its logical form would contain these conjuncts:

. . . & $\text{Obj}(e,8\text{-ball}) \ \& \ \text{Into}(e,\text{side pocket}) \ \& \ \text{Obj}(e,9\text{-ball}) \ \& \ \text{Into}(e,\text{corner pocket})$. . .

These conjuncts can be permuted into an equivalent form, which is then the underlying form of

Mary hit the 8-ball into the corner pocket and the 9-ball into the side pocket.

But this sentence is not equivalent to the original, and so the symbolization is incorrect. The solution is to construe the surface English conjunction as indicating conjoined appeals to underlying events, as opposed to conjoined predications of a single underlying event.

I conclude tentatively that explicit surface conjunctions of modifiers (or of fragments of the VP containing modifiers) have readings that permit multiple underlying quantifications over events, as opposed to multiple predications connected to the same underlying quantification.

This leaves open the possibility that surface conjunctions of modifiers are ambiguous constructions having readings that require the

lication of the modifiers to one and the same event. We sometimes interpret sentences as conveying such information, as in

walked quietly and carefully through the room.

s could naturally be taken to say that there was a single walking that was both quiet and careful (and through the room). On the other hand, it is also possible to hold that surface conjunctions of modifiers can have logical forms that contain multiple predications connected by the same underlying quantification over an event, but that the meaning of a sentence in context often implies this extra information. I am tempted by this view, but I am not aware of any solid evidence for or against it.⁷

Alternatives to the Underlying Event Approach

that the underlying event approach correctly captures the logic of modifiers adds to its attractiveness when we survey the known alternatives. Most either yield incorrect inferences, and so are false, or they fail to yield some of the correct ones, and so are incomplete. In almost every alternative account that is correct but incomplete, the underlying event account turns out to be a refinement of it. In this section I survey six alternatives. The “modifiers” I discuss throughout are VP modifiers unless I indicate otherwise.

1.1 Unanalyzed Predicates

The simplest alternative is the practice of logic textbooks, which is to treat each complex of verb-plus-modifiers as a single unanalyzed atomic predicate. For example, we might represent each of the following forms by the predicate on the right:

x stabbed y	Sxy
x stabbed y violently	Vxy
x stabbed y with z	Wxyz
x stabbed y violently with z	Gxyz

This approach is correct but incomplete. Certainly the English forms on the left yield predicates of the sort displayed on the right. Indeed, from the point of view of the underlying event account, the forms on the right are all definable, as follows:

$Sxy = (\exists e)[\text{Stabbing}(e) \ \& \ \text{Subj}(e,x) \ \& \ \text{Obj}(e,y)]$
 $Vxy = (\exists e)[\text{Stabbing}(e) \ \& \ \text{Subj}(e,x) \ \& \ \text{Obj}(e,y) \ \& \ \text{violent}(e)]$

$Wxyz = (\exists e)[\text{Stabbing}(e) \ \& \ \text{Subj}(e,x) \ \& \ \text{Obj}(e,y) \ \& \ \text{with}(e,z)]$
 $Gxyz = (\exists e)[\text{Stabbing}(e) \ \& \ \text{Subj}(e,x) \ \& \ \text{Obj}(e,y) \ \& \ \text{violent}(e) \ \& \ \text{with}(e,z)]$

These definitions all yield predicates of the correct form, and they reveal structure that is hidden in the primitive predicates of (1) through (4). So the underlying event account is a refinement of the standard logic-text practice of representing modified phrases. While not incorrect, that practice leaves out a host of good inferences.

Why cannot the logic-text practice be made more adequate by separating out the modifiers themselves as independent predicates? We might represent

2 x stabbed y violently
by

2' Sxy & Vxy,

where ‘Vxy’ means something like ‘x did something violently to y’, and represent

3 x stabbed y with z
by

3' Sxy & Wxyz,

where now we read ‘Wxyz’ as ‘x did something to y with z’. But this gets the logic wrong; it yields incorrect inferences. For we should now have to represent

4 x stabbed y violently with z
as

4' Sxy & Vxy & Wxyz.

But now (2') and (3') together entail (4'), so this representation tells us incorrectly that if Brutus stabbed Caesar violently and also stabbed him with a knife, then he stabbed him violently with a knife. But this does not follow; Brutus could have stabbed him deftly with a knife and—simultaneously—stabbed him violently with an icepick.

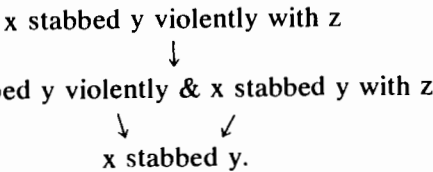
A little tinkering with the various possible uses of predicate logic here should convince the reader that without underlying quantification over something, all the correct inferences will not follow from the assigned logical forms alone unless some incorrect ones are included.

4.4.2 Meaning Postulates

Desired inferences are sometimes accounted for by proposing “meaning postulates.” These are sentences of the formal symbolism that, in conjunction with the structurally simple logical forms assigned to individual sentences, yield the desired inference patterns. For example, we might supplement the simple logical forms suggested for (1) through (4) with these principles:

- A (x)(y)(z)[Gxyz → Wxyz & Vxy]
- B (x)(y)(z)[Wxyz → Sxy]
- C (x)(y)[Vxy → Sxy].

By appealing to various combinations of (A) through (C), we can then produce the desired inferences:



This technique yields correct results in individual cases, but it is not clear whether it can be generalized. We needed (A) through (C) to handle two modifiers and one verb: ‘violently’, ‘with x’, and ‘stab’, but every new modifier or verb would require new meaning postulates linking it with all of the others. It is not even clear that the required number is finite, since the number of combinations of modifiers may not be finite.⁸

There is a further difficulty: the constructions under discussion are productive. If a new adverb of manner were to enter the language, it would enter into the same types of inference as those I have been discussing. This fact needs explanation along with my explanation of the inference patterns involving modifiers already in the language. The use of meaning postulates then needs to be supplemented by some further metaprinciple to address the issue of productivity.

I assume that, if this task were carried out, the resulting theory would yield the same inferences involving modifiers as the underlying event theory, and that both would be equally empirically correct in this domain. The remaining issue would be how to relate these modifiers with other constructions in the language, for example, how to connect ‘dance slowly’ with ‘a slow dancing’. My suspicion is that any correct extension of the use of meaning postulates would be parasitic on the underlying event account.

4.4.3 Many-Place Predicates

Another possible use of predicate logic to handle modifiers is worthy of comment. It has been suggested that the basic forms of verbs should contribute many-placed predicates to their logical forms, and that apparently fewer-placed cases should be realized by existentially quantifying the “unused” places.⁹ To take an oversimplified example, ‘stab’ would contribute a four-place predicate

Pxyzw,
which relates x,y,z, and w just in case x stabbed y in z with w. We then represent ‘Brutus stabbed Caesar in the back with the knife’ by P(Brutus, Caesar, Caesar’s back, the knife).

Then, if we want to say, “Brutus stabbed Caesar in the back,” we paraphrase this by ‘Brutus stabbed Caesar in the back *with something*’:
($\exists w$)P(Brutus, Caesar, Caesar’s back, w).

Likewise, the apparently simple ‘Brutus stabbed Caesar’ would be
($\exists z$)($\exists w$)P(Brutus, Caesar, z, w).

There are three problems with this approach, two of which may be solvable. A potentially solvable problem is determining the actual number of predicate places for the given verb. (This is the so-called “variable polyadicity” problem.)¹⁰ Since we need to be able to say Brutus stabbed Caesar in the back through his toga with the knife at noon on the bridge under the arch, ‘stab’ will have to contribute at least an eight-place predicate, and probably many more places are needed. In principle, we may not be able to determine the correct number of places for each verb. But neither is it clear that this is impossible.¹¹

A second problem that might be solvable is that the proposal focuses entirely on prepositions, ignoring the question of how to handle adverbs. A possible solution is to construe all adverbs as disguised prepositional phrases, with their object places quantified. Here are some paraphrases that might be useful:

- violently = in a violent manner
- quickly = in a quick manner
- rudely = in a rude manner

Everything I propose throughout this book is neutral with respect to whether adverbs are reducible to prepositional phrases in this way. I

nothing against quantifying over "manners," but I do not see that either solves or complicates any of the problems I discuss. A problem I do not see as solvable is that some cases of verbal modification are genuinely optional, and in these cases it is incorrect to quantify over an extra place. For example, it is possible to write a note to someone, but it is also possible to write a note that is not sent to anyone at all. Likewise, it is possible to stab someone through his toga, but also possible to stab him without doing so through anything. It is possible to threaten someone *with* a weapon, and also possible to threaten her simpliciter.¹² This third proposal would require every note be written to someone, that every stabbing be through something, and so on. It might be advantageous, for all we have seen so far, to associate with verbs many-place predicates, containing variables to stand for the objects of prepositions that *must* be present, either explicitly or "understood,"¹³ but this will not work as a general solution to the problem of the logic of modifiers.

Operators

Some modifiers modify whole sentences. Examples are 'necessarily', 'possibly', 'probably', and 'in a dream'. In the tradition of philosophical semantics these have generally been treated as *propositional operators*, that is, they stand for operators (or functions) that map propositions to propositions. For example, 'necessarily' stands for a function that maps the proposition that giraffes are mammals to the proposition that necessarily giraffes are mammals. Although the philosophical analysis of notions such as necessity are replete with controversy, their grammatical status as operators is well entrenched. I do not challenge the received opinion on such modifiers, but they operate on formulas of English, including molecular ones, whereas my enterprise investigates modifiers that work at the subatomic level.

The success of the operator analysis of sentence modifiers of English has led some researchers to extend it to other modifiers, treating modifiers such as 'slowly' as operators too.¹⁴ The most popular account treats 'slowly' as standing for an operator that maps properties of individuals to properties of individuals.¹⁵ On this account, the logical form associated with 'Agatha ran slowly' is $\text{slowly}(\text{ran})(\text{Agatha})$.

'slowly' thereby turns out to have the same syntactic role as 'with z', that is, it is a one-place predicate.

Using this approach, we must treat operators as acting on the properties expressed by verbs, not on their extensions.¹⁶ If everybody drove if and only if he or she smoked, then the extension of 'x drives' would be the same as 'x smokes', but it would not follow from this that everyone drives slowly if and only if he or she smokes slowly. The solution is to suppose that 'slowly' operates on the properties of driving and smoking, which are different properties no matter how they are manifested in the actual world. This is on a par with the treatment of sentence operators, which take propositions, not truth-values, as their arguments.

The operator account of modifiers appears to say nothing incorrect, but it is not complete. Part of the reason is that this account was intended, historically, to be a special case of a completely general account that includes sentence modifiers as well as verb modifiers. As a general account, it fails to sanction *any* of the inferences under discussion. For example, since the following inference fails

Allegedly, Mary ran \therefore Mary ran

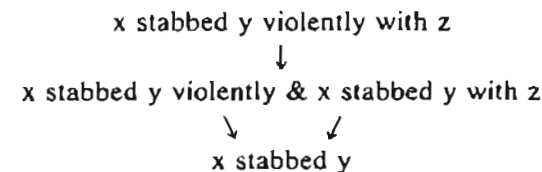
and since verb operators mimic sentence operators, this inference also fails:

Mary ran slowly \therefore Mary ran.

The commonest remedy for this recognized inadequacy has been to classify modifiers with respect to this trait. Modifiers such as 'slowly' are called "standard" modifiers because they satisfy the scheme

$[\text{OPERATOR}(\text{VERB})](x) \therefore \text{VERB}(x)$.

However, this classification remains inadequate for two reasons. The first problem is that the account is still incomplete. Consider again our sample diagram of inferences:



On the operator approach, whenever there are two or more operators in a given sentence, one must take wider scope than the other. In the top sentence in the diagram, either 'violently' or 'with z' must take wider scope. Let us suppose that it is the latter. Then the logical form of the top sentence is

$[\text{with } z(\text{violently}(\text{stabbed}(y)))](x)$.

By the special rule for "standard" modifiers, this easily entails the logical form of 'x stabbed y violently'

$\text{violently}(\text{stabbed}(y))(x)$.

But it does *not* entail the logical form of 'x stabbed y with z':

$\text{with}(z, \text{stabbed}(y))(x)$.

Conversely, if 'violently' is given wider scope, then the inference to 'x stabbed y violently' fails. So an important part of the logic of modifiers is not captured by this proposal.

The second difficulty with the operator account is that there is no evidence that modifiers have scope. According to the operator account, the first sentence

x stabbed y violently with z

is *ambiguous*; it can be read with either modifier taking scope over the other. But no such ambiguity appears in the English sentence.¹⁷ If the operator account is to be viable, then it requires supplementing to neutralize the ambiguity inherent in the use of operators.

If the underlying event account is correct, it offers a natural way to try to do this. The underlying event account may be seen as a refinement of the operator account. Whether this is possible is a somewhat complicated technical issue.

On the underlying event account of verb-phrase modifiers, the correct logical form of 'x stabbed y violently' is given by

$(\exists e)[\text{Stabbing}(e) \ \& \ \text{Subj}(e, x) \ \& \ \text{Obj}(e, y) \ \& \ \text{Violent}(e)]$.

We can conceive of this form having been produced by inserting 'x' and 'y' into the argument places of a two-place predicate

$\lambda v \lambda w (\exists e)[\text{Stabbing}(e) \ \& \ \text{Subj}(e, v) \ \& \ \text{Obj}(e, w) \ \& \ \text{Violent}(e)]$.

(This can be read as "being a v and a w such that v stabbed w violently.")

We can think of this two-place predicate as having been produced by some operation from another two-place predicate, the other being

$\lambda v \lambda w (\exists e)[\text{Stabbing}(e) \ \& \ \text{Subj}(e, v) \ \& \ \text{Obj}(e, w)]$.

("being a v and a w such that v stabbed w.")

This last "input" predicate stands for the type of relation that, according to the operator account, the modifier 'violently' is supposed to operate on, and the "output" predicate given above stands for the type of relation that is supposed to be produced by applying the operator

to the verb. It is natural to suppose, then, that there is a function mapping inputs of this sort to outputs of this sort, and that this function is the denotation of the modifier. Then the underlying event account provides an analysis of the operator. The missing inference is supplied by the additional details of the underlying event account. For the same reason, the scope distinctions are neutralized. The underlying event account which is built into the meaning of the operators shows the alternative scope readings to be logically equivalent.

The technical issue is whether it is possible to analyze operators in this way. The operator account requires that modifiers stand for functions. But it is not at all clear that there is a *function* mapping the "inputs" to the "outputs" in every case, as we imagined above. If there is no such function, then the underlying event account is not consistent with the operator account, and we must choose between them on their merits.

Whether there are functions that can serve as the denotata of operators that yield the same results as the underlying event approach depends on the theory of meaning that is presupposed and on additional assumptions about the available choice of verb meanings. For example, if meanings are taken to be intensions, as these are normally understood within possible worlds theory, and if no restrictions are placed on the range of possible verb meanings, then there are possible intensions for verbs and modifiers such that in some cases no function works as I described. Suppose two quite different kinds of event, say stabbings and kickings, are always performed simultaneously in every possible world. Suppose, however, that some stabbings are violent when the contemporaneous kickings are not. Then the property of being a v and a w such that v stabs w would be the very same property as the property of being a v and a w such that v kicks w. And, since 'violently' stands for a function, it would have to map both these properties to the same property (since they are not two properties, but only one). And this would require that anyone who stabs someone violently also kicks that person violently, which should not follow.

It is not true of course that kickings and stabbings coincide in all possible worlds, and a genuine example is hard to come by. It would require two verbs that are necessarily equivalent but that diverge when modified, and I am unaware of any examples of this in natural language. A possible example is the pair 'be bought' and 'be sold', which might be necessarily equivalent even though 'be bought with a credit

is not synonymous with 'be sold with a credit card'. Such examples might cause trouble for certain versions of the operator approach, but not for others.

summary, the operator approach may or may not be consistent with the underlying event approach. In its traditional formulation it is in need of supplementation. It is unclear, for technical reasons, whether the two approaches can be brought into conformity with one another.¹⁸

generally ignore the operator account of verb-phrase modifiers because it does not contribute to the issues that remain to be discussed. Modifiers give no hint of the analysis of perceptual idioms, nor of the relationships between implicit and explicit reference to events, nor of the use in analyzing causative constructions. The underlying event account may possibly be phrased in terms of the operator framework, but this framework does not provide a *better* approach than the underlying event approach.

Iterations of Modifiers

Iterations of modifiers provide a crucial test for theories of their semantics. The unsupplemented operator account does not address this issue. Other approaches are equivalently incomplete. For example, McConnell-Ginet's (1982) analysis is illustrative.¹⁹

If *V* is a verb and *A* is an adverb then the meaning of *V*+*A* is obtained as follows:

Let *R* be the relation expressed by *V*. Then there is a unique augmentation of *R* (determined by *A*) to a relation with one more place than *R*, and satisfying the constraint that *R*^{*A*}(*x*₁, . . . , *x*_{*n*+1}) entails *R*(*x*₁, . . . , *x*_{*n*}). (This is the only constraint that is placed on the augmentation of *R* relative to *A*.) Further, there is a one-place property *Q*^{*A*} associated with *A*. Then the translation of [*V*+*A*](*x*₁, . . . , *x*_{*n*}) is given by

$$\exists r_1 \dots \exists r_n [(Q^A(x_{n+1}) \ \& \ R^A(x_1, \dots, x_{n+1}))].$$

For example, using intuitive notation, the analysis of 'x runs quickly' is

There is a [rate] *r* such that *r* is quick and *x* runs-at *r* (where 'runs-at' is the two-place relation that augments 'runs' with respect to 'quickly', and 'quick' is the one-place property associated with 'quickly').

This is an intuitively natural proposal for analyzing "quickly." To run quickly is to run at a quick rate.²⁰ The adverb is responsible both for augmenting running to running-at-a-given-rate, and also for restricting

the rates in question to the quick ones. (McConnell-Ginet proposes treating prepositional phrases in the same manner as adverbs.)

The iterative challenge comes with simple sentences containing more than one modifier. Here it is natural to apply the analysis twice, once per modifier. When you reiterate the modification you reiterate the analysis, so that the analysis of 'x V's A-ly B-ly' comes out as

$$(\exists z)[Q^B(z) \ \& \ W(x,z)]$$

where *W* is the augmentation of the analysis of "V-ing A-ly" with respect to *B*; that is, it augments

$$\lambda x(\exists y)[Q^A(y) \ \& \ R^V(x,y)]$$

with respect to *B*.

This analysis of the two-modifier case has two drawbacks, both of which it shares with the "operator" approach. First, it is incomplete: it fails to sanction the inference from 'x V's A-ly B-ly' to 'x V's B-ly'. Second, it creates scope distinctions, assigning substantively different meanings to 'x V's A-ly B-ly' and to 'x V's B-ly A-ly'. But 'Brutus stabbed Caesar violently with a knife' does not differ substantively from 'Brutus stabbed Caesar with a knife violently'. The account needs supplementation to produce the missing inference and to neutralize the scope distinctions.

We could try to avoid these problems by using a "conjunctive" approach. Suppose that 'x V's A-ly B-ly' has as its analysis 'x V's A-ly & x V's B-ly', where this is construed as

$$(\exists z)[Q^A(z) \ \& \ R^A(x,z)] \ \& \ (\exists z)[Q^B(z) \ \& \ R^A(x,z)].$$

This avoids the problem cited for the first proposal, but now it is incorrect, because it makes

Brutus stabbed Caesar violently and Brutus stabbed Caesar with a knife

entail

Brutus stabbed Caesar violently with a knife.

There are other ways to try to extend the analysis to reiterated modification, but I will not pursue them here.²¹

In summary, along with the operator approach in general, I find nothing incorrect in McConnell-Ginet's proposals, but I do not see either of them as solving the problems raised.

4.4.6 Reichenbach's Theories

Hans Reichenbach (1947, 301-09) proposes two accounts of the logical forms of sentences containing modifiers. Donald Davidson developed one of these accounts into something like the present version of the underlying events account. Davidson 1967 contains a full discussion of why Reichenbach's original account needs to be modified in various ways and gives the needed improvements. I want to comment on Reichenbach's other account, which Davidson does not discuss.

The gist of the account is that ordinary sentences of English contain underlying quantifications over "specific properties." For example, the logical form of

x moves

is, roughly,

x has some specific motion-property.

In symbols,

$(\exists f)[f(x) \ \& \ M(f)]$,

where ' $M(f)$ ' is read as 'f is a motion-property'. Reichenbach uses this proposal to analyze verb modifiers. The statement

x moves slowly

is, roughly,

x has some specific motion-property that is slow.

In symbols,

$(\exists f)[f(x) \ \& \ M(f) \ \& \ S(f)]$,

where ' $S(f)$ ' means 'f is slow'. Although Reichenbach does not discuss reiterated modification, the theory can clearly be extended to such cases by treating the additional modifiers as additional conjuncts within the scope of the quantifier over properties.

This theory may be evaluated in terms of its formal adequacy and in terms of its substance. On merely formal grounds, the resulting theory is *formally isomorphic* to the underlying event account. Suppose that the quantifier ' $(\exists f)$ ' is construed as ranging over events, instead of over specific properties, and suppose that ' $M(f)$ ' means that f is an *event of moving* instead of a *property of moving*. Finally, suppose that the clause ' $f(x)$ ' is shorthand for 'x is the subject of f'. The resulting reinterpretation yields the underlying event analysis. Since the forms of the two theories agree, they must have the same

formal consequences. And this entails that they both yield the same "logic of modifiers."²²

However, on grounds of substance, I see two objections to Reichenbach's account. One, not conclusive, suggests that something is wrong somewhere. His reading of ' $S(f)$ ' as 'f is slow' cannot be correct, since f is supposed to be a property, and properties are not fast or slow. The things that are properly said to be slow are either people or motions (or "rates"). The slow-person reading is clearly irrelevant here, and the motion reading forces us to interpret the 'f' as ranging over motions—which are events, not properties. Reichenbach's reading of ' $S(f)$ ' thus forces us to interpret his theory as the *same* as the underlying event account, not as an alternative to it.

The more serious objection to Reichenbach's account is that it does not connect with other data of natural language. In contrast, the underlying event theory accounts for other linguistic phenomena, such as perception sentences ('Mary saw x move') and for facts about explicit reference to events ('the singing of the anthem'). If we were to construe underlying events as "specific" properties, we should undercut these additional accounts.

Even this objection is not conclusive. Reichenbach himself seemed to think that the underlying event account was compatible with the underlying specific property account. He explicitly presents the underlying event account as better than the underlying specific property account (1947, 307), but he clearly thought of both as correct. I speculate that this is because the underlying specific property account mirrors the underlying event account at a higher level. Such mirroring is now familiar to us from many applications of higher-order logic; in any such type-theoretic system it is possible to mirror structures of lower type by structures of higher type. And Reichenbach's intent seemed to be to mirror structures involving things of lowest type (events) by things of the next higher type (specific properties). Each event can be mirrored by the "conjunction" of all of that event's properties. Each such "conjunction" is called a specific property, and then individual events can be paired off with specific properties. If this is Reichenbach's intent, then the underlying specific property account is parasitic on the underlying event account, and so its correctness as an "alternative" to the underlying event account supports, rather than casts doubt on, the correctness of the underlying event account.²³

4.5 Distinguishing Kinds of Modifiers

4.5.1 Classes of Modifiers

Partially on the basis of Jackendoff 1972 and Bellert 1977, I suggest that modifiers may fruitfully be classified into five main categories:

- I. Speech-Act Modifiers
- II. Sentence Modifiers
- III. Subject-Oriented Modifiers
- IV. VP Modifiers
- V. Other

The VP modifiers turn out to represent predicates of events according to the theory of underlying events. I shall first characterize the categories. Then I shall turn to the question of how one tells which modifiers fall into which categories.

Speech-Act Modifiers may be subcategorized as²⁴

Evaluative: 'fortunately', 'happily', 'surprisingly', 'thanks to God',

Epistemic Modal: 'perhaps', 'probably', 'certainly', . . .

Conjunctive: 'therefore', 'however', 'finally', 'in conclusion', . . .

Pragmatic: 'frankly', 'sincerely', 'honestly', 'in my opinion', . . .

Each of these modifiers has the effect of producing a sentence that is used to make two assertions: a main assertion of a fact that is determined by the rest of the sentence, excluding the modifier, and a secondary assertion stating that that fact has a certain property. For example, the sentence

Fortunately, Mary arrived on time.

is suited for making the two assertions:

Main assertion Mary arrived on time.

Secondary The fact that Mary arrived on time is fortunate.

In many cases these modifiers carry hidden parameters that need to be supplied from the speech context. For 'fortunately', we need to determine "fortunately for whom," and for 'therefore', we need to determine "follows from what."

The dual assertion nature of these constructions lets them display a kind of factivity. 'Fortunately, Mary arrived on time' seems to entail that Mary arrived on time; and 'Therefore, S' seems to entail that S.²⁵ (Even 'perhaps' is factive in this sense, though its use indicates that the speaker takes very little responsibility for the truth of the main

assertion.) Likewise, they display a kind of opacity. From 'Fortunately, Mary arrived' it does not follow that it was fortunate that the Queen arrived if Mary is the queen. Further, the speech-act orientation of these modifiers prohibits their being within the scopes of other adverbs (we do not have 'Quietly, fortunately Mary sang') or of quantificational NPs ('Fortunately, more than five people showed up' cannot mean 'For each of more than five persons it was fortunate that he/she showed up'). They also cannot take scope inside of negations: 'Fortunately, Mary did not come' cannot mean 'It is false that fortunately, Mary came'.

Speech-act modifiers form a fascinating area of study. For want of space, I shall not discuss them. The point of including them in this initial survey is to distinguish them from VP modifiers, which form my main topic.

Sentence Modifiers include the alethic modalities, that is, the alethic readings of 'possibly' and 'necessarily' (though not the epistemic readings, which are Speech-act modifiers), as well as certain prepositional phrases, such as 'according to Agatha' and 'in the story'.²⁶ Unlike Speech-act Modifiers, they do not produce dual assertions. They can take scope inside other modifiers ('Possibly, every deity is necessarily good') and with respect to quantificational NPs ('Everybody is possibly omnipotent') and negation ('God isn't necessarily good'). They are not typically factive, though a particular lexical meaning (for example, of 'necessarily') may override this. They typically produce opacity, though again a particular lexical meaning (for example, of 'actually') may override this too.

The semantics of Sentence modifiers is familiar from work in philosophical logic: they stand for properties of propositions. 'Necessarily, God is good' is true if and only if the proposition that God is good has the property of being necessary. In my formal symbolism, I precede a sentence with a caret '^' to form a name of the proposition that is expressed by that sentence. So if G is the logical form associated with the sentence 'God is good', the logical form of 'Necessarily, God is good' is 'N(G)', where 'N' is a predicate of propositions. The details of the semantics of such Sentence modifiers are matters of some complexity and subtlety, as the literature well attests. However, none of this complexity or subtlety bears in any special way on the theory of underlying events or on any other aspect of "subatomic semantics," since Sentence modifiers operate on structures that are already full-

fledged formulas of English. I shall not comment further on these adverbs, except when I must distinguish them from VP adverbs.

Subject-Oriented Modifiers include adverbs such as 'willingly', 'intentionally', 'deliberately', and certain readings of 'rudely', 'wisely', 'carefully', such as the natural readings of 'Wisely, Mary invested in stocks', or 'Rudely, she spoke in a language that her mother-in-law did not understand'.²⁷ These modifiers are all factive, and they create opacity, though never in the subject position. They can take scope over quantificational NPs, as in 'Rudely, she insulted everyone'.

Except for their special sensitivity to the subject position, these modifiers resemble Sentence modifiers, and probably similar accounts can be given of each. The common suggestion is that they stand for relations between things and propositions, and that the form, for example, of 'Rudely, x insulted y' is 'Rude(x, "[x insults y])', i.e., "It was rude of x that x insulted y."²⁸ As with earlier classes, Subject-oriented adverbs are not the main objects of study in this book, and I ignore them except insofar as I need to contrast them with VP modifiers.

VP Modifiers include such locutions as 'gently', 'quietly', 'smoothly', 'in the back', 'with a knife', and certain readings of 'rudely', 'wisely', 'carefully', namely, the natural readings occurring in 'Mary spoke rudely', 'Mary invested wisely', 'She ran her fingers carefully along the edge'. These modifiers are all factive, and they do not create opacity. They stand for properties of underlying events or states, according to the theory I am investigating. I have already described their semantics, and I shall continue to examine it in this chapter, and at various points throughout the book.

Other modifiers include such words as 'merely', 'just', 'only'. They have various interesting functions in sentences, but I shall ignore them.

Temporal Modifiers cut across the categories outlined above—the general category that I call "Temporal". It includes phrases such as 'soon', 'at midnight', 'during the afternoon', 'from 2:00 to 3:00', 'usually', 'never', and 'twice'. I discuss these modifiers in chapter 11.

4.5.2 Tests for Classifying Modifiers

A certain amount of literature is devoted to the question of how modifiers may be classified into categories on the basis of their observable semantic effects on the sentences in which they occur.²⁹ This is a difficult enterprise to carry out. A modifier may not manifest

behavior typical of its class because of the special character of its meaning. For example, Sentence modifiers are typically not factive, yet 'Necessarily, S' entails 'S' because of the special meaning of 'necessarily'. It is also tricky to classify modifiers when they may be homonymous. It is especially difficult to tell, in operational terms, whether the difference in meaning between

Happily, the war ended.

and

The war ended happily.

is due to an ambiguity in 'happily' or to its occupying different positions in the two sentences, or whether the differences between

The dolphin swam swiftly

and

The baby with the innertube swam swiftly

are due to homonymy in 'swiftly', or to a contextual shift in the relevant standards of swiftness that are appropriate, or possibly to its taking scope over the subject of the sentence. It is especially difficult to formulate *theory-neutral* versions of such tests.

I shall not try to develop such operational tests. Perhaps the best that can be done is to articulate a theory that covers the various kinds of modifiers that are posited and then to view a proposed classification of each modifier in each construction as an hypothesis that is subject to test, given the rest of the theory. Perhaps a fully developed theory will, in hindsight, yield some operational tests.

Instead, I offer some rules of thumb that may be helpful in classifying modifiers into the categories given above.

Test #1 Sentence Position Jackendoff 1972 distinguishes three positions in which an adverb may appear in a simple sentence: in initial position (optionally with a comma), in Aux position—that is, between the subject and the main verb—and inside the VP. The positions are illustrated in

Initial	Aux	VP-Internal
↓	↓	↓
Fortunately	Mary willingly	ran swiftly to the store.

The following rules of thumb help to classify adverbs in terms of their occurrences.

. Any adverb that can occur only in Aux position is in the category "Other"; examples are 'merely', 'nearly' and 'only'.³⁰

. Any adverb that occurs in Initial or Aux position but not in VP-internal position is a Speech-act modifier, or a Sentence modifier, or Subject-oriented modifier. Examples: 'fortunately', 'possibly'.

. Any adverb that occurs in Aux or VP-internal position but not in initial position is a VP modifier. Example: 'easily'.

. Any adverb that occurs in all three positions, but is ambiguous in Aux position, is homonymous between a VP adverb and a Speech-act modifier or Sentence modifier or Subject-oriented adverb.³¹

This homonymy is quite important. The classic illustration is 'happily', which occurs as a Speech-act adverb in initial position, as a VP adverb in VP-internal position, and is ambiguous between these two readings in Aux position. Other examples are 'carefully', 'wisely', 'rudely'.³²

Test #2 Factivity This is simple if homonymy is not at issue: all modifiers except Sentence modifiers are factive.

Test #3 Opacity Speech-act modifiers, Sentence modifiers, and Subject-oriented modifiers are all capable of producing opacity, unless this is ruled out by their special lexical meaning.

Test #4 Presupposition Under Negation If the modifier occurs with a simple negated sentence, then

. If the modifier is a Speech-act modifier, the sentence is unambiguous, and the "main assertion" is a negation. E.g., 'Fortunately, Mary did not show up' is unambiguous; the main assertion is that Mary did not show up, and this is what is said to be fortunate.

. If the modifier is a Sentence modifier then it can take scope either inside or outside of negation. Although word order or choice of determiner ('everyone' versus 'each one') often helps disambiguate, a sentence with a Sentence modifier can be ambiguous because two different orderings of the scopes of the modifier and the negation are possible. An example is 'I didn't fly in my dream', or 'That isn't required according to the church'.³³

. If the modifier is Subject-oriented, then the sentence is unambiguous; the negation goes with the "content" sentence, not with the

modifier. 'Rudely, Mary didn't answer' can mean only "It was rude of Mary not to answer," not "For Mary to answer was not rude."

4. If the modifier is a VP modifier, then the negation is of the whole sentence, including the modifier; an example is the reading of 'Agatha didn't run quickly' to deny that Agatha ran quickly, which could felicitously be followed by 'She didn't run at all'.

Presupposition and Focus A factor that interacts with the negation tests has to do with what is called "focus" and its effect on presupposition. To take an example without negation, if the sentence 'Agatha and Fred arrived late' is pronounced with emphasis on 'and Fred', a natural account of this speech act is to say that the speaker presupposes that Agatha arrived late, and asserts that Fred did too:

Asserted Agatha and Fred arrived late

Presupposed Agatha arrived late

It is a subtle matter to formulate an adequate account of this phenomenon, but one cannot deny its reality, and it must be taken into account when testing modifiers for status. For example, for VP modifiers this phenomenon produces an additional reading when coupled with negation: in addition to the reading of 'Agatha didn't run quickly', which merely denies that she ran quickly, there is another reading that presupposes that she did run and asserts that she did not do so quickly. This gives the appearance of the negation's somehow applying to the 'quickly' by itself, but this is no more accurate than to suppose that the negation applies to 'and Fred' in 'Agatha and Fred didn't run'.³⁴ This phenomenon also occurs with Sentence modifiers and with Subject-oriented modifiers when they occur in the VP (or in Aux position following the negation); witness 'Mary didn't *willingly* run' (which presupposes that she ran) and 'God isn't *necessarily* good' (which presupposes that God is good). Phrases other than negation can be "limited" in this way to a single part of the sentence. In 'She allegedly stabbed him *with a knife*', the allegation is in some sense limited to *with a knife*. This works the same as above:

Asserted Alleged by z: x stabs y with knife

Presupposed x stabs y

(where z is supplied from context). Thereby, no special logical form is required for 'allegedly' in order to capture its "limitation" to only part of the sentence.

5.1 Thematic Roles in Grammatical Theory

In contemporary syntactic theory it is common to relate simple sentences to structures consisting of a verb and a tense plus some NPs marked for “deep cases” (Fillmore’s term) or “thematic roles” (the contemporary term). These thematic roles can affect the surface position of the NPs (as in Modern English), their inflections (in inflected languages), and the choice of prepositions that precede them. All these are surface clues to the semantically significant thematic roles of the NPs. In the version of Fillmore 1968, a typical thematic structure from which we might generate a sentence has this pattern:

Tense	Verb	Role: Agent	Role: Theme	Role: Instrument
X	V	NP ₁	NP ₂	NP ₃

For example, one might begin with this structure:

Tense	Verb	Agent	Theme	Instrument
PAST	stab	Brutus	Caesar	the knife

This would then underlie either of the following two “sentences”:

Agent		Theme		Instrument
[Brutus]	[stabbed]	[Caesar]		[with the knife]
Theme		Agent		Instrument
[Caesar]	[was stabbed]	[by Brutus]		[with the knife]

In the first (active) sentence the Agent is identified by being in subject position, the Theme is identified by being in direct object position, and the Instrument is “marked” by the preposition ‘with’. These are the surface clues that let us figure out the thematic roles of the NPs in the sentence, given the lexical meaning of ‘stab’. (Other verbs might require a different set of correlations between surface clues and thematic roles, and other languages would use a different system of clues to identify the roles. For example, in Old English, word order has little significance; inflections on the nouns and their modifiers provide the clues.) In the second sentence the passive is indicated by the verb’s being marked with its passive form; the subject now indicates the Theme, and the Agent is marked with the preposition ‘by’.

The general pattern correlating surface clues and thematic roles is this. Lexical information about the verb determines which thematic roles it may combine with. Then general information about the language, supplemented by particular information about the verb in question, determines which sentences may be formed using this verb plus thematic roles. English, in particular, is subject to some of the following principles (in which “double-object” verbs are ignored for simplicity).

Assumptions Not Referring to Thematic Roles:

- 1. A past or present tense verb by itself indicates an “active” sentence; a verb preceded by the copula and in the past participle form indicates a “passive” sentence.
- 2. Each simple sentence must have a subject. (In English, the subject is an NP that precedes the verb.)
- 3. Some sentences have direct objects. (In Modern English these are NPs that immediately follow the verb.)

Assumptions Involving Thematic Roles:

- 4. In an active sentence, if an Agent is present it must be the subject; in a passive sentence, if an Agent is present it is marked with ‘by’.
- 5. If a Theme is present with an Agent, the Theme must be the direct object in an active sentence and the subject in a passive sentence.
- 6. If an Instrument is present, it is marked with ‘with’ (unless it is the subject, in which case it is unmarked).

Using the structure indicated above, if we wish to make an active sentence, then the sentence must begin with a subject and a verb, and, by one, two, and four they must be

Agent	Verb
Brutus	stab

Then, by five and three, the sentence may continue:

Agent	Verb	Theme
Brutus	stab	Caesar.

Finally, by six, the Instrument appears with 'with'; since all earlier positions are occupied, it goes at the end:

Agent	Verb	Theme	Instrument
Brutus	stab	Caesar	with the knife.

The assumptions need not be "applied" in any given order. Any structure that satisfies all of them is supposed to yield an acceptable English sentence.

If, instead, we wish to make a passive sentence, rules one, two, and five require the sentence to start with

Theme	Verb
Caesar	was stabbed.

Then, by four, the sentence may continue,

Theme	Verb	Agent
Caesar	was stabbed	by Brutus

And then 'with the knife' again appears on the end, by six:

Theme	Verb	Agent	Instrument
Caesar	was stabbed	by Brutus	with the knife.

In the last example, the Agent need not be placed before the Instrument; if we do things in reverse order we get instead

Theme	Verb	Instrument	Agent
Caesar	was stabbed	with the knife	by Brutus.

If we start with different underlying structures, other sentences are generated. For example, beginning with

Tense	Verb	Agent	Theme
PAST	stab	Brutus	Caesar

and using the same assumptions, we produce the simpler sentences

Brutus stabbed Caesar

Caesar was stabbed by Brutus.

Beginning with the still simpler structure

Tense	Verb	Theme
PAST	stab	Caesar

we get

Caesar was stabbed.¹

The assumptions also permit a structure that may be impossible for 'stab', though possible for other verbs. If we begin with

Tense	Verb	Instr.	Theme
PAST	stab	knife	Caesar,

then the assumptions allow the sentence

Instrument	Verb	Theme
The knife	stabbed	Caesar,

where 'the knife' is missing its 'with' because it appears as subject. This sentence may be unacceptable in English (this is arguable); if this is a special fact about 'stab' since various other verbs permit this structure. For example, we have

The hammer hit the nail,

which should follow from 'John hit the nail with the hammer'. If 'the hammer' is the Instrument in both sentences, then the two sentences have related underlying thematic structures:

John hit the hammer with the nail:

Tense	Verb	Agent	Instrument	Theme
PAST	hit	John	the hammer	the nail

The hammer hit the nail:

Tense	Verb	Instrument	Theme
PAST	hit	the hammer	the nail

The latter sentence is like the former, except that it is missing its Agent.

5.2 Thematic Roles with Underlying Events

The theory described above fits nicely into the grammatical framework of Panini that I alluded to in chapter 1. This framework provides three levels: the semantic level, containing an event and a number of objects related to the event by distinctive relations; a "surface structure", containing a verb and a number of NPs, all with a specified order and/or marked with inflections or prepositions, depending on the language in question; and the actual sentence itself, in phonological form or in written form.

The theory described in the previous section can implement this account, provided that we attribute *semantic* significance to the classification of NPs in terms of their roles. As it stands, the theory merely describes how sentences are related to certain structures that contain NPs classified by thematic role. What is missing is how all of this is correlated with the semantic realm—how the roles relate to the world. The version of the theory that I shall explore correlates the thematic roles in a one-one fashion with distinctive relations that hold between objects and events at the semantic level.²

This is in fact a description of the theory of underlying events, with one addition: that the 'Subj' and 'Obj' relational symbols are now regarded as placeholders for more specific "deep" thematic relations such as Agent and Theme. The logical form of the sentence

Brutus stabs Caesar,

which was formerly

$(\exists e)[\text{Stabbing}(e) \ \& \ \text{Cul}(e) \ \& \ \text{Subj}(e,B) \ \& \ \text{Obj}(e,C)]$

is now replaced by

$(\exists e)[\text{Stabbing}(e) \ \& \ \text{Cul}(e) \ \& \ \text{Agent}(e,B) \ \& \ \text{Theme}(e,C)].$

The old 'Subj' relation is now seen as short for 'whatever relation ends up being relevant to the surface subject of the sentence' (in this case, Agent), and similarly for the 'Obj' relation.

The precise ways in which surface syntactical forms are related to thematic relations in logical forms is described in detail in chapter 13. The more important issue has to do with the principles on which I base that description. The main questions of principle to be faced are: (1) what thematic roles are there? and, (2) how do we tell which NPs have which thematic roles in a given case?

In answering the first question, I shall not be concerned with possible relations to events that show up at the surface only as prepositional phrases. For example, the prepositional phrase 'through x' will appear in a great many sentences, and correlated with it in logical form will be the relational formula 'Through(e,x)'. I shall not count this as a "thematic role". Since the same word 'through' is used in both the surface form and logical form, I shall not be concerned with discovering *which* relation is at play. This oversimplifies a major issue since such questions arise whenever a preposition is ambiguous. And most prepositions appear to be highly ambiguous.³ Rather than focusing on the ambiguity of prepositions, which is worth a book of its own, I address only the issue of which semantic relations between events and things are sometimes indicated by a variable for the thing that occupies the position of subject, direct object, or indirect object.⁴

Which thematic roles of this sort are there? There is certainly no agreement in the literature on this issue, and so any answer I give will be idiosyncratic. Sections 5.2 through 5.6 describe a particular version of the theory of thematic roles. My discussion is neutral among various frameworks for syntactic theory; none of my proposals require the thematic roles to play a significant part in the purely syntactic principles of sentence formation (assuming that there are such principles). Section 5.7 discusses the feasibility of dispensing with thematic roles within the theory of underlying events.

5.3 The Basic Account

A simple version of the theory of thematic roles assumes that six such roles can appear in English unmarked by prepositions:

Role	Typical Position in Active Sentence
Agent	Subject
Theme	Direct Object; subject of 'is'
Goal	Indirect object, or with 'to'

Benefactive	Indirect object, or with 'for'
Instrument (=Performer)	Object of 'with'; subject
Experiencer	Subject

Each of these roles relates an event (or a state) and a thing. No event stands in one of these relations to more than one thing; thus, each event possesses at most one Agent, at most one Experiencer, and so on.⁵

Most of the names chosen here for thematic roles are awkward at best. By their very nature, the roles combine with a wide variety of verbs, and any English word chosen to name the role will be odd in some cases. That apology made, I turn to explaining how to identify the roles in general, relying heavily on paradigms.

Use of the Agent relation in a sentence indicates agency on the part of the thing picked out. It indicates not only that the thing in question is a doer but also that it is responsible for what is done. This relation may also be used in nonhuman cases of agency, as when we say 'GM is now offering rebates on its new models'. (A popular test for the Agent role in the linguistic literature is whether it makes sense to precede the NP in question with 'persuade'. For example, we can say felicitously "We persuaded GM to offer rebates on its new models.")

In an active sentence of English, if there is an Agent NP in the sentence, then it must be the subject. The Agent relation is used in subject position in these sentences:

Brutus stabbed Caesar.
 Mary walked to school.
 Sam sliced the salami.
 Mary looked at the buffalo.

The use of Theme ("Patient") is often called the "leftover case," since so little can be said about it in general. The direct object of a (noncausative) transitive verb in English is always a Theme,⁶ and the subject of a copula plus an adjective or prepositional phrase is almost always a Theme. Examples are the italicized phrases in

Brutus stabbed *Caesar*.
 John hit *the nail* on the head with the hammer.
 Mary saw *the woman*.
The book is red.
Brutus is under the tree.

'Goal' is the usual term for indirect objects that are paraphrasable with 'to'. Thus we have

Agent	Goal	Theme	Agent	Theme	Goal
Bill	sold	Mary the book.	Bill	sold	the book to Mary.

'Benefactive' is the usual term for indirect objects that are paraphrasable with 'for':

Agent	Benef	Theme	Agent	Theme	Benef
We	threw	John a party.	We	threw	a party for John.

Use of the Experiencer relation does not indicate agency, but it does indicate sentience in a broad sense. We sometimes speak of institutions or mechanisms in terms appropriate to sentient beings; these things can also fill the Experiencer role. The Experiencer relation is used for the subjects of these sentences (all of which fail the "persuade test"):⁷

Mary knows that there are spotted giraffes.
 Mary likes roses.
 Mary sees the buffalo.
 The government thinks I owe it back taxes.
 The computer understands the first command but not the second.

Use of the Instrument relation includes the objects of instrumental 'with', and it sometimes surfaces as the subject. The italicized NPs in the following examples all use the Instrument relation:

John opened the door *with the key*.
The key opened the door.
 They loaded the wagon with hay *with large pitchforks*.
 John carried the piano upstairs with Gertrude *with a handtruck*.

(Use of the nonitalicized 'with' in the third sentence is sometimes called the 'ornamental use' to distinguish it from the instrumental use. The nonitalicized 'with' in the last sentence is the 'with' of joint action, discussed in section 5.5.)

Over and above the contribution of the thematic roles, the whole sentence or the context in which it occurs may indicate agency, or experiencer, or instrument. Thus, in

Brutus stabbed Caesar,
 we might naturally assume that Caesar is a normal human being, and thus an agent and an experiencer, but these are not implied by the thematic role of 'Caesar' in the sentence. The word occurs simply as

the Theme. Brutus could have stabbed his pillow as well, and it is neither an agent nor an experiencer.

Even without clear criteria of classification, which NPs play which roles is easy to discern in most sentences. Here are some illustrative samples with comments:

She slapped me with her hand; I just stood there.
I see you; stop yelling!
She gave him the book, but he didn't read it.
I looked for days, and finally I found it.

Agent Theme Instr Agent
| | | |

She slapped me with her hand; I just stood there.
Although one can guess from the whole sentence that 'me' refers to an experiencer, its role as object of 'slap' does not tell us this; anything can be slapped. The classification of 'I' as Agent indicates that agency includes intentionally "doing nothing." There may also be a nonagentive reading of this sentence.

Exper Theme Agent
| | |
I see you; (you) stop yelling.

It is tricky to classify the subject of 'see', which seems to be borderline between Agent and non-Agent.

Agent Goal Theme Agent Theme
| | | | |

She gave him the book, but he didn't read it.
Although the last sentence says that he did *not* read the book, which is consistent with his lacking agency, the classification of 'he' depends on the verb, not the whole sentence. The subject of 'read' will be agentive, no matter what the whole sentence says. In this case, the whole sentence denies that a certain person is agent of a certain reading.

Agent Exper Theme
| | |

I looked for days, and finally I found it.

5.4 Enhancements

Theories of thematic relations appear in various forms in the literature. Two enhancements of the system just described are extending and relabeling the Instrument role, and allowing NPs to have multiple roles in the same occurrence.

5.4.1 Extension and Relabeling of the Instrumental Role

A classic objection to the roles described above stems from sentences like

The wind opened the door.

In 'Mary opened the door', it appears that 'Mary' should be Agent and 'the door' should be Theme. But then what is 'the wind' in 'The wind opened the door'? It cannot also be Theme, because then the logical forms of 'The wind opened the door' and 'The door opened the wind' would be equivalent. The wind cannot be an Agent, at least not without personification (which is not at issue here), and it is certainly not Experiencer. This leaves only Instrument. But if the wind is an instrument in this sentence, where is the agent that uses the instrument?

This sort of case is much more widespread than has been recognized in the literature. The classic use of Instrument as subject of a sentence is illustrated by examples such as

The hammer hit the nail.

But even here there need not be an agent to use the instrument. Granted, if Mary hit the nail with the hammer, then the hammer is an instrument. But what if the hammer just materialized out of thin air, and fell to the ground, hitting a nail on the way? The sentence does not *itself* require a user of the hammer. And thus even here the use of Instrument as a role seems misguided. Indeed, I am unaware of a single sentence that has been identified in the literature as having an Instrument as subject where the actual sentence containing that subject requires for its truth that the subject be used as an instrument.

Many sentences are unclassifiable by the original use of thematic roles if the title 'Instrument' is taken literally. These sentences look like those with Agent subjects, but there is no agency involved. Here are some examples:

??? Theme
 |
 The large ball followed the small ball down the ramp.

??? Theme
 |
 The brick hit the window and bounced off.

??? Theme
 |
 The knife cut his leg.

In all of these cases the subject *could* be the instrument used by an agent in the event in question, but it need not have been. The traditional proposal to identify an independent thematic role in these cases is correct, but, because it is optional whether the thing fulfilling the role is an instrument, 'Instrument' is a poor name. Instruments provide only one kind of example of things fulfilling the role. A better title might be 'Performer', if this is not understood as implying agency. I shall retain the term 'Instrument' out of deference to the literature, assuming that it includes all of the traditional cases plus the problem cases listed above.

5.4.2 NPs with Multiple Thematic Roles

The theory I have endorsed allows for each event to have at most one agent, at most one experiencer, at most one theme, and at most one performer. But this leaves it open whether an NP may simultaneously occupy more than one thematic role. I do not have in mind here examples such as 'Sam sees himself', in which Sam stands in both relations to the event. In the underlying form of 'Sam sees himself' we will have distinct occurrences of variables, one occupying the Experiencer position, and one occupying the Theme position. The question I raise now is whether the same *position* in the underlying form might be classified, say, as both Agent and Theme. I begin with some data that suggests that this often occurs.

There seem to be some systematic connections between many prepositions of motion and location. 'Onto' seems related in some way to 'on', 'into' to 'in', 'to' to 'at', and so on. These relations hold of the Motion senses of the former prepositions, and relate them to the Locative senses of the latter. The relations are illustrated by the following inferences:

If Sam hits the 8-ball *into* the pocket, then the 8-ball ends up *in* the pocket.

If Mary will chase the cat *onto* the lawn, then the cat will be *on* the lawn.

Using 'onto' and 'on' as a paradigm, my proposal is this: Any event that is onto something results in a state of being on that thing. The Themes of the event and the state are the same.

More precisely:

$\text{Onto}(e,y) \ \& \ \text{Theme}(e,x) \ \& \ \text{Cul}(e,t) \rightarrow$

$(\exists s)[\text{On}(s,y) \ \& \ \text{Theme}(s,x) \ \& \ \text{Hold}(s,t)].$

This postulate, which is independent of any choice of verb, yields all of the following inferences when applied to the logical forms of the sentences:

Mary will throw the ball onto the roof \rightarrow

The ball will be on the roof

John will push the piano onto the rug \rightarrow

The piano will be on the rug

Samantha kicked the frisbee onto the sidewalk \rightarrow

The frisbee was on the sidewalk.

The same postulate applies to several other pairs of related motion and location prepositions, relating

'into' and 'in'

'to' and 'at'⁸

'out of' and 'outside of'

'away from' and 'away from'

'under' and 'under'

'behind' and 'behind'

'off' and 'off'

The "motion" use of the first preposition is intended, and the "location" use of the second.

The postulates yield inferences such as

Mary will push the cow into the barn \rightarrow

The cow will be in the barn

John will fly the model airplane to the top of the hill \rightarrow

The model airplane will be at the top of the hill

Samantha let the fly out of the bottle →
 The fly was outside of the bottle
 Samantha pulled the sticker off the bottle →
 The sticker was off the bottle
 Kim kicks the book under the sofa →
 The book is under the sofa
 Cathy chased the cat behind the barn →
 The cat was behind the barn

(In the past tense examples, one must ignore the implication suggested by reading the antecedent and consequent in order, that the state that is reported held when the event began.)

This approach focuses attention on a host of similar inferences *not* accounted for in the theory as formulated so far, since the NP is not (so far) classified as a Theme:

Bill will run behind the house →
 Bill will be behind the house
 Mary will drive to the airport →
 Mary will be at the airport

It would be wrong to expand the meaning postulate to thematic relations other than Theme, since this would yield incorrect inferences. For example, we might try to account for the two examples just cited by replacing Theme in the postulate by Agent, but that would yield false inferences such as:

Mary threw the book under the sofa →
 Mary was under the sofa.

I propose that in certain cases an NP can have more than one thematic role. In particular, in many cases Agents and Performers can also be Themes. A simple rule effects this proposal:

Every verb takes a Theme.⁹

The subject of every intransitive verb thereby becomes a Theme, in addition to whatever role it already has, since the subject will be the only NP available for this role. The meaning postulate now yields many further inferences:

Mary ran into the store →
 Mary was in the store
 Sam will swim to Catalina →
 Sam will be at Catalina

Kareem hops quickly onto the bus →
 Kareem will be on the bus
 Fido crawled under the house →
 Fido was under the house,

and so on. Since the principles in question apply to the motion senses of the prepositions cited, they do not apply to a sentence such as 'Kathy looked under the sofa'.

This extension of Theme to the subjects of intransitives brings my use of the notion closer to the traditional uses. One general rule of thumb for "Theme" in the literature is that anything that is in motion in an event is a Theme, and also anything that is required to be at rest in an event of staying or remaining is a Theme. This makes the subjects of 'run', 'swim' and 'hop' all be Themes. It also makes the subject of 'stay' be a Theme, which is not relevant to my analysis of prepositions but which seems unobjectionable.

The notion of Theme may be one that comes naturally to human language learners, since we seem to have an intuitive understanding of it: we instinctively generalize to it from a small sample of paradigms. Classifying 'John' in 'John walks' as a Theme is simply an obvious truth for this intuitive understanding.

Many of the intransitive verbs of Modern English evolved from Old English forms that permitted syntactically overt Themes, subject to the provision that that Theme is a pronoun agreeing with the subject. For example, in Old English one could say either "He went home" or "He went him home".¹⁰ But the semantic import of the Theme need not be lost just because the more complex form dropped out of the language.

Occasionally I use the term 'Agent-Theme' for any NP that is both Agent and Theme, and 'Instrument-Theme' for any NP that is both Instrument and Theme. In 'Agatha pushed the book under the sofa' the Agent and Theme are distinct, whereas 'Agatha crawled under the sofa' now has a single Agent-Theme, and 'The cup rolled under the sofa' has a single Instrument-Theme (Performer-Theme). The first sentence entails that the book ends up under the sofa; the second and third entail respectively that Agatha and the cup do.

A number of further details might be pursued. Not only can we infer from the cup's rolling onto the rug that it ended up on the rug but we may also infer that it was not on the rug just prior to its rolling on.

The principle at work here is something like

Onto(e,y) & Theme(e,x) & Cul(e) →

There is a time preceding the culmination of e such that for every time t that is between that time and the culmination of e there is no state s such that On(s,y) & Theme(s,x) & Hold(s,t).¹¹

The relations between certain adverbs of motion and of location, such as 'home' in 'Fred went home' and 'home' in 'Fred is home' might also be explored. The postulate for prepositions can be stated for adverbs as well, yielding such inferences as

If Mary comes here, then she will be here.

If Sam dives deep, then he will be deep.

If Sharon goes away, then she will be away.

Relations between certain verbs and prepositions might also be explored. The relation between the verb 'cross' and the preposition 'across' provide a key example for Gruber (1976), who holds that they overlap in meaning. A relation between them can be encapsulated in the postulate

Across(e,x) = Crossing(e) & Theme(e,x).

This postulate makes it redundant to add the preposition 'across' to 'cross', as in 'She crossed across the stream'. Gruber's theory (not described here) is intended to explain such data. Regarding the preposition, we ought also to be able to validate the inference

If Mary swam across the channel, then she crossed the channel.

The postulate does this as well, by classifying the swimming across as a crossing. However, it is rare to find a verb and a preposition etymologically related in this way, and the non-etymological cases are generally not plausible.¹²

This section has addressed a variety of semantical issues within the semantical framework of underlying events, combined with a thematic role theory. The semantical precision of the framework permits careful tests for such hypotheses, and the details make certain hypotheses simple and natural to express. Many other theories cannot capture these generalizations about motion and place prepositions and adverbs,¹³ but obviously I have barely scratched the surface.¹⁴

5.5 Objections to the Use of Thematic Roles

5.5.1 Roles Have No Use in Syntax

The main discussion of thematic roles in recent work in linguistics has centered on their utility in theories of syntax, the majority view being that they are dispensable, and that the best theory of "autonomous" syntax does not appeal to them. However, the theory I am developing is a theory of semantics, and thematic roles in this theory have semantic import. The principles that link thematic roles with NPs in English sentences are meant to apply to any theory of syntax that can identify notions such as "subject" of a simple active sentence; they do not take sides on how this is to be done. A well-developed theory of syntax could extend the present "core" theory to a wide range of sentences I have not addressed, but the syntactic theory itself need not use thematic roles. So even if thematic roles are not appealed to in syntax, they might be useful in semantics, perhaps as in the theory under discussion.

5.5.2 Multiple Agents

The theory presumes that each event has at most one agent, at most one theme, and so on. Most apparent counterexamples to this have the Agent or Theme as a group. In 'The girls carried the piano upstairs', or 'Mary and Bob carried the piano upstairs', the Agent is a group: the group of girls in the first case, and the group consisting of Mary and Bob in the second. Fillmore (1968) discusses potential counterexamples to the principle that each sentence contain only one NP per thematic role. 'Bill robbed the bank with Mary' appears to have a reading in which Mary and Bill are equally seen as bank-robbers, and (perhaps) in which only one robbery is in question. This may be an example of what Fillmore calls a 'comitative' function, where the clause 'with Mary' indicates something like "displaced conjunction." That is, we might see the sentence (on the reading in question, assuming that it exists) as simply a variant of

Bill and Mary robbed the bank.

And this in turn could easily be seen as a sentence with a group NP as its subject.

Another reading contains the 'with' of accompaniment.

Accompaniment is less than comitativity. For example

Bill walked home with Mary.

has an accompaniment reading not requiring that Mary walked too—she might have been in a wheelchair, or on a bicycle. This reading raises no issue of multiple agenthood.

5.5.3 Buying and Selling

Buying and selling offer good illustrations of examples that intertwine issues about roles with issues of the identity of events. Consider:

Kim bought a tricycle from Sheehan.

Sheehan sold a tricycle to Kim.

The tricycle appears to be a Theme of both events, the buying and the selling. Kim is the Agent of the buying, and Sheehan is the Agent of the selling.¹⁵ Some would insist that the buying and the selling are one and the same event, differently described. This makes Kim the Agent of the selling, and Sheehan the Agent of the buying, which entails that Kim sold a tricycle to Kim, and Sheehan bought a tricycle from Sheehan. Something is wrong.

The right answer is that the buying and the selling, while intimately related, are not the same event. A full defense of this nonidentity requires a global look at a number of issues, that I deal with only later. But I can briefly defend my view without any essential reference to roles. One possibility is that Kim bought the tricycle with his MasterCard, though Sheehan did not sell it with Kim's MasterCard. Likewise, Sheehan may have sold it with a hard sales pitch, though Kim did not buy it with a hard sales pitch. And Kim might have bought it quietly, without Sheehan's having sold it quietly (if, say, Kim's purchase was handled by a middleman, with Sheehan shouting over the phone). In all of these cases, the nonidentity of the events is forced by the account of modifiers in the theory of underlying events, quite apart from treating the subjects as Agents. In order to accommodate all of our intuitions we may have to appeal to a notion of "transaction," or "situation," as an entity encompassing two or more events. Perhaps each buying *transaction* is a selling *transaction*. But this does not identify buyings and sellings.

5.5.4 Abstruments

David Dowty (personal communication) has raised an objection to my principle about Themes, based on consideration of the following sentences:

- 1 I emptied the tank.
- 2 I emptied the tank into the sink.
- 3 I emptied the tank of water.
- 4 I emptied water from the tank.
- 5 I emptied the water from the tank into the sink.
- 6 *I emptied the tank of water into the sink.

Sentences (3) and (6) are both ambiguous. The readings in question are *not* those in which the direct object of the verb 'empty' is 'tank of water', but in which 'tank' is the direct object and 'of water' plays some other role. Its role is supposedly indicated by the fact that (3) and (4) are meant to be (almost) synonymous, and that (5) and (6) would be practically equivalent if (6) were grammatical. Dowty argues that (6) is ungrammatical, and that this is a problem for the theory under discussion, since according to that theory (6) should make perfectly good sense.¹⁶ Sentence (6) is obviously awkward, though one can attribute to it a fairly clear meaning. I return to this issue later, but first let us see how the theory of underlying events applies to these sentences.

The verb 'empty' in (3) is not the same as the verb 'empty' in (4); they are homonyms. One meaning is at play in sentences (4) and (5), and the other sentences all contain another. Sentences (4) and (5) both contain the same verb, and have straightforward treatments.

($\exists e$)[Emptying(e) & Theme(e ,water) & From(e ,tank)]

($\exists e$)[Emptying(e) & Theme(e ,water) & From(e ,tank) & Into(e ,sink)]

In these formulas my earlier discussion of adverbials of motion applies, and the sentences imply that the Theme (= the water) ends up away from the tank, and, in case (5), in the sink.

At first glance, sentence (2) seems an embarrassment. Since 'the tank' is the direct object, and since (2) contains the motion adverbial 'into the sink', the tank appears to be the Theme of the emptying, and so the tank should end up in the sink. But (2) does not say that the tank ends up in the sink; its contents do. So some other analysis seems to be required. In fact, sentences (1) through (3) and (6) are all "causative" constructions. These are discussed in chapter 6, but the basics are easy to explain. The form of sentence (1), for example, is complex:

- 1' I emptied the tank = I did something that caused the tank to become empty.

Here the verb 'empty' is analyzed in terms of an adjective ('empty') that applies to the tank. The logical form of (1) involves two events: the thing I did that caused the tank to become empty, and the becoming empty. The latter event is uniquely related to the final state of the tank: the tank ends up being empty. The whole analysis has the following complexity:

- 1' For some event e:
 I am the agent of e
- For some event e':
 The tank is the theme of e'
- For some state s:
 s is a being-empty
 the tank is the theme of s
- Further:
 e causes e'
 e' is the becoming of s.

Then why doesn't

- 2 I emptied the tank into the sink

entail that the tank ends up in the sink? In (2), as in (1), there are two underlying events that might be "modified" by 'into the sink'. One is the caused event, the becoming empty of the tank. Since this is not a motion, it would be anomalous to predicate 'into the sink' of it. The other possibility is the causing event. Its character is completely undetermined by the logical form, except that I am identified as its agent. So nothing prevents applying 'into the sink' to it. It is also a plausible candidate, since the only way to empty a tank into a sink is to move its contents into the sink. That is, we know that this is what the sentence says, so, reasoning backwards, this tells us something about the nature of the causing event. In short, of the two underlying events to be characterized by 'into the sink', the second is ruled out by its meaning, and the first is plausible. An unproblematic form for (2) is then

- 2' For some event e:
 I am the agent of e
 e is into the sink
- For some event e':
 The tank is the theme of e'

- For some state s:
 s is a being-empty
 the tank is the theme of s
- Further:
 e causes e'
 e' is the becoming of s.

This form requires something to end up in the sink (namely, the unspecified theme of the causing event); it does not say what, not even that the something is the tank.

In each of the two remaining sentences containing the phrase 'of water', I see two different ways to analyze them. For

- 3 I emptied the tank of water,
'of water' can be seen as characterizing the final state of emptiness of the tank. The sentence says that I did something that made the tank end up empty-of-water. It does not say that I made it end up empty; perhaps I emptied it of water by filling it with mercury until the water all overflowed, so that it ended up empty of water but full of mercury. We capture this idea by modifying the final state in question; its form is a slight embellishment of that of (1):

- 3' For some event e:
 I am the agent of e
- For some event e':
 The tank is the theme of e'
- For some state s:
 s is a *being-empty-of-water*
 the tank is the theme of s
- Further:
 e causes e'
 e' is the becoming of s.

This may require further analysis of the state-predicate 'being empty of water', but that analysis is not part of my present task.

Alternatively, (3) can be seen as telling us that I emptied the tank by doing something involving water. If we see the 'of' in 'of water' as identifying the Theme of the underlying causing event, then the analysis is

- 3" For some event e:
 I am the agent of e
 The water is the theme of e

For some event e' :

The tank is the theme of e'

For some state s :

s is a being-empty

the tank is the theme of s

Further:

e causes e'

e' is the becoming of s .

This analysis is less plausible because it requires that the tank end up empty, without specifying what respect of empty. 'Empty' all by itself seems to mean by default 'completely empty', or at least 'completely empty of the sorts of thing that are normally contained'. Yet (3) clearly means that the tank ends up empty *of water*, not "completely empty."

A combined analysis in which 'of' forces the water to play a dual role would be

3 For some event e :

I am the agent of e

The water is the theme of e

For some event e' :

The tank is the theme of e'

For some state s :

s is a being-empty-of-water

the tank is the theme of s

Further:

e causes e'

e' is the becoming of s .

I think that the first analysis is the right one and that the second and third are strained, but it is helpful to see them as possible options.

The problem sentence (6) now emerges as a combination of the constructions in (2) and (3). On the first method of analyzing (3), the analysis of (6) is

6' For some event e :

I am the agent of e

e is into the sink

For some event e' :

The tank is the theme of e'

For some state s :

s is a being-empty-of-water

the tank is the theme of s

Further:

e causes e'

e' is the becoming of s .

This fails to entail that the water ends up in the sink, a defect if the sentence is grammatical. The second analysis is

6" For some event e :

I am the agent of e

e is into the sink

The water is the theme of e

For some event e' :

The tank is the theme of e'

For some state s :

s is a being-empty

the tank is the theme of s

Further:

e causes e'

e' is the becoming of s .

This entails that the water ends up in the sink, but it also entails (perhaps inappropriately) that the tank end up "empty" (as opposed to "empty of water").

The "combined" analysis is:

6 For some event e :

I am the agent of e

e is into the sink

The water is the theme of e

For some event e' :

The tank is the theme of e'

For some state s :

s is a being-empty-of-water

the tank is the theme of s

Further:

e causes e'

e' is the becoming of s .

But even though the symbolization seems to get everything right, how can the theory be right if it attributes a clear meaning to sentence (6), which is (arguably) not fully grammatical?

The problem with sentence (6) has nothing to do with either underlying events or with thematic roles. It can be solved by reflecting on

the different kinds of function that 'water' is asked to play in the various analyses. In the construction 'empty the tank of water', 'water' occurs as a bare mass term, and its use in the analysis is in the adjectival construction 'empty of water'. If we replace this use of 'water' with an ordinary NP such as 'some water', this yields anomaly; what does it mean to "empty a tank of some water" or for a tank to be "empty of some water"? We can try to make sense of this, but it is unnatural. I suggest that (6) is unnatural because the construction 'empty the tank of X into the sink'.

(6) demands an unquantified mass term for the "X" position, whereas 'empty into the sink' requires a Theme that can move. But the use of the unquantified mass term that goes with 'empty' cannot be the same as the one that can be a Theme of a motion. In terms of the logical forms discussed above, the blanks in

_____ is the Theme of e & e is into the sink
d _____

is a being-empty-of-_____

cannot consistently be filled with the same kind of term. The former demands something that denotes an object or a particular quantity of stuff, whereas the latter demands something that denotes a *kind* of stuff. (6) is odd because we make sense of it only by using 'water' in two different ways. This is made clear by the way in which we describe the consequences of the sentence's being true. We say that the tank ends up "empty of *water*," and the "*the water* ends up in the sink." In the first case we use the bare term 'water', and in the second we use 'the water'; replacing either of these by the other is odd, and creates an unnatural reading.

Something like this also seems to apply to several other examples that Dowty has gathered under the title "abstruement":

_____ in leached the soil of nutrients.
_____ unbridled himself of his fears.
_____ the land was depopulated of its aboriginal inhabitants.
_____ the waves washed the beach of seaweed.

Some of these contain (almost) bare plurals instead of mass terms, but bare plurals and mass terms are known to behave similarly, and the general point is the same. We cannot say, for example, "Rain leached the soil of nutrients into the stream," because 'of' demands a word that refers to a kind of thing, whereas 'into the stream' demands an

event with a theme that moves. In context, of course, one can force a reading in which 'of' takes a particular quantity of stuff, a quantity that can move. For example, one can force a reading on

Rain leached the soil of the salt I put there yesterday,
and even

Rain leached the soil of the salt into the stream.

The theory of underlying events can analyze these forced readings; I do not see this as a defect. Why the readings are *forced* is not unique to the theory under investigation.

5.6 Passive Sentences

The treatment of passive sentences has already been hinted at. A verb in the passive form has no effect on the translation of the verb itself—it still stands for the same property of events as in the active form. The presence and order of its arguments in the surface syntax of the sentence are, however, affected. In particular, for a passive sentence using an ordinary (single-object) transitive verb, the Theme becomes the subject. Whatever would normally have been the subject of the corresponding active sentence is optionally present, marked with the preposition 'by'.¹⁷

The distribution of thematic roles in simple sentences is a consequence of a three-stage process:

1. The Verb determines which thematic roles may be present in the sentence. 'Stab' may combine with an Agent and a Theme, 'walk' combines with an Agent-Theme, 'fall' with a Theme, and so on.
2. A set of principles determines which roles may occur in which positions in active surface sentences. These principles were illustrated in section 1 above.¹⁸
3. A set of principles determines which roles may occur in which positions in passive surface sentences. These principles may be stated so that they are parasitic on the rules for active sentences, as illustrated above, or they may be stated independently.

Special principles may also be needed for causative sentences (discussed in chapter 6), and additional principles will be needed for perception sentences, such as 'The bucket was seen by Mary to fall onto the pavement'.

The logical forms underlying simple sentences of English are always logically equivalent in their active and corresponding passive forms. For example,

Harriet loves Harvey.
and

Harvey is loved by Harriet.

have equivalent logical forms; each is equivalent to
($\exists e$)[Loving(e) & Exp(e ,Harriet) & Theme(e ,Harvey)].

The differences between the sentences themselves are entirely due to whether the verb is in its active or passive form, which NP ends up being subject, whether there is a direct object, and so on. These are all matters of syntax, not of logical form. Failures of equivalence between actives and passives are due to other phenomena. For example, it is well known that quantifier scopes tend to follow the order of quantifier NPs at the surface, and so the most natural readings of the following "corresponding" active and passive sentences differ:

Every boy dates some girl.
Some girl is dated by every boy.

But this is due entirely to the order of the quantifiers; the forms they are quantifying into are synonymous:

For every boy x : For some girl y : ($\exists e$)[Dating(e) & Agent(e , x) & Theme(e , y)]

For some girl y : For every boy x : ($\exists e$)[Dating(e) & Agent(e , x) & Theme(e , y)]

Corresponding actives and passives also have different VPs. In logical form this provides different structures for other elements in the sentence to operate on. I have avoided mention of logical forms of VPs in order to avoid complicating the text, but they are relevant to this issue. (See chapter 13 for details). Clearly, however, the difference between the active and the passive VPs is due to the VP formation rule, but the ingredients of the VPs of corresponding active and passive sentences are the same.¹⁹ In the simplest cases, actives and passives containing the same NPs in corresponding places are logically equivalent.

5.7 The Utility of Thematic Relations

There are two fundamental but interdependent issues regarding thematic roles:

Issue 1. Should we appeal to thematic roles at all in a theory of semantics based on underlying events? Instead of symbolizing 'Brutus stabbed Caesar violently' as:

($\exists e$)[Stabbing(e) & Agent(e ,Brutus) & Theme(e ,Caesar) & Violent(e)],

we might eliminate the complications of the thematic roles 'Agent' and 'Theme', writing

($\exists e$)[Stabbing(e ,Brutus,Caesar) & Violent(e)],

where 'Stabbing(e , y , z)' means ' e is a stabbing by y of z '. What does the extra complexity of the additional conjuncts buy us? What is the evidence for it?

Issue 2. Are thematic roles univocal across verbs? Suppose we have settled issue 1; we have established the utility of the logical forms in question. This does not automatically resolve the further issue of whether the thematic roles appealed to in the symbolism are univocal across verbs. Is there a relation of agenthood, for example, that is the same relation for both stabbing and kissing? For stabbing and running? The logical forms might be justifiable even if agenthood were relative to the type of event in question. Interestingly, this issue turns out to interact with the metaphysical issue of the identity conditions for events.

I call Issue 1 'The Utility of Thematic Relations' and Issue 2 'The Cross-Verbal Identity of Thematic Relations'. I discuss Issue 1 in this section, and Issue 2 in the next.²⁰ For both discussions, I presuppose the underlying event analysis, and I also presuppose that verb modifiers are properly construed in logical form as conjuncts containing predicates of the underlying event.

5.7.1 Articulation of the Options

Davidson's original 1967 paper did not employ thematic relations. Their use is a quite independent idea. Panini discussed them, Fillmore (1968) and others discussed them in the 1960s, and Castañeda (1967) suggested them as an addition to Davidson's theory. Davidson origi-

nally proposed a simpler account, one in which the verb contributes a multiplace predicate to logical form, with a place for the event, and an additional place for each of the NPs I have been treating as having thematic roles. A simple illustration of the difference is given by these alternative symbolizations of 'Brutus stabbed Caesar with the knife'.

Davidson's Original Proposal:

$(\exists e)[\text{Stabbing}(e, \text{Brutus}, \text{Caesar}) \ \& \ \text{With}(e, \text{knife})]$.

Using Thematic Relations:

$(\exists e)[\text{Stabbing}(e) \ \& \ \text{Agent}(e, \text{Brutus}) \ \& \ \text{Theme}(e, \text{Caesar}) \ \& \ \text{With}(e, \text{knife})]$.

In each of these analyses the modifier remains a separate conjunct. In the latter analysis the thematic roles appear as separate relational conjuncts, whereas in the former they disappear into the meaning of the verb. I refer to the latter option as the "independent conjunct" analysis and the former as the "incorporation analysis," since on this approach whatever meaning is contributed by the thematic role is incorporated into the verb itself.²¹

There is no obvious reason why this logical difference should correspond to the difference between NPs that are traditionally thought to be candidates for occupying thematic roles and other NPs. The real question concerns which NP places, if any, are to be treated by the incorporation approach, and which, by the independent conjunct analysis.

5.7.2 Syntactic Marks of Thematic Roles

Thematic role NPs are not easily distinguished from others by their surface marks. Languages generally identify traditional thematic roles by word order, by differences in spellings, by inflections, or by the use of prepositions. In Modern English the subject of a simple sentence comes first, and this position helps identify its thematic role. Indeed, the only way to distinguish the role of 'Brutus' from that of 'Caesar' in 'Brutus stabbed Caesar' is by word order. Modern English also uses differences in spelling in some cases; this is illustrated by the differences in 'He saw him' and 'She saw her'. These differences are mostly redundant in standard Modern English, but in unusual poetic constructions we still might find 'him the woman saw', where the accusative case spelling of 'him' would be important. Modern English does not

use inflections. It does use prepositions in some cases for thematic relations, such as 'to' in the second sentence:

Mary gave John the book

Mary gave the book to John.

There is even more variation across languages. None of these surface marks will therefore be a good guide to distinguishing thematic roles from nonthematic prepositions. Nor will any of them provide a good guide as to which NP places are to be analyzed using the incorporation account and which, the independent conjunct account. Each of the four devices is used by some language or other to indicate its thematic roles. If we are to find an important difference, we must look deeper.²²

5.7.3 The Logic of Modifiers

Since the differences between the approaches involves a difference in logical forms, we might expect that a difference in logical consequences would help us decide between them. The main difference between the two approaches lies in how they handle optional NPs. In the independent conjunct treatment, if an NP is missing from a sentence, its conjunct is simply omitted. In the incorporation approach, if an NP is omitted then its place is existentially bound. Using the sentence 'Brutus stabbed Caesar violently in the back', we can extend the pattern discussed earlier. In the following list, each sentence entails each of the others that are obtained from it by omitting an NP or a prepositional phrase:²³

- a Brutus stabbed Caesar violently in the back.
- b Brutus stabbed Caesar violently.
- c Brutus stabbed Caesar in the back.
- d Brutus stabbed Caesar.
- e Brutus stabbed violently.
- f Brutus stabbed in the back.
- g Caesar was stabbed violently.
- h Caesar was stabbed in the back.
- i Brutus stabbed.
- j Caesar was stabbed.

In fact, both approaches get these data exactly right. The independent conjunct approach analyses the inference from c to j as one from $(\exists e)[\text{Stabbing}(e) \ \& \ \text{Agent}(e, \text{Brutus}) \ \& \ \text{Theme}(\text{Caesar}) \ \& \ \text{In}(e, \text{back})]$

to
 $(\exists e)[\text{Stabbing}(e) \ \& \ \text{Theme}(\text{Caesar})]$.

This involves dropping two conjuncts. The incorporation account analyses it instead as an inference from

$(\exists e)[\text{Stabbing}(e, \text{Brutus}, \text{Caesar}) \ \& \ \text{In}(e, \text{back})]$

to
 $(\exists e)[(\exists x)\text{Stabbing}(e, x, \text{Caesar})]$,

by dropping one conjunct and existentially quantifying the "Brutus" place.

These considerations indicate that the logic of modifiers does not select between the incorporation account and the independent conjunct account.

5.7.4 Semantic Optionality

Davidson 1985 offers a proposal directed at finding out when we should apply the incorporation account and when, the independent conjunct account. He proposes that we "incorporate" any NP place that is necessarily filled by something in its logical form, and that we treat all others as independent conjuncts:

... reduce the number of places of the underlying verbal predicate to the smallest number that will yield, with appropriate singular terms, a complete sentence. But do not think you have a complete sentence until you have uncovered enough structure to validate all inferences you consider due to logical form. (232–33)

Thus, suppose we decide that every stabbing must have an agent and must be done with something, but, reflecting on cases such as 'Brutus stabbed, but he missed', we think that stabbings may lack themes. Then we must incorporate the agent and instrument case into the verb but leave the theme as a separate conjunct

Brutus stabbed Caesar with the knife =
 $(\exists e)[\text{Stabbing}(e, \text{Brutus}, \text{knife}) \ \& \ \text{Theme}(e, \text{Caesar})]$,

where 'Stabbing(e, x, y)' means that e is a stabbing by x with y. This is a quite different proposal, markedly different from any natural one proposed elsewhere in the literature; its distinction between what is and is not incorporated into the verb bears no natural relation to the traditional category of thematic roles versus non-roles.²⁴

It is not clear whether this proposal is correct. But reflecting on its rationale allows us to see that certain applications of the incorporation

analysis must be incorrect, and that certain applications of the independent conjunct analysis must be incomplete. For example, we can now see that the incorporation analysis cannot be systematically applied to all cases of agents and themes. For consider the resulting analyses of the sentences

Brutus stabbed Caesar in the back =
 $(\exists e)[\text{Stabbing}(e, \text{Brutus}, \text{Caesar}) \ \& \ \text{In}(e, \text{back})]$

and

Brutus stabbed =
 $(\exists e)[(\exists y)\text{Stabbing}(e, \text{Brutus}, y)]$.

These forms illustrate that the former sentence entails the latter, and not vice versa, and they interact correctly with a wide variety of other such examples. But the latter form is wrong, because it is true only if Brutus stabbed *something*. Yet, if Brutus stabbed and missed, there is nothing that he stabbed.

Likewise, if we uniformly apply the independent conjunct analysis to all cases, we get an analysis that is incomplete. Consider these analyses:

Brutus stabbed Caesar with the knife =
 $(\exists e)[\text{Stabbing}(e) \ \& \ \text{Agent}(e, \text{Brutus}) \ \& \ \text{Theme}(\text{Caesar}) \ \& \ \text{With}(e, \text{the knife})]$

and

Brutus stabbed Caesar =
 $(\exists e)[\text{Stabbing}(e) \ \& \ \text{Agent}(e, \text{Brutus}) \ \& \ \text{Theme}(\text{Caesar})]$.

Again, the relationships are right; the former entails the latter, and not vice versa. But the latter now fails to entail that Brutus stabbed Caesar *with something*. This is not incorrect, but it has left something out of account.

5.7.5 The Dream Machine

I am not sure what the right analyses should be, but I am inclined to defend the following: (1) Davidson's proposal is correct if properly construed, and (2) when properly construed, it shows that all thematic relations should be analyzed by the independent conjunct approach.

It is well-known that what is required by the meaning of a phrase may differ from what follows necessarily from it. For example, there is a difference in meaning between

Fred is a giraffe or he isn't

and

Mary is a gorilla or she isn't,

even though the sentences, being tautologies, are logically equivalent. My point is subtler, and harder to defend. People often wish to make statements having certain (obvious) necessary consequences, where these consequences are not intended to follow from those statements when they occur within certain embeddings. In particular, a statement *S* may be made in describing an unreal situation, and in the real world *S* may require the truth of *S'*, but *S'* is not intended to apply to the unreal situation. In such a case, *S'* follows necessarily from *S*, but *S'* should not be built into the logical form of *S*.

The unreal situations I appeal to are dreams, and the examples come from our attempts to accurately describe some of our dreams that are not only unreal but that in various ways verge on incoherence. In trying to describe such a dream, I may say

In a dream last night, I was stabbed, although in fact nobody had stabbed me, and I wasn't stabbed with anything.

I do *not* mean this to be a report that, according to the dream, I *had* been stabbed by somebody, but that the stabbing had taken place earlier than the events in the dream, and so I did not actually experience (in the dream) the stabbing. Such a report raises no interesting issues at all. I mean this to be a report of an incoherent dream, one in which, say, I am bewildered by the fact that I have been stabbed but not by anyone or anything. Such testimony should *not* be analyzed as containing an explicit contradiction, as in

I was stabbed, but not by anybody =

$(\exists e)[e \text{ is a stabbing of me by somebody} \ \& \ e \text{ was not by anybody}]$.

In my report I use an "agentless passive," a construction in which the agent role is unoccupied. Any analysis that attempts to analyze this example by existentially quantifying an agent role will be wrong; it will attribute to me what I do not intend. I have not said anything from which it should be inferred that in the dream I was stabbed by somebody. My dream may have been incoherent, but I am not, and what I am saying should not contain a self-contradictory logical form.

The independent conjunct account of thematic roles can handle such examples perfectly. The missing NPs are genuinely missing. The incompleteness of the account is not a defect, for what is missing is not

part of the meaning of what is said. It may be true that in the real world you can't stab someone without stabbing him or her with something, and this may be a truth known to users of the language. This explains why we infer an instrument when told of a stabbing. That is,

$(e)[\text{Stabbing}(e) \rightarrow (\exists x)\text{With}(e,x)]$

is a known truth—perhaps even a necessary truth—about real stabbings. But this should not be automatically built into the logical forms of sentences containing the verb 'stab'.

I propose this without having a general criterion of how we apportion truths into those due to the meanings of words and those due to knowledge of the world. There may be some arbitrariness here, in which case the account I propose is only one of many. But it seems to work correctly, and I don't know of others that do as well.

In summary, I propose to qualify Davidson's test so that it is clearly understood as saying only that the incorporation analysis should be applied to all NP roles that are required to be filled by the meaning of the verb. This test leads us to conclude that the incorporation analysis should not be applied to any such roles at all, a judgment resulting from reflection on descriptions of unreal situations.²⁵

5.8 Cross-Verbal Thematic Roles

In this section I take for granted that, in simple sentences, NP positions not marked by prepositions (that is, positions such as subject, direct object, indirect object) are categorizable in terms of thematic roles such as Agent, Benefactive, Theme, and so on. There are two ways in which this might be implemented in logical form. One way is to represent the roles by relational predicates that appear as separate conjuncts. An example is the by now familiar:

Brutus stabbed Caesar =

$(\exists e)[\text{Stabbing}(e) \ \& \ \text{Agent}(e,\text{Brutus}) \ \& \ \text{Theme}(e,\text{Caesar})]$.

Another way is in terms of the incorporation analysis *coupled with a system of classification by roles*. That is, we might retain the analysis

Brutus stabbed Caesar =

$(\exists e)[\text{Stabbing}(e,\text{Brutus},\text{Caesar})]$,

but add to it that the places occupied by names for Brutus and Caesar attribute to each of them a special relation to the event in question. The supplementary principle tells us that the second place of the

stabbing relation identifies the Agent of a stabbing, and that the third place of the stabbing relation identifies its Theme:

$$(\exists x)(\exists y) \text{Stabbing}(e,x,y) \rightarrow$$
$$[\text{Agent}(e,z) \equiv (\exists y) \text{Stabbing}(e,z,y)] \ \&$$
$$[\text{Theme}(e,z) \equiv (\exists x) \text{Stabbing}(e,x,z)].$$

This policy attributes to 'Brutus stabbed Caesar' a different logical form than the one used in the independent conjunct analysis, but it still classifies the participants of the event in terms of their thematic relations to it.

There are two reasons for wanting to use thematic roles in one or the other of these ways. First, it offers a convenient (though perhaps dispensable) way to summarize the principles used to determine which NP places can end up as subject, direct object, and so on. If this is the *only* use of thematic roles, then they may be of little significance. On the other hand, the roles might also be seen as providing a cross-verbal comparison of relations between events and their participants. This is Issue 2 from the last section.

The point at issue is whether a relation, such as Agent, is the same relation when used with different verbs, or whether its significance changes with the verb. That is, having analyzed the following sentences in these terms

Brutus stabbed Caesar =

$$(\exists e)[\text{Stabbing}(e) \ \& \ \text{Agent}_s(e,\text{Brutus}) \ \& \ \text{Theme}_s(e,\text{Caesar})].$$

Brutus kissed Caesar =

$$(\exists e)[\text{Kissing}(e) \ \& \ \text{Agent}_k(e,\text{Brutus}) \ \& \ \text{Theme}_k(e,\text{Caesar})].$$

can we assume that Agent_s stands for the same relation as Agent_k, and that Theme_s stands for the same relation as Theme_k? All of the previous exposition has been carried out as if these relations were the same, but it is worth considering what the theory would be like if we assume they are different.²⁶ I call the option according to which the roles can differ when used with different verbs the "Relative Role" option; I call the other the "Regular Role" option.

5.8.1 Cases in which No Evidence is to be Found

In many applications the two approaches are equivalent. Here are two such cases to consider. The first involves comparison of sentences in which the same verb is used. The group of sentences used in the last section will do as an illustration

- a Brutus stabbed Caesar violently in the back.
- b Brutus stabbed Caesar violently.
- c Brutus stabbed Caesar in the back.
- d Brutus stabbed Caesar.
- e Brutus stabbed violently.
- f Brutus stabbed in the back.
- g Caesar was stabbed violently.
- h Caesar was stabbed in the back.
- i Brutus stabbed.
- j Caesar was stabbed.

Each sentence in this list entails any other that is obtained from it by deleting NPs (and their associated prepositions, if any, and possibly by rearranging words). The theory of Regular Roles predicts this. But so does the theory of Relative Roles. This is because the same verb is used in every sentence, and so the relativity of role has no effect in this case. The roles can vary with the verb, but if the verb does not vary, neither do they. So both options are equivalent here.

A second case that leads us nowhere is the comparison of most unrelated simple sentences containing different verbs. An example is

Brutus stabbed Caesar =

$$(\exists e)[\text{Stabbing}(e) \ \& \ \text{Agent}_s(e,\text{Brutus}) \ \& \ \text{Theme}_s(e,\text{Caesar})].$$

Brutus kissed Caesar =

$$(\exists e)[\text{Kissing}(e) \ \& \ \text{Agent}_k(e,\text{Brutus}) \ \& \ \text{Theme}_k(e,\text{Caesar})].$$

These two sentences are logically independent, but this has nothing to do with whether the roles are the same or different in the two cases. The sentences have to be independent since 'Stabbing(e)' and 'Kissing(e)' are independent. We could establish a connection between the sentences only if there were a connection between kissing and stabbing, if, say, they picked out the same event.

5.8.2 Identity Conditions for Events

One thing that *is* at stake between the two options is the identity conditions for events. Suppose that these two sentences are true:

- Mary wrote the check.
- Mary paid the bill.

In a normal case in which the bill that Mary paid was supplied to her by the phone company, the following would *not* be true:

D.1 Introduction

What kind of logical forms are we to attribute to *state* sentences,¹ those not seeming to report events or processes?² Certainly, we do not want to appeal to underlying *events* in

Brutus is clever

Brutus has a dog.

But why not underlying states? Why not attribute to these sentences forms such as

($\exists s$)[*s* is a state of being clever & Subj(*s*, Brutus)]

($\exists s$)[*s* is a having & Subj(*s*, Brutus) & Obj(*s*, a dog)]?

Is there evidence for such analyses, as there was in the case of event sentences? Or evidence against? Or what?

There is indeed evidence in favor of the underlying state approach for state sentences, but there is not as much of it, and it is not as easy to evaluate, as the evidence for the underlying event approach for event sentences.

I am tempted by the following picture, which I discuss in detail in the remainder of the chapter:

Verbs All verbs stand for kinds of events or kinds of states. 'Stab' picks out a kind of event, whereas 'have' picks out a kind of state. The logical forms of simple sentences with state verbs are exactly like those with event verbs, except that we use Hold instead of Cul. So, for example, the logical form of (B) above is

States

B" ($\exists x$)[*x* is a dog & ($\exists s$)[*s* is a having & Subj(*s*, Brutus) & Obj(*s*, *x*) & Hold(*s*, now)]].

Adjectives Adjectives pick out kinds of states. An adjective occurring with a copula (as in 'was clever') yields the same kind of logical form as a state verb. The logical form of (A) above is

A" ($\exists s$)[*s* is a state of being clever & Subj(*s*, Brutus) & Hold(*s*, now)].

Locatives Locatives that occur with the copula stand for predicates of states. The logical form of

C Brutus is under the tree

is

C" ($\exists s$)[Under(*s*, the tree) & Subj(*s*, Brutus) & Hold(*s*, now)].

These predicates are the very same as those that occur in the logical forms of other sentences, such as

Brutus sat under the tree.

Mary played the clarinet under the tree.³

For example,

($\exists e$)[Playing(*e*) & Agent(*e*, Mary) & Theme(*e*, clarinet) & Under(*e*, tree) & Cul(*e*, before now)].

Nouns Nouns probably do *not* pick out events or states (except for "higher-order" nouns, such as 'killing' or 'accident'). Their logical forms are exactly as they are generally supposed to be in logic texts.

For example,

D Fido is a giraffe

has as its logical form

D" Giraffe(Fido),

and

E A giraffe ran

has as its form

E" ($\exists x$)[Giraffe(*x*) & *x* ran].⁴

It is possible to interpret nouns as standing for kinds of states, having logical forms resembling those of verbs. For example, it is possible to interpret 'Giraffe(*x*)' as being short for '($\exists s$)[*s* is a state of being a

Mary wrote the bill.

In this case the Regular Role option makes a prediction that the Relative Role option does not. It predicts that the check writing is not identical with the bill paying. If they were the same, then on either option we should have the following:

$(\exists e)[\text{Writing}(e) \ \& \ \text{Agent}_w(e, \text{Mary}) \ \& \ \text{Theme}_w(e, \text{check}) \ \& \ \text{Paying}(e) \ \& \ \text{Agent}_p(e, \text{Mary}) \ \& \ \text{Theme}_p(e, \text{bill})]$.

But this, by reshuffling and omission of conjuncts, yields

$(\exists e)[\text{Writing}(e) \ \& \ \text{Agent}_w(e, \text{Mary}) \ \& \ \text{Theme}_p(e, \text{bill})]$.

On the Regular Role analysis the subscripts are irrelevant, and this is the logical form underlying 'Mary wrote the bill', which should *not* follow from the two earlier sentences. So on the Regular Role analysis we must reject the possibility that the check writing and the bill paying are identical. Perhaps Mary paid the bill *by* writing the check, but this 'by'-relation does not connote identity of events.

On the Relative Role analysis, the nonidentity of the events is not predicted. The last form above contains subscripts that are not irrelevant. Since they differ, it is a well-formed piece of logical symbolism that is not the logical form of any sentence of English. It is certainly not the logical form assigned to 'Mary wrote the bill', since it contains a subscript 'P' where a subscript 'W' is required. It uses a role appropriate to the verb 'pay' instead of a role appropriate to 'write'.

We have found a difference between the analyses, but what does it tell us about them? If we were sure that the events were the same, it would refute the Regular Role analysis. If we were sure they were different it would be evidence (though not conclusive evidence) for the Regular Role analysis, since that analysis would be making an interesting and correct prediction that the Relative Role analysis fails to make. It is difficult to address this issue in a definitive way. Here are two considerations:

'By'-Phrases We might try arguing that we have independent means of showing that the bill paying is different from the check writing. After all, Mary paid the bill *by* writing the check, she did not write the check *by* paying the bill. But they would be equivalent if the bill paying and the check writing were identical. Unfortunately, this argument is a little too cavalier. The form of the argument is

Mary paid the bill by writing the check.

The bill paying = the check writing.

\therefore Mary wrote the check by paying the bill.

The argument involves, among other things, interchanging phrases in a 'by'-context when the things interchanged resemble descriptions of the same event. But it is not clear that 'by' governs descriptions of events in these contexts. This use of 'by' is a difficult one to analyze. It does not seem to be an ordinary preposition, taking ordinary NPs as objects. For example, we do not say things like:

*Mary paid the bill by the writing of the check.

If we did, the above reasoning might hold. But if we do not, we are left with the other idiom, 'by writing the check', and it is not clear what its logical form might be.

The reasoning would clearly be bad if 'by' created nonextensional contexts. But it is hard to find evidence for or against this. Suppose, for example, that Mary delighted the populace by killing the dictator. Suppose also that the dictator happened to be the butcher. Does it follow then that she delighted the populace by killing the butcher? I suspect that it does follow, and that this is indirect evidence that 'by' does not create nonextensional contexts. But the data are not clear, and even assuming that the inference is good we have not established the interchangeability of 'by writing the check' and 'by paying the bill', since further assumptions are needed about what the logical form is. I suspect that 'by' stands for a relation between two events, the one in the main clause and the one in its "object," and that the argument above proves that the bill paying is not the check writing, but I do not see how to establish this in a convincing way.

Modifiers I suspect that we can get better evidence for the nonidentity of the events in question by appeal to more ordinary modifiers. In particular, the following is true:

Mary paid the bill with a check,

and it is false that

Mary wrote the check with a check.

But if the bill paying is identical with the check writing, then the truth of the first sentence yields the truth of the second on either analysis—since modifiers are regular on either account. So we may be able to conclude that the check writing is not identical with the bill paying. If

so, the Regular Roles analysis is saved from counterexample, and it may even be preferable for yielding a correct result (the nonidentity of the two events) from simple examples.

The issue is more complex than this in many ways. For example, 'pay the bill' may be a causative construction, which I discuss in the next chapter. And the discussion above uses phrases like 'the writing of the check' in crucial ways that explicitly refer to events. I discuss them in chapter 7. I return to the issue of identity and nonidentity of events in chapter 8. My discussion here does not yield a conclusive choice between Relative Roles and Regular Roles. I take for granted the Regular Role account throughout most of this book (excepting chapter 8), though I think that little depends on it.

Chapter 6

Causatives and Inchoatives

6.1 Introduction

Certain English word pairs or triples relate their words both logically and etymologically in interesting ways. A standard pattern of transitive verb—intransitive verb—adjective is illustrated in

Transitive Verb Mary closes the door.

Intransitive Verb The door closes.

Adjective The door is closed.

Transitive Verb Mary melts the wax.

Intransitive Verb The wax melts.

Adjective The wax is molten.

Some other triples of this form are

Trans.	Intrans.	Adjective	Sample Transitive Use
fell	fall	fallen	"fell the tree"
cool	cool	cool	"cool the soup"
break	break	broken	"break the window"
burn	burn	burnt	"burn the wood"
close	close	closed	"close the door"
harden	harden	hard	"harden the metal"
awaken	awaken	awake	"awaken the child"
fill	fill	full	"fill the tank"
melt	melt	molten	"melt the wax"
alert	—	alert	"alert the burglar"
solidify	solidify	solid	"solidify the emulsion"
brighten	brighten	bright	"brighten the color"
redde	redde	red	"redde the solution"
lighten	lighten?	light	"lighten the load"
randomize	—	random	"randomize the digits"
dirty	—	dirty	"dirty the rug"

empty	empty?	empty	"empty the ashtray"
fatten	—	fat	"fatten the cattle"
wet	—	wet	"wet the towel"
set	sit	—	"set the ax (on the rug)"
seat	sit	seated	"seat the couple"
run	run	—	"run the machine"
walk	walk	—	"walk the dog"
sink	sink	sunken	"sink the Bismarck"
fly	fly	—	"fly the kite"

(Dashes indicate absence of the form in question; question marks indicate doubt. This is merely a sample; there are hundreds of such cases in the language.)

The transitive verbs in these triples are usually called "causatives" because the transitive form of the verb has roughly the meaning of 'cause to V', where "V" is the intransitive form. To break the window is to cause the window to break; to cool the soup is to cause the soup to cool; to close the door is to cause the door to close, and so on.

Whatever the meaning of 'cause', we know that the transitive form entails the intransitive: if Mary closes the door then the door closes, if she fells the tree then the tree falls. It is also important in analyzing the logic of these examples that the intransitive alone not imply any form of the transitive. If the door closes, that does not entail that anyone or anything closes it; if the soup cools, then we may not infer that anyone or anything cools it, and so on.

When the intransitive forms are related to an adjective, they are called "inchoatives." An inchoative verb has the meaning of 'become Adj', where 'Adj' is the related adjective. For the door to close is for it to become closed, in the adjectival sense of 'closed'; for the clay to harden is for it to become hard; for the wax to melt is for it to become molten. Some care is needed in distinguishing the adjectival forms, since many of them are identical with the past participle forms of the verbs. In the case of 'open' there is a clear difference, and there is no danger of confusing

an open door (a door that is not closed)
with
an opened door (a door that has been opened).
But with 'closed', both forms are spelled alike:
a closed door,
and so the construction is ambiguous; in its adjectival reading it pertains to a door that is not now open, and in its past participle form it

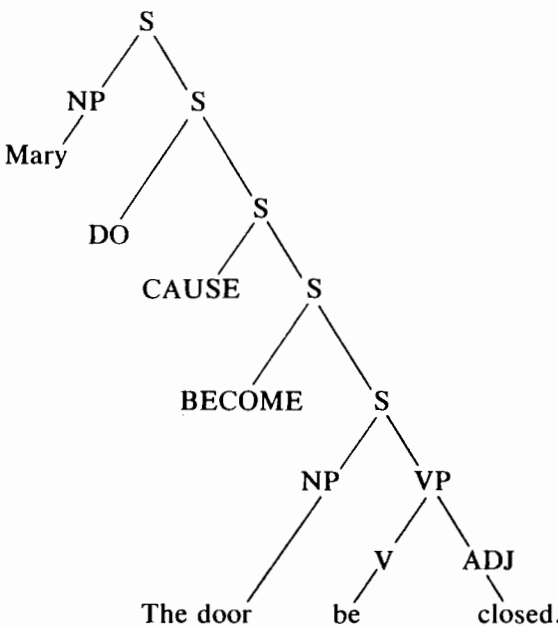
pertains to a door that has previously been closed. The former reading would apply to a door that was created in a closed position and never moved; the latter would be false of such a door. It is important to keep these two straight. An inchoative intransitive verb means 'become X' where 'X' is the adjective, not the past participle.

In order to get the logic right, we must remember that the adjective form need not imply any version of either verb form; an open door might be a door that has never opened, and never been opened by anyone or anything. But the truth of the intransitive form entails the truth of the adjectival form at the same or a later date: if the door closes at t, then at t (or right after) the door must be closed, and if the wax melts, then at that time (or just after) the wax must be molten.

This chapter deals with the proper analysis of causatives and inchoatives in terms of events and states.

6.2 Causatives in the Generative Semantics Tradition

One account of causatives and inchoatives stems from the early Generative Semantics tradition, especially from the work of Lakoff and McCawley.¹ This account would attribute to the sentence 'Mary closes the door' a "deep structure" something like



In Generative Semantics this deep structure was actually treated as a form from which the *syntax* of the sentence ‘Mary closed the door’ should be derived; the semantics of the sentence was also supposed to be pictured in the deep structure displayed. There were many objections to this account on syntactic grounds, and the general framework has been rejected by most linguists for syntactic reasons. But the semantical analysis implicit in the proposal can be considered independently of the framework within which it was first proposed; it is that ‘Mary closes the door’ somehow has these ingredients:

Mary DO CAUSE BECOME the door be closed.

In a sense the theory of underlying events already has one of these additional ingredients: the role of the DO may be captured by the deep case relation of Agent. That is, if ‘Mary’ ends up in logical form in the context ‘Agent(e,Mary)’ then the semantical import of the DO may have been taken care of. This leaves the other ingredients to consider.

David Dowty (1979) gives an analysis of causative and inchoative structures within the symbolism of Montague Grammar. Simplifying his notation somewhat, his form for ‘Mary closes the door’ is

$(\exists P)[(P(\text{Mary}))\text{CAUSE}(\text{BECOME}(\text{The door is closed}))]$,

where CAUSE stands for a relation between the two propositions

$P(\text{Mary})$ and $\text{BECOME}(\text{The door is closed})$,

and where BECOME maps the proposition that the door is closed to another proposition: the proposition that the door becomes closed. The whole analysis is supposed to be read as

Mary does something that causes the door to become closed.

The proposed reading of Dowty’s analysis seems to me on the right track, and his particular proposal is the best way of capturing this intuitive reading in the framework he had at his disposal. But the analysis should be improved upon. For one thing, nothing in the proposed analysis itself captures the idea that Mary *did something*, as opposed to, say, that Mary *had a property*. Further, the CAUSE in Dowty’s analysis does not link what Mary did with the becoming closed of the door; rather, it links the proposition that she did it with the becoming closed of the door. Likewise, the idea that what is caused is a proposition, as required in the symbolization, instead of an event, seems counterintuitive.²

According to Dowty’s analysis, the notions DO, CAUSE, and BECOME all take scope over whole sentences. If this were true it would

be evidence for a bisentential analysis of causatives and against a bievent analysis. But there is little evidence for these notions having scope; they do not create opacity, and they do not interact with other scope bearing items such as quantifiers. There is no evidence that ‘Mary breaks every window’ is ambiguous between

For every window w, $(\exists P)[(P(\text{Mary}))\text{CAUSE}(w \text{ breaks})]$

and

$(\exists P)[(P(\text{Mary}))\text{CAUSE}(\text{For every window, } w, w \text{ breaks})]$.³

6.3 An Analysis of Causatives in Terms of Events

I take over the idea behind the proposed analysis from the Generative Semanticists and Dowty. The guiding idea is that

Mary flew the kite

means

Mary did something that caused a flying of the kite.

Within the underlying events framework, this form contains quantifications over two events: what Mary did, and what the kite did. The general form of analysis is as follows: If TV is a causative transitive verb derived from an intransitive verb IV, then the translation of ‘x TV y’ is

$(\exists e)[\text{Agent}(x,e) \ \& \ \text{Cul}(e) \ \& \ (\exists e')[\text{IVing}(e') \ \& \ \text{Cul}(e') \ \& \ \text{X}(e',y) \ \& \ \text{CAUSE}(e,e')]]$,

where ‘X’ is the thematic relation specified by the intransitive verb IV as its normal subject.

The translation of ‘Mary fly the kite’ will then be

$(\exists e)[\text{Agent}(e,\text{Mary}) \ \& \ \text{Cul}(e) \ \& \ (\exists e')[\text{Flying}(e') \ \& \ \text{Cul}(e') \ \& \ \text{Theme}(e',\text{kite}) \ \& \ \text{CAUSE}(e,e')]]$,

where ‘Flying(e’)' means ‘e’ is a flying’. This ‘flying’ is formed from the intransitive verb ‘fly’, not from the transitive verb ‘fly’, so it refers to the kind of thing the kite does, not to the kind of thing Mary does in flying it.

This analysis yields the right logical relations between the transitive and intransitive forms; the logical form given above entails the logical form of the sentence ‘The kite flies’:

$(\exists e')[\text{Flying}(e') \ \& \ \text{Cul}(e') \ \& \ \text{Theme}(e',\text{kite})]$.

(And this, in turn, does not entail that anyone flies the kite.)

'Walk the dog' is different from 'fly the kite' in terms of its thematic relations. In causatives, the syntactical direct object of the causative transitive verb corresponds to the syntactical surface subject of the underlying intransitive. This means that the dog will be an Agent-Theme in 'walk the dog', but the kite will be the Theme in 'fly the kite'. This is an automatic consequence of the analysis and is essential if the transitive form is to entail the intransitive form.

The rule above needs to be supplemented to allow for modifiers in the sentence. Syntactically, causative transitive verbs seem to allow the same modifiers in their sentences as other transitive verbs. But in logical form these modifiers may go with either of the underlying events, within certain general guidelines. Consider the argument

Agatha is over the lake.

So, Agatha is flying her kite over the lake.

The conclusion seems ambiguous: the argument is valid on one reading and invalid on the other. The proposed explanation is that, on the interpretation that validates the argument, the modifier 'over the lake' applies to the causing event, to what Agatha is doing. On the other interpretation it applies to the caused event, to what the kite is doing.

One rule of thumb is that instrumentals always seem to go with the causing event; 'Samantha walked the chimpanzee with a cane' cannot mean that the chimpanzee walked with a cane. Also, adverbials of direction and motion always modify the caused event, not the causing one.

Since a causative sentence contains reference to two events, the question arises of how the complex form is related to time. Does such a sentence become true when the causing event occurs or when the caused event occurs? Or is there some third alternative? Most speakers treat causatives in such a way that for a past tense sentence to be true, both events must culminate in the past, and for a future tense sentence to be true, both must culminate in the future. So a past tense causative is not true until the caused event culminates, and a future tense causative is no longer true after the causing event culminates. Present tense causatives are almost impossible to use reportively unless the causing and caused events are very close together in time. Further, if the causative contains a temporal adverbial specifying an interval of time, the sentence is not true unless both events culminate in the interval, no matter the tense. 'Yesterday, Mary exploded the

bomb' is not true unless both what Mary did to explode the bomb, and the exploding itself, occurred yesterday.

Actually, the "data" are less clear in these cases than I have indicated. Some speakers simply identify the culmination time of the causative with that of the causing event, and others identify it with the caused event, and still others sense an ambiguity between these two options. Any of these policies can be adapted into the framework; I accept the commonest interpretation.⁴

6.3.1 Variants

Within the Generative Semantics framework a popular view was that some triads of words with unrelated spellings also have the semantics of causatives and inchoatives. The most famous case is

kill die dead

It was proposed that 'die' is to be analyzed as 'become dead', and 'kill' is to be analyzed as 'cause to become dead'. The lack of similarity of 'kill' to 'die' and 'dead' is misleading, since this triad originates from another that contained related spelling. Old English had a causative pair related as in "kill-die," but it was not etymologically related to 'dead', but to 'kill'. The spelling was

cwell—kill

cwel—die

The latter term 'cwel' was eventually replaced by the Scandinavian term 'die', thus destroying the etymological connection between our terms for dying and causing to die, but preserving that meaning.⁵

As Dowty points out, the idea that 'kill'-'die'-'dead' might form a causative-inchoative triad gets additional support from the fact that there seems to be no English causative of the form 'deaden' with the meaning of 'cause to become dead', in spite of the fact that adjectives form causative transitives quite freely in a regular manner. There is a general principle, called "blocking," which holds that regular patterns of word-formation in English are blocked if there already exists in the language a common word with the meaning of the word that would be generated by the pattern. Thus, since 'kill', already in the language, means 'cause to become dead', this "blocks" the formation of 'deaden' with that meaning.⁶

It is difficult to find any other examples of "apparent" causatives or inchoatives in English, that is, of examples with dissimilar surface forms.⁷

6.4 Objections to the Analysis of Causatives

The idea behind the above analysis has been around for a long time, and there are a number of objections to it in the literature that depend on its origin within the particular details of the framework of Generative Semantics. Instead of discussing them, I focus on what I take to be common to all such analyses—the idea that to break a window is to cause it to break, to close a door is to cause it to close, and so on. There are five objections to such analyses. The first is that ‘cause’ is the wrong term to use in the analysis. The second is that the analysis gets the times of the events wrong. The third is that tenses and temporal modifiers work incorrectly. The fourth is that ‘by’-phrases work incorrectly. And the fifth is that some verbs of causative form are not causatives at all.

Objection 1: ‘CAUSE’ cannot mean ‘cause’; indirect causation and control. If ‘CAUSE’ means the same as the English word ‘cause’ then there are apparent counterexamples to the analysis, because the English word ‘cause’ applies in cases of “indirect causation,” whereas causatives do not seem to work in this way. Suppose I hire someone to intimidate a shop-owner, and that person throws a brick through the shop-owner’s window. Then I seem to have caused the breaking of the window, but I did not break it. This particular objection is not overly persuasive, because in the case described it is not obvious that I did cause the breaking—perhaps I just motivated somebody else to do it. The causing gets more plausible in the other cases. If I hold a person’s arms and force him to gesture in such a way that a brick from his hand goes through the window, then it is clearer that I caused the window to break. But now we may be able to say that I broke the window (by making the person’s arms move in such a way that . . .). Reactions to examples of these sorts tend to fall into two classes:

Reaction 1: “The counterexamples all fail, since the causatives are indeed synonymous with their paraphrases with ‘cause’.”

In defense of this reaction, I suggest that finding some way to understand ‘break the window’ that on *some* occasion differs from *some* way of understanding ‘cause the window to break’ presents no difficulty for the analysis. After all, we are dealing with vague terms, and there is leeway in their interpretation. It is easy to construct situations in which we vacillate over whether the agent broke the window; yet

we do not want to conclude that ‘break the window’ is not synonymous with ‘break the window’. The question is whether, for any applicable use of ‘break the window’ there is a corresponding use of ‘cause the window to break’ that works the same. If so, the paraphrase is a good one, and an analysis that depends on it, getting all the other details right, may be correct.

Reaction 2: “The defense of the proposal sketched in (1) is not plausible. There are clear cases in which causative constructions and their paraphrases with ‘cause’ diverge, because the paraphrases truly apply to situations in which the causal path is indirect, while causatives truly describe only situations in which the causal path is direct.”

This appears to be the most popular reaction to examples of the sort discussed. Dowty (1979, 98) says, “It is now widely assumed that there are at least two kinds of causation evidenced systematically in natural languages, direct (or *manipulative*) causation and indirect (or *directive*) causation.” The implication is that the former is the meaning that is needed for CAUSE in analyzing causatives, and that the English word ‘cause’ encompasses both kinds. The consequence is that CAUSE does indeed differ in meaning from ‘cause’, since the former means something like ‘directly cause and control’. Both ‘CAUSE’ and ‘cause’ are generally thought to stand in need of further analysis, but I shall not attempt it here.

I remain neutral between these two “reactions,” using ‘CAUSE’ without commitment as to whether it is synonymous with the ordinary English word ‘cause’. Fortunately, the exact analysis of the notion is not needed to account for the major logical characteristic of causatives—that, for example, if Mary cools the soup then the soup cools. That inference is guaranteed by the forms of the sentences; it does not depend on the content of the term ‘CAUSE’ at all.

Objection 2: ‘CAUSE’ cannot mean ‘cause’; lack of interchangeability. This attack comes from examples such as the following from Barbara Partee, quoted in Dowty 1979:

- 1a A change in molecular structure caused the window to break.
- 1b A change in molecular structure broke the window.
- 2a The low air pressure caused the water to boil.
- 2b The low air pressure boiled the water.

- 3a The angle at which the door was mounted caused it to open whenever it wasn't latched.
- 3b The angle at which the door was mounted opened it whenever it wasn't latched.

Partee notes (correctly, I think) that some people will feel that the (a) and (b) examples are accurate paraphrases of one another. But more will find them divergent, thinking that the (b) examples are typically false when the (a) examples are true.

None of these examples is directly relevant to the present analysis, since they all involve nonagentive subjects. I believe that these sentences have quite different logical forms from the ones discussed above. When we say that Mary broke the window, and then that the explosion broke the window, we are saying quite different things. Mary breaks the window by *doing something* that causes the window to break, whereas the explosion itself breaks the window—it isn't something that the explosion *does* that breaks the window. The constructions in which an event itself appears as subject with a causative verb will be analyzed in chapter 7.

Examples (2) and (3) seem to show that the English 'cause' applies to situations in which a *state* is a causal factor in a causing situation, whereas causatives are (probably) not correctly used in such situations. If so, then 'CAUSE' has a narrower range than 'cause', but this does not speak to the question of whether these notions coincide in cases where events are concerned.

Objection 3: Tenses work incorrectly. Jerry Fodor (1970) gives "Three Reasons for Not Deriving 'Kill' from 'Cause to Die'." Two apply to standard causatives, and so Fodor also argues against deriving 'Floyd melted the glass' from 'Floyd caused the glass to melt'.⁸ Although the theory sketched above does not "derive" the former sentence from the latter (syntactically), it links them closely in meaning, and it is worth considering whether Fodor's arguments raise difficulties for it.

Fodor's first argument is that although one can say,

- 17 Floyd caused the glass to melt on Sunday by heating it on Saturday,

the following "derivation" from it is ungrammatical:

- 18 *Floyd melted the glass on Sunday by heating it on Saturday.

So (18) could not be derived from (17). But if 'Floyd melted the glass' is derived from 'Floyd caused the glass to melt', (18) should be derivable from (17).

There are two difficulties. First, contrary to Fodor's claim, sentence (18) is grammatical. But this is unimportant, since Fodor needs to show only that (17) cannot mean the same as (18); (18) need not be ungrammatical for his purposes. His point is that (17) says something that might be true, whereas (18) cannot be true. He says, "One can cause an event by doing something at a time which is distinct from the time of the event. But if you melt something, then you melt it when it melts." (p. 433) But this remark is not in conflict with (18). (18) does not say that Floyd's melting of the glass preceded the glass's melting; it says that his *heating* of the glass preceded its melting. One needs the additional assumption that his heating of the glass could not have preceded his melting of the glass, an assumption that is open to question. (Of course, if his heating of the glass *is* his melting of the glass, then the conclusion follows. But this is not clearly a matter of bare data.)

The data on this issue are unclear. However, if I understand Fodor correctly, the example he cites is no problem for the theory I have sketched, since on that account (18) would not be true in the envisioned circumstances. (I am taking the 'by' phrase in (18) to indicate the causing event of the causative.) It would not be true because 'on Sunday' limits the time of *both* the causing and caused events to Sunday, which is contradicted by the idea that the causing event occurred on Saturday. This *is* a difference between the causative 'melt the glass' and the explicit causal 'cause the glass to melt', but it is not a problem for the theory. (For a discussion of explicit causals, see chapter 7.)

There is also some related discussion in the philosophical literature about, for example, "the time of a killing." This is discussed in chapter 8.

Objection 4: 'By'-phrases work incorrectly. Fodor's next argument is that although

- 30 John caused Bill to die by swallowing his tongue
- is ambiguous, the following is not
- 32 John killed Bill by swallowing his tongue.

This, Fodor argues, militates against deriving 'kill' from 'cause to die'.

I want to address an analogous example using a causative that has not generated as much controversy as 'kill'. Consider the suggestion that (A) is ambiguous while (B) is not:

John caused Fido to walk by moving his legs sideways.

John walked Fido by moving his legs sideways.

(A) is ambiguous, but I believe that (B) is not, so here is a genuine phenomenon that needs explanation.⁹ We might even have to acceptodor's conclusion that (B) does not have a syntactical "deep structure" that embeds a sentence in which 'Fido' is the subject of intransitive 'walk'. But the account I am examining does not contain embedded sentences of this sort. It does, however, need a principle that would explain why (B) is not ambiguous—since the basic framework adopted does not guarantee this. I suspect that the principle has more to do with the interpretation of 'by'-phrases than with anything else. The solution is similar to the principle that, when an instrumental phrase modifies a causative verb, it always applies (semantically) to the causing event, not to the caused event. A similar principle might apply to 'by'-phrases: that the subject of the verb modified by the 'by'-phrase must be the agent of the 'by'-phrase event. Since (A) contains two verbs and (B) only one, this would explain why (A) is ambiguous and (B) not. I have no idea why this principle should be true of English, nor do I know whether it generalizes to other languages.

Objection 5: Causatives of bodily motion. This puzzle is based on Vendler's observation that I can "move my arm" in two different ways. I can move it by using a pulley contraption attached to it, or I can just move it." The former kind of moving has an intuitively plausible analysis as a causative in the present framework, but the latter seems to require a different treatment, since it allows that I move my arm without doing anything that causes my arm to move.

Part of the problem of choosing the right answer is that there are so many options available. For example, 'move' might be ambiguous, having one meaning for direct motion, and another for caused motion. The 'CAUSE' might be replaced in the analysis by 'CAUSE or ='. A particularly interesting option is to obtain the "direct motion" sense of 'move' by retaining the notion of agency while removing the extra causing event. The analysis of 'x moves y', in the "direct" sense of 'move', could then be

$(\exists e)[\text{Moving}(e) \ \& \ \text{Agent}(e,x) \ \& \ \text{Theme}(e,y) \ \& \ \text{Cul}(e)]$,

where 'Moving(e)' is the very same predicate used in intransitive sentences, such as 'His arm moved'. (This analysis is based on a suggestion in Dowty 1979, 125.) Since the constructions *are* special, it is not odd to attribute to them forms not found elsewhere in the language. As with the causative account of "indirect" motion, this analysis correctly predicts that 'Mary (directly) moved her arm' entails 'Mary's arm moved', but the latter sentence does not entail that anyone or anything moved the arm (in either sense of 'move').

6.5 An Incorrect Analysis Based on Optional Thematic Relations

It is worth considering whether causatives actually require the positing of two events. Can the data be explained by some sophisticated application of the theory of thematic roles developed in the preceding chapter? Within Fillmore's system of thematic roles, and in the spirit of some of his proposals, we might try to explain causative verbs in a natural way.

Since causative transitive verbs are so often spelled just like their intransitive counterparts, the only thing that distinguishes them "on the surface," except for word order, seems to be that the transitive verb has an agent NP accompanying it. So one might think that in the case of causatives the transitive and intransitive verbs are identical, and that the different uses arise from the optional choice of an agent NP. The logical forms of

Mary closes the door

versus

The door closes

might be seen as

$(\exists e)[\text{Closing}(e) \ \& \ \text{Cul}(e) \ \& \ \text{Theme}(e,\text{door}) \ \& \ \text{Agent}(e,\text{Mary})]$

versus

$(\exists e)[\text{Closing}(e) \ \& \ \text{Cul}(e) \ \& \ \text{Theme}(e,\text{door})]$.

The transitive form thereby entails the intransitive (and not vice versa), as desired.

This analysis leaves out the notion of causality altogether, and this notion seems involved in the construction somehow, though I don't know how to argue this point. More importantly, the approach does

not explain certain ambiguities in clauses with causative verbs. An example is

Mary flew her kite behind the museum.

One reading has Mary doing something behind the museum, and the other has the kite flying there. If there is only one event, it is hard to see how the sentence can have these two distinct interpretations. There would be just one analysis:

$(\exists e)[\text{Flying}(e) \ \& \ \text{Agent}(e, \text{Mary}) \ \& \ \text{Theme}(e, \text{kite}) \ \& \ \text{Behind}(e, \text{museum})]$.

I cannot locate an ambiguity that would save the analysis. The two interpretations are easily produced on the dual-event analysis, since there are two distinct events for the modifier to apply to

$(\exists e)[\text{Agent}(e, \text{Mary}) \ \& \ (\exists e')[\text{Flying}(e') \ \& \ \text{Theme}(e', \text{kite}) \ \& \ \text{Behind}(\text{_____, museum}) \ \& \ \text{CAUSE}(e, e')]$,

where the blank may be filled by either e or e' .

A related point is that, in the sentence

Mary felled the tree into the pond with a chainsaw,

the phrase 'into the pond' applies to the falling of the tree, and 'with a chainsaw' modifies what Mary does. There must be some difference in status between these modifiers, since the sentence, taken in its most natural reading, entails

The tree fell into the pond,

but it does not entail

The tree fell with a chainsaw.

In general instrumentals seem to modify the causing events in causatives, motion and direction adverbials modify the caused event, and locatives and some manner adverbials can modify either. These phenomena do not seem to be accounted for by any version of the optional case theory.¹⁰ I conclude that it is not correct to see the difference between causative verbs and their intransitive counterparts as merely a matter of optional cases.

6.6 Inchoatives

Recall the Generative Semantics treatment of Inchoatives, using BECOME, as modified by Dowty:

The door closes = BECOME(The door is closed).

One of the simplest ways to incorporate this idea into a framework with underlying events is to suppose that adjectives pick out kinds of states. The door's becoming closed is the coming-to-be of a state of the door's being closed. I use 'BECOME' to stand for this relation between an event and its "target" state. Then 'x closes' is analyzed as follows:

'x closes' = $(\exists e)[\text{Cul}(e) \ \& \ \text{Theme}(e, x) \ \& \ (\exists s)[\text{Being-closed}(s) \ \& \ \text{Theme}(s, x) \ \& \ \text{Hold}(s) \ \& \ \text{BECOME}(e, s)]]$.

A few additional facts hold of the BECOME relation. One is that the Theme of its event is the same as the Theme of its target state:

$\text{BECOME}(e, s) \rightarrow [\text{Theme}(e, x) \equiv \text{Theme}(s, x)]$.

With this assumption, either of the Themes in the analysis given above could be dropped. A second assumption about becoming is that the target state of a becoming does not hold prior to the becoming itself. Introducing times into the notation (temporarily) to clarify this point, the assumption is¹¹

$\text{BECOME}(e, s) \ \& \ \text{Cul}(e, t) \rightarrow \text{Hold}(s, t) \ \& \ \neg(\exists t')[t' < t \ \& \ \text{Hold}(s, t')]$.

With these assumptions, the analysis could be simplified to

'x closes' = $(\exists e)[\text{Cul}(e) \ \& \ \text{Theme}(e, x) \ \& \ (\exists s)[\text{Being-closed}(s) \ \& \ \text{BECOME}(e, s)]]$.

Alternatively, the assumptions could be built into the analysis:

'x closes' = $(\exists e)[\text{Cul}(e) \ \& \ \text{Theme}(e, x) \ \& \ (\exists s)[\text{Being-closed}(s) \ \& \ \text{Theme}(s, x) \ \& \ \text{Hold}(s) \ \& \ \neg\text{PAST}(\text{Hold}(s)) \ \& \ \text{BECOME}(e, s)]]$.

With this version, it is not even clear that BECOME is needed anymore. This bears thinking about.

The best version of the theory may not hold that adjectives pick out kinds of states but that they are simple predicates of individuals. In such a version BECOME should probably be a predicate operator, mapping a predicate of individuals to a predicate of events. BECOME(Red) would pick out those events that result in things becoming red. The analysis of Inchoatives on this version would look like

'x closes' = $(\exists e)[\text{Cul}(e) \ \& \ \text{Theme}(e, x) \ \& \ \text{BECOME}(\text{Closed})(e)]$.

One additional variant is that in the case of certain inchoatives such as 'redden', the theme does not become red but instead becomes redder. The theme *may or may not* start out being red. This variant is

consistent with the analysis given so far; it merely requires the further assumption that the state that the theme comes to be in is redder than any state it was in previously. Something like the following is required:¹²

BECOME(e,s) & Cul(e,t) → Hold(s,t) & (s')(t')[t'is just before t & Hold(s',t') → Redder(e,e')].

6.7 Causative-Inchoatives

Causative-Inchoatives are transitive verbs that are derived from a related adjective with the "cause to become ADJ" meaning. There may or may not be an inchoative intransitive verb "between" the adjective and the transitive verb. We have

fell, fall, fallen

but

randomize, ----, random.

In either case we can express the meaning of the transitive verb by combining the analyses of the causative and the inchoative discussed above:

x closes the door =

(∃e)[Cul(e) & Agent(e,x) & (∃e')[Cul(e') & Theme(e',door) & CAUSE(e,e') & (∃s)[Being-closed(s) & Theme(s,door) & Hold(s) & BECOME(e',s)]]].

As with individual causatives and inchoatives, the extra underlying events and states are subject to modification by modifiers in the sentence.¹³

6.8 Modifiers of Events and Modifiers of States

By the time we have three underlying eventualities in sentences it is no surprise that there is a variety of things for modifiers to modify. All my remarks about modifiers in causatives hold for causative-inchoatives as well, but the presence of underlying states offers new possibilities.¹⁴ In particular, the states may be modified. This is clearly indicated in the following example that mixes the 'with' of "adornment" with the instrumental 'with':

We loaded the wagon with hay with pitchforks.

'With pitchforks' modifies the cause, and 'with hay' modifies the caused state. (The sentence entails that the wagon ends up in the state: loaded with hay. It does not end up in the state: loaded with pitchforks.¹⁵) This shows that both are sometimes modified. In case the modifier is simple, the typical indication of state modification as opposed to event modification is the appearance of the modifier as an adjective instead of an adverb. An example is 'x closed the door tight', in which 'tight' indicates the type of final state in question. These adjectives appear as additional conjuncts on the state variables:

x closes the door tight =

(∃e)[Cul(e) & Agent(e,x) & (∃e')[Cul(e') & Theme(e',door) & CAUSE(e,e') & (∃s)[Being-closed(s) & Theme(s,door) & Hold(s) & BECOME(e',s) & Being-tight(s)]]].

In paraphrase,

x CAUSES the door to BECOME tightly closed (or "closed tight").

Other examples are 'chop the onions fine', 'fatten the pigs good and round', 'sink them deep under the sea', 'burn it black'.¹⁶

As noted above, instrumentals modify the causing event, not the caused state. If you alert a burglar with a floodlamp, you do something with a floodlamp that causes the burglar to become alert. The burglar does not end up in the state: alert with a floodlamp.

It is a measure of the "productivity" of the causative-inchoative process that underlying adjectives bring their modifiers with them to the causative-inchoative constructions. We have seen how 'tight' in 'tightly closed' surfaces in the above example.¹⁷ 'Partway' does this as well. Just as we can refer to a door as 'partway closed' we can say 'x closed the door partway'. The difference is that 'partway' modifies the adjective 'closed' in a different way than does 'tightly'. 'Partway' is a "non-standard" modifier of modifiers; if something is partway closed, it does not follow that that thing is closed, as it does if it is tightly closed. 'Partway' is syntactically very special; it occurs in contexts in which other adjectives may not:

Partway up the ladder, she got stuck.

*Quick(ly) up the ladder, she got stuck.

*Quiet(ly) . . .

*At noon . . .

*With a knife . . .

*In the back . . .

Modifiers of this sort have been much studied in the literature, and the consensus seems to be that they are best modeled as predicate operators. Thus 'partway closed' is formed by applying the functor 'partway' to 'closed', yielding 'partway(closed)'. This seems correct to me and also independent of the question of whether 'closed' is a predicate of states or of individuals. The treatment of 'x closes the door partway' is

x closes the door partway =

$(\exists e)[\text{Cul}(e) \ \& \ \text{Agent}(e,x) \ \& \ (\exists e')[\text{Cul}(e') \ \& \ \text{Theme}(e',\text{door}) \ \& \ \text{CAUSE}(e,e') \ \& \ (\exists s)[\text{Being-partway}(\text{closed})(s) \ \& \ \text{Theme}(s,\text{door}) \ \& \ \text{Hold}(s) \ \& \ \text{BECOME}(e',s)]]]$.

This entails that the door ends up partway closed; it does not entail that it ends up closed. Other examples are 'wet the cloth thoroughly', 'break it completely', and 'fill it mostly with cream'.

In addition to ordinary causative-inchoatives, a special and interesting kind of construction in English is illustrated in the following examples (again, I rely on Dowty 1979):

Agatha hammered the metal flat.

Sam pulled the rope taut.

Mary ran herself silly.

Although similar in surface form to 'x closed the door tight' they do not contain causative verbs, and so they require another analysis. They are unlike ordinary causative-inchoatives in having an extra adjective stuck on the end, but they are like causative-inchoatives in having meanings involving causing and becoming. I call them "resultative tags." They are like causative-inchoatives in which we are given additional information: we are told *how* the agent caused the becoming. The difference between 'Agatha flattened the metal' and 'Agatha hammered the metal flat' is that the latter tells us how Agatha flattened the metal. These constructions may be analyzed like causative-inchoatives, with the additional information about the type of the causing event made explicit:

x hammered the metal flat =

$(\exists e)[\text{Cul}(e) \ \& \ \text{Agent}(e,x) \ \& \ \text{Hammering}(e) \ \& \ \text{Theme}(e,\text{metal}) \ \& \ (\exists e')[\text{Cul}(e') \ \& \ \text{Theme}(e',\text{metal}) \ \& \ \text{CAUSE}(e,e') \ \& \ (\exists s)[\text{Being-flat}(s) \ \& \ \text{Theme}(s,\text{metal}) \ \& \ \text{Hold}(s) \ \& \ \text{BECOME}(e',s)]]]$.

Resultative tags are logically related to causatives that are based on the adjectival tag. It follows from the analysis given that if I hammer the metal flat then I flatten the metal, and if I shoot him dead then I kill him. These inferences seem right. Other modifiers also carry over from one to the other; if I quietly shoot him dead with a revolver then I quietly kill him with a revolver.¹⁸

There is another possible application of the notion of resultative tag. In section 5.4.2, I proposed principles that let us infer 'The bike will be on the lawn' from 'Mary threw the bike onto the lawn'. The principle involved an inference from an "onto" event to an "on" state having the same theme. The same phenomenon might be predicted by viewing apparent motion adverbials as tag causatives involving locative adverbials. That is, we analyze

Mary pushed the bike onto the lawn

on a par with

Mary hammered the metal flat.

It gets a form meaning "Mary did some pushing that caused the bike to become on the lawn." I haven't explored evidence that might favor this account over the one given previously.

6.8.1 Becoming Uncrated

The transitive verb 'uncrate' has a quite ordinary analysis as a causative-inchoative. To uncrate something is to cause that thing to become uncraled. Here the adjective is 'uncraled', as in "No uncraled bicycles may be carried in the cargo hold." The implication that if you uncrate something it had to start out crated is accounted for by the same implication that if you open something it has to start out closed.¹⁹ The significance of this is that no special logical form is needed for the transitive verb 'uncrate'; in particular, it need not be analyzed in terms of negation plus the positive adjective 'crated'.²⁰ The thing that is special about the causative-inchoative verb 'uncrate' is that it comes from a special adjective, 'uncraled', which is composed of a prefix 'un-' and the adjective 'crated'. Assuming that adjectives are predicates of states (see chapter 10), the meaning of the adjective 'uncraled' might be elucidated by

$(x)(t)[(\exists s)[\text{Theme}(s,x) \ \& \ \text{Hold}(s,t) \ \& \ \text{uncraled}(s)] \equiv \neg(\exists s')[\text{Crated}(s') \ \& \ \text{Theme}(s',x) \ \& \ \text{Hold}(s',t)]]]$.

e., a thing is in an uncrated state if and only if it is not in a crated state. (This may need to be limited to physical objects that are appropriate for crating.) An uncrated bicycle need not be a bicycle that has never been taken from a crate.²¹

9 An Alternative Version of the Theory

I do not fully discuss the nature of the Progressive, 'Mary is singing', until chapter 9. I mention it here because the main theory I propose here does not fit well with the analysis of causatives and inchoatives as yet developed. The favored theory of the Progressive is one in which 'Cul' is replaced in the translation of a verb by 'Hold'. For example, 'Mary leaves' replace

Mary leaves:

[e][Leaving(e) & Agent(e, Mary) & Cul(e)]

Mary is leaving:

[e][Leaving(e) & Agent(e, Mary) & Hold(e)].²²

This move insures that the fact that Mary *is leaving* does not entail that Mary actually leaves, either now or in the future: she might be interrupted. However, the account of causatives and inchoatives proposed above is in danger of producing a similar consequence that, if not clearly incorrect, is at least odd. Consider the analysis of the causative-inchoative 'x closes the door':

x closes the door =

[e][Cul(e) & Agent(e,x) & (∃e')[Cul(e') & Theme(e',door) & CAUSE(e,e') & (∃s)[Being-closed(s) & Theme(s,door) & Hold(s) & BECOME(e',s)]]].

If we try to capture the meaning of 'x is closing the door' by changing 'Cul' to 'Hold', the result is

x is closing the door =

[e][Hold(e) & Agent(e,x) & (∃e')[Hold(e') & Theme(e',door) & CAUSE(e,e') & (∃s)[Being-closed(s) & Theme(s,door) & Hold(s) & BECOME(e',s)]]].

This, then, does not entail that x ever closes the door, which is correct. But suppose that x is closing the door and is in fact interrupted. The

analysis still entails something that may be equally objectionable: it entails that *there is* an event caused by what x is doing—presumably the door's closing—and *there is* a state of the door's being closed that holds. So even though x does not succeed in closing the door, the door ends up closed.

This requires a change in the analysis of the inchoative, independently of whether it requires a change in the analysis of the causative. Suppose we change the status of BECOME (renaming it 'BECOME#') so that it is now a predicate operator; in this role it maps predicates of states to predicates of events. For example, the complex predicate BECOME#(closed)

will be a predicate true of an event if and only if that event is "a becoming closed." This permits simple inchoatives to have simple forms: they are treated just like other intransitive verbs, except that the predicate contributed by the verb is complex. The translation of 'The door closes' will be

(∃e)[BECOME#(closed)(e) & Cul(e) & Theme(e, the door)].

As with the earlier analysis of BECOME, a meaning postulate is now required, linking the event with the target state, if there is one:

BECOME#(closed)(e) & Theme(e,x) & Cul(e) → (∃s)[Being-closed(s) & Hold(s) & Theme(s,x) & ¬PREVIOUSLY(Hold(s))].

Or we could use the original BECOME and say

BECOME#(closed)(e) & Cul(e) → (∃s)[BECOME(e,s)].

It is less clear whether a similar change is required in the analysis of causatives. If Mary is closing the door, is the door closing? Certainly we usually say 'Mary is closing the door' in a situation in which the door is actually closing, and a similar generalization holds for other causatives as well. But there might also be situations in which Mary closes the door by the use of a device that is actuated prior to the door's starting to close. There would then be a period between the initial actuation of the device and the door's beginning to close, in which it might be true to say that Mary is closing the door but the door is not yet closing. If this is so, then another analysis of causatives is needed.

For this (possible) revision we could introduce CAUSE# as a predicate operator that maps predicates of events to predicates of events. 'Agatha flies the kite' is analyzed as

Agatha flies the kite =

$(\exists e)[\text{CAUSE\#}(\text{Flying})(e) \ \& \ \text{Cul}(e) \ \& \ \text{Agent}(e, \text{Agatha}) \ \& \ \text{Theme}(e, \text{the kite})]$.

As with BECOME#, this will require a meaning postulate to the effect that, if an event of the type CAUSE#(Flying) actually culminates, then it causes a culminated flying event whose theme is the theme of the original event:

$\text{CAUSE\#}(\text{Flying})(e) \ \& \ \text{Cul}(e) \rightarrow (\exists e')[\text{Flying}(e') \ \& \ \text{Cul}(e') \ \& \ (x)[\text{Theme}(e, x) \equiv \text{Theme}(e', x)] \ \& \ \text{CAUSE}(e, e')]$.

As before, causative-inchoatives are analyzed by combining the analyses of causatives and inchoatives. Modifiers are allowed in the same places as before, though we shall need something like lambda abstracts to symbolize complex predicates. Since 'onto the truck' modifies the falling of the tree in 'Agatha felled the tree onto the truck', the analysis of the whole construction will be

$(\exists e)[\text{CAUSE\#}(\lambda e[\text{BECOME\#}(\text{Being-fallen})(e) \ \& \ \text{Onto}(e, \text{the truck})])(e) \ \& \ \text{Cul}(e) \ \& \ \text{Agent}(e, \text{Agatha}) \ \& \ \text{Theme}(e, \text{the tree})]$,

in which CAUSE# operates on the complex predicate 'fall onto the truck':

$\lambda e[\text{BECOME\#}(\text{Being-fallen})(e) \ \& \ \text{Onto}(e, \text{the truck})]$.

So far as I can see, these two modifications of the theory, coupled with the indicated meaning postulates, account for the same data as the unmodified theory in the case of nonprogressive sentences.

Chapter 7

Explicit Discourse about Events

English has a wide variety of locutions that are used to refer to and to quantify over events: 'Mary's singing', 'the destruction of the city', 'the accident that occurred last night', and so on. Some simple and detailed account of how these locutions are used, and their relationships to the events they appear to be used to talk about would be gratifying. It would be even neater if this account were to link these locutions with the simple sentences of English to which they appear to be related. I have in mind relationships such as those illustrated by the following pairs (phrases referring to events are italicized):

The destruction of the city . . . ; the city was destroyed.

Mary saw Brutus stab Caesar; Mary saw *the stabbing*.

Amundsen's flight over the north pole took place in May, 1926;

Amundsen flew over the north pole in May, 1926.

Mary's singing broke the glass; Mary broke the glass.

The explosion broke the window; Mary broke the window.

God's waving his hands caused the world to come into existence;

God caused the world to come into existence.

In fact, a small number of principles yield a surprisingly simple and intuitively plausible explanation of these various relationships within the context of the theoretical account developed in previous chapters. No new primitives are needed; they are already present in the theory.

7.1 Basic Principles

We refer explicitly to events in much the same ways in which we refer to other sorts of entities—primarily by the use of NPs. Since we rarely